Course Listings

This Catalog offers information about the academic programs and support services of the University. This Catalog is as accurate as possible, but the information may not remain current for all of the academic year. Circumstances may prompt changes in courses, course content, credit, fees, regulations, semester calendar, curriculum, degrees offered, and other University matters. Such changes authorized by the University apply both to prospective students and to those previously enrolled, unless the latter are specifically exempted.

Not all courses are offered each semester or session. Students should consult the current class schedule book and the departmental office for specific details regarding frequency of offerings in specific courses.

Course descriptions are listed alphabetically by fields. (See the BIOM prefix and the College of Osteopathic Medicine of OSU College Catalog for osteopathic medicine course descriptions.)

Explanation of Course Listings

A course listing is comprised of the following elements, in order:

Course Number. All courses are identified by numbers composed of four digits. The first digit indicates the class year in which the subject is ordinarily taken, although enrollment is not exclusive as to student classification, the second and third digits identify the course within the field and the last digit identifies the number of semester credit hours the course carries. A course number beginning with 0 indicates that the course does not carry University credit. A course number ending in 0 indicates that the course carries variable credit. An asterisk (*) following the four-digit number indicates the course is approved for graduate credit.

Those numbered 5000 and above are primarily for graduate students, and only graduate students and selected seniors with consent of the instructor may enroll in them. Courses numbered 3000 and 4000 may be taken for graduate credit if the course number is labeled with an asterisk. Extra work is required of a graduate student in a 3000- or 4000-level course.

General Education Requirement Codes. The capital letters in parentheses preceding some course titles designate courses fulfilling various undergraduate general education requirements. (See "Academic Regulations.")

Course Title. The title of the course is printed in boldface letters.

Statement of Variable Credit. Each course number ending in zero is followed by a statement of the credit that may be earned. Typical entries are 1-6 credits, maximum 6 and 1-3 credits, maximum 12, the first part of the entry indicating the permissible credit per enrollment, followed by a statement of the maximum credit which may be earned in the course through repeated enrollment.

Laboratory Hours. If a course contains a laboratory, the number per week of laboratory hours are stated, e.g., Lab 3.

Prerequisite(s). Prerequisites from the same department as the course being described are listed first, with no departmental abbreviation and in increasing numerical order. If from another department, that departmental abbreviation must precede the number of the prerequisite course. Those courses having prerequisites from both within and from outside the department bear combination entries such as 3303 and STAT 2012. Prerequisites are listed in the following manner:

- Prerequisites: A, B or C
  - A or B or C is acceptable
- Prerequisites: A, B and C
  - A and B and C are required
- Prerequisites: A, and B or C
  - A and either B or C
- Prerequisites: A and B, or C
  - Both A and B, or C required
- Prerequisites: A, or B and C
  - Either A or both B and C required
- Prerequisites: A or equivalent and B
  - Both A, or the equivalent of A, and B are required
- Prerequisites: A, and B or equivalent
  - Both A and B, or the equivalent of B, are required
- Prerequisites: A and B, or equivalents
  - Equivalents of both A and B are acceptable.

Where no prerequisites are listed for courses numbered 3000 or 4000 level, it is understood that the prerequisite is approval of the student's adviser. The prerequisite for courses numbered 5000 or 6000 level is graduate standing in addition to any other prerequisites listed. Instructors may waive prerequisites when student background justifies. Prior approval of instructor may be required in problems courses, independent study, internships, thesis and dissertation courses, and courses taught in a professional school.

Description of Course Content. The content of the course and its major emphases are described. Courses which are taught under another name and number are indicated by the statement Same course as 0000. Credit may not be earned in both courses so cross-referenced.
## Abbreviations Used

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<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<td>A&amp;S</td>
<td>Arts and Sciences</td>
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<td>ABSE</td>
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<td>AG</td>
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<td>ZOOL</td>
<td>Zoology</td>
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**Course Listings**
Accounting (ACCT)

2103 Financial Accounting. Prerequisite: 24 semester credit hours, including ENGL 1113 and MATH 1483 or equivalent. Financial accounting concepts and the use of financial accounting information in decision making.

2203 Managerial Accounting. Prerequisite: 2103. Managerial accounting concepts and objectives, planning and control of sales and costs, analysis of costs and profits.

3013 Federal Income Taxation. Prerequisite: 2203. Federal income tax and its relationship to business decision-making; primary emphasis on recognition of the important tax consequences that attach to business transactions and the impact on business decision making.

3203 Cost Accounting. Prerequisites: 2203 with a grade of "C" or better and STAT 2023. Cost accumulation systems, allocating product costs, planning and controlling costs, standard costing, and profitability analysis.

3433 Financial Accounting and Reporting Concepts. Prerequisite: 2203 with a grade of "C" or better. Theory and concepts underlying financial accounting and reporting.

3603 Accounting Information Systems. Prerequisite: 2203 with a grade of "C" or better. Accounting system design and installation.

3900 Undergraduate Internship in Accounting. 1-3 credits. Prerequisites: accounting major, nine hours of upper-division accounting, and consent of instructor. Supervised internship in public accounting, industry, or not-for-profit organizations. May be counted as elective hours only.

4010 Accounting Projects. 1-6 credits, maximum 6. Prerequisites: consent of instructor and 3203 and 3403. Special topics, projects, and independent study in accounting.

4013* Advanced Federal Income Taxation. Prerequisite: 3013 with a grade of "B" or better. Federal income tax law applicable to individuals, corporations, partnerships, trusts and estates, and other specialized topics.

4203* Topics in Management Accounting. Prerequisites: 2203 with grade of "C" or better and MSIS 3223. Integrative course in cost and management accounting: use of accounting information for internal decision making.

4403* Financial Accounting III. Prerequisite: 3403 with grade of "C" or better. Consolidated statements and other financial accounting topics.

4433 Financial Accounting and Reporting Applications and Research. Prerequisite: ACCT 3433 with a grade of "C" or better. Developing financial research skills and applying them to accounting and reporting issues.

4453* Contemporary Integrated Accounting and Business Systems. Prerequisite: 3603. Concepts and software applications underlying the design and use of databases for financial, managerial, and tax accounting measurement, compliance disclosure, and decision-related reporting in traditional and electronic commerce settings.

4503* Auditing. Prerequisites: 3433, 3603. Auditing theory, procedures and practices.


5000 Thesis. 1-6 credits, maximum 6. For students writing reports and theses in accounting.

5013* Seminar in Tax Research. Prerequisite: 4013 or consent of instructor. Development and administration of federal tax law with emphasis on the development of tax research skills.

5023* Seminar in Estate and Gift Taxation. Prerequisite: 5013 or consent of instructor. Federal tax law applicable to estate and gift taxation and income taxation of estates and trusts.

5033* Seminar in Oil and Gas Taxation. Prerequisite: 5013 or consent of instructor. Federal income tax laws applicable to the petroleum and other extractive industries.

5042* Seminar in Partnership Taxation. Prerequisite: 5013 or consent of instructor. Federal income tax laws applicable to partners and partnerships.

5053* Seminar in Corporate Taxation. Prerequisites: graduate standing and 5013 or consent of instructor. Federal income tax law applicable to corporations and to other entities in their capacity as corporate shareholders.

5103 Financial Accounting and Analysis. Prerequisites: admission to MBA program or consent of MBA director. Development of the ability to read and to analyze financial statements and to use this information along with other types of information in decision making.

5110* Special Topics and Individual Work in Accounting. 1-10 credits, maximum 10. Prerequisite: consent of instructor. Individual work on special topics, projects or readings selected to acquaint students with significant accounting literature.

5113* Managerial Accounting. Prerequisite: 5103. Interpretation of accounting data in planning, controlling and decision making.

5123* Enterprise Resource Planning. Prerequisites: graduate standing and 5103, 5113, MSIS 5643, or consent of director of MIS/AIS. Resource planning for global business organizations. Integrated data flow and computer software for enterprise resource planning. Integration of transactional analysis, fundamental accounting practice, financial planning, and supply chain analysis forming the basis for study in this integrated approach to enterprise resource planning. Same course as MSIS 5123.

5133* International Oil and Gas Accounting. Prerequisite: graduate standing. Financial accounting and reporting for U.S. and international oil and gas operations. Domestic and international joint venture accounting. Accounting for international concession and profit sharing agreements.

5203* Seminar in Contemporary Accounting Theory I. Prerequisite: 3403. Origin and development of accounting and a critical study of modern accounting theory.

5303* Seminar in Contemporary Accounting Theory II. Prerequisite: 3403. Critical study of contemporary accounting theory.

5313* Financial Statement Analysis. Prerequisite: consent of graduate coordinator. A study of the demand and supply of financial data, properties of numbers derived from financial statements, the role of financial information in investment decisions, and features of the decision-making environment.

5400* Practicum in Professional Accounting. 1-6 credits, maximum 6. Prerequisite: admission to M.S. in accounting program or consent of instructor. Study of accounting policies, retirement policies, tax issues, and other relevant business issues associated with mergers, acquisitions and divestitures.

5503* Advanced Assurance Services. Prerequisite: 4503 or equivalent, and admission to M.S. in accounting program. Advanced topics in statutory auditing, operational auditing, and investigative services.

5603* Accounting-based Information Systems. Prerequisite: 18 credit hours of accounting including 4203. Concepts underlying the design and use of an effective accounting information system.

5613* Information Systems Control, Assurance, and Information Risk Management. Prerequisite: admission to MIS/AIS program or M.S. in accounting program. Controlling and auditing business information systems including management and applications controls, electronic commerce, and inter-related controls. Evaluation of system performance through use of audit software.

5713* Seminar in International Accounting. Prerequisites: 3403 and consent of graduate coordinator. Accounting issues faced by multinational enterprises and internationally listed companies, including diversity in financial reporting and harmonization.

5803* Valuation and Business Risk Management. Prerequisite: admission to M.S. program or consent of instructor and 18 credit hours of accounting. Intensive study of valuation models, (including methods to value both business and individual assets and liabilities), risk management (including both financial and operations risk management), and other topics of an advanced nature relating to cost management.

5900 Graduate Internship in Accounting. 1-3 credits, maximum 3. Prerequisites: admission to master's program; consent of graduate coordinator. Supervised internship in public accounting, industry, or not-for-profit organizations. May be counted as elective hours only.

5902* Research Report. Prerequisite: consent of supervising professor and coordinator of graduate programs in accounting. Methods used in research and report writing in accounting. Independent investigation and writing of an acceptable report on a topic approved by the student's supervising professor. Restricted to candidates seeking the M.S. in accounting degree and not available to students who have credit in 5000.
Aerospace Studies--Air Force (AERO)

1111 Foundations of the U.S. Air Force I. Lab 1. Doctrine, mission, and organization of the United States Air Force through a study of the total Air Force structure, strategic offensive and defensive forces, general purpose forces, and aerospace support forces.


2211 Evolution of U.S. Air Force Air and Space Power I. Lab 1. Growth and development of aerospace power through history beginning with first manned flights and continuing through World War II.

2212 Air Power History II. Lab 1. Development and growth of aerospace power from the period following World War II through the Vietnam conflict; concepts of peaceful deployment of US air power.

3103 Air Force Leadership Studies I Lab 2. The study of the fundamental leadership, management, and communication skills required of an Air Force junior officer. Basic managerial processes, management of forces in changing environments, organizational power, politics and managerial strategy and tactics.

3203 Air Force Leadership Studies II. Lab 1. The application of leadership, management, and communication skills required of an Air Force junior officer. The individual as a leader in the Air Force environment, individual motivational and behavioral processes, group dynamics, leader and management ethics, counseling and evaluating are discussed.

3504 Field Training Encampment Program. Prerequisite: consent of professor of aerospace studies. Practical training on an Air Force base. Junior officer training, familiarization training in most functional aspects of a typical Air Force base. Includes career orientation, small arms firing, flight orientation rides, and survival training.

4103 (S)National Security Affairs I. Lab 2. The formulation, organization and context of national security; civilian-military interaction and the evolution of strategy. Review of the military profession and officership.

Agricultural Communications (AGCM)

2103 Communications in Agriculture. Lab 2. Prerequisite: ENGL 1113. Fundamentals of agricultural newswriting and other communication methods. Careers in and the role of the media in agriculture and related fields.

3103 Communicating Agriculture to the Public. Prerequisite: junior standing in the College of Agricultural Sciences and Natural Resources or consent of the instructor. Understanding and application of writing principles and communication theory as related to public issues in agriculture and the environment. Practice in writing for a variety of media and preparation of other communications as part of a communications campaign strategy.

3213 Layout and Design for Agricultural Publications. Lab 4. Prerequisite: 2103. Fundamentals of layout and design as applied to agricultural publications, such as brochures, newsletters and flyers. Practical application of design principles, typography, desktop-publishing software, and printing practices. Opportunity for service-learning experiences.

3223 Web Design for Agricultural Organizations. Lab 4. Prerequisite: 2103. Development of World Wide Web sites for agricultural organizations. Practical application of theory and skills related to visual design, computer software, writing, editing, and project management. Opportunities for service-learning experiences.

3233 Basic Photography and Photo Editing for Agriculture. Lab 4. Prerequisites: 2103 or consent of instructor. Beginning course focusing on photographic equipment, related software and photo composition in an agricultural setting.

4203 (S)Professional Development in Agricultural Communications. Lab 1. Prerequisite: junior standing. Professional preparation and development for careers in agricultural communications. Skills, resume and portfolios, presentations, networking and job interviews. Requirements and procedures for completing required supervised internship related to academic major.

4300 Internships in Agricultural Communications. 1-6 credits, maximum 6. Prerequisites: consent of internship coordinator and adviser. Supervised work experience with approved employers in agricultural communications including agricultural publications, radio stations, television stations, public relations offices, advertising firms, government offices, and other related opportunities. Presentation required following the internship.

5413 Capstone for Agricultural Communications. Lab 4. Prerequisites: JB 3263; senior or graduate standing and consent of instructor. The development of agricultural communications projects with focus in either broadcast or print media. Practical application of writing, editing and design skills as well as software applications.

5990 Problems in Agricultural Communications. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Small group and individual study and research on problems relating to communications within the agricultural sector and from the agricultural sector to other constituencies.

Agricultural Economics (AGEC)

1114 (S)Introduction to Agricultural Economics. Prerequisite: MATH 1483 or 1513. Economic theory of production, marketing and consumption of agricultural products. The role and structure of agriculture in the American economy. Policies to achieve efficiency and welfare goals in agriculture. No general education credit for students also taking ECON 1113 or ECON 2103.

3010 Internship in Agricultural Economics. 1-6 credits, maximum 6. Prerequisite: approval of internship committee and adviser. Supervised work experience with approved public and private employers in agricultural economics including banks, farm credit services, agriculture chemical firms, Soil Conservation Service, congressional offices and other opportunities. Credit will not substitute for required courses. Graded on pass-fail basis.
3101 Professional Career Development. Prerequisites: junior standing and agricultural economics or an equivalent. Overview of the various areas of specialization within agricultural economics and agribusiness and their associated career opportunities and obligations. Development and improvement of written communication, oral communication, and leadership skills.

3213 Quantitative Methods in Agricultural Economics. Lab 2. Prerequisites: 1114, STAT 2023 or equivalent, and MSIS 2103, AG 2112 or equivalent. Indices, graphics, budgeting, discounting, basic statistical measures, use of microcomputers, and price analysis. Basic background methods for some courses involving analysis.

3323 Agricultural Product Marketing and Sales. Prerequisites: 1114, ENGL 1113, SPCH 2713. Fundamentals of agricultural marketing management and planning applied to specific agricultural product (input and output) marketing problems. Institutional differences between agricultural and non-agricultural marketing environments. The role of the individual sales representative in a marketing and sales organization. Written and oral presentations of marketing and sales information required of all students.

3333 (S)Agricultural Marketing and Price Analysis. Prerequisite: 3323. Supply, demand and price determination within the institutional environment of agricultural commodity markets. The roles provided by government intervention, marketing agreements, and cooperatives in agricultural markets. Some graphical analysis of commodity market data. Fundamentals of futures markets applied to agriculture.

3423 Farm and Agribusiness Management. Prerequisites: 1114, ACCT 2103. Fundamentals of managerial functions as applied to agricultural firms. Organization and management of human, financial, and physical assets for the profitable operation of an agricultural business. An introduction to business planning, enterprise budgeting, financial statements, and record keeping.

3463* Agricultural Cooperatives. Prerequisite: 3423. An evaluation of the historical perspective, objectives, structure, finance, and management associated with the cooperative organization. An analysis of the cooperative business organization within the modern economic, historical, legislative, and evolution. An examination of careers related to cooperatives.

3503* (S)Natural Resource Economics. Prerequisite: 1114 or ECON 2103. Framework for analyzing natural resource management decisions. Applications of microeconomic theory to the management of soil, water and other resources, with specific attention to institutions having an impact on management opportunities. Supply and demand for natural resources, resource allocation over time, rights of ownership, and public issues of taxation, police power and eminent domain.

3603* Agricultural Finance. Prerequisite: 3423. Farm financial management; preparation and analysis of net worth, cash flow and income statements, including microcomputer applications; financial intermediaries; serving agriculture; procedures for evaluating investments; alternative means of acquiring control of farm resources.


3990 Special Problems in Agricultural Economics. 1-3 credits, maximum 3. Directed study of selected agricultural economics topics.

4101 Agricultural Economics Seminar. Prerequisites: senior standing and agricultural economics or agribusiness major status. Contemporary problems in agricultural economics.

4213* Quantitative Price Analysis. Prerequisites: 3213, 3333, MATH 2103, and ECON 3023 or 3113. Quantitative analysis of agricultural supply and demand in situations involving risk and uncertainty within the institutional setting of agricultural markets. Use of spreadsheets to perform regression analysis and simulation of potential market outcomes. Analysis of specific agricultural market cases with written and oral presentation of the results.


4434 International Agricultural Markets, Trade and Development. Prerequisite: 3333. International trade of agricultural products with emphasis on theory of trade and monetary flows, national trade policies and world market structures for agricultural products. Impacts of trade on the domestic agricultural sector and the role of trade in agricultural economics.

4403 Advanced Farm and Ranch Management. Prerequisites: 3213, 3333, 3603, MATH 2103, and ECON 3023 or 3113. The development of professional understanding of the role of technology, science, and management in the agricultural sector and the role of the individual farmer or rancher in the farm and ranch business.

4413 Agricultural Law. Prerequisite: 1114. Survey of law with emphasis on agricultural problems and applications. Contract law, tort law, property law, real estate transactions, oil and gas leases, business organization, estate planning and credit.

4423 Advanced Agribusiness Management. Prerequisites: 3213, 3333, 3603, MATH 2103, and ECON 3023 or 3113. Application of modern decision theory in the uncertain environment that the agricultural business operates. Planning, organizing, implementing, coordinating, and controlling problems associated with establishing an agricultural business, achieving firm growth, and operating the firm through time. Use of spreadsheets to perform production planning and analysis related to agricultural business operation with linear programming, simulations and other tools. Analysis of the interaction of resources, prices and production alternatives.

4503* Environmental Economics and Resource Development. Prerequisite: 3503 or ECON 3113 or consent of instructor. Understanding the relationship of natural resource development and environmental quality. Valuation of priced and non-priced natural and environmental resources. Analysis of environmental and natural resource policy and the role of public and private agencies in conservation and development.

4513* Farm Appraisal. Lab 2. Prerequisite: 3423. Estimating the market value of agricultural real estate using the three approaches to value. Determining the feasibility and profitability of land purchases.

4703* (S)American Agricultural Policies. Prerequisites: 3213, 3333, MATH 2103, and ECON 3023 or 3113. Economic characteristics and problems of agriculture; evolution and significance of programs and policies.

4723* (S)Rural Economic Development. Prerequisite: 1114. Concepts and theories of regional and community economics, including input-output, economic base, simulation, target location, and routing. Oklahoma applications.

4803 (S)International Agricultural Economics Tour. Prerequisite: Consent of Instructor. A two-three week international travel component. Provides an integrated approach to the cultural, agricultural, historical, technological, political, economic and religious backgrounds of the region. Comparison of the agricultural business environment of the region to that of the U.S.

4990 Problems of Agricultural Economics. 1-6 credits, maximum 6. Open to students with consent of instructor only. Research on special problems in agricultural economics.

5000* Thesis or Report in Agricultural Economics. 1-6 credits, maximum 6. For students working for a M.S. degree in agricultural economics. Independent research and thesis under the direction and supervision of a major professor.

5010* Professional Experience in Agricultural Economics. 1-6 credits, maximum 6. Prerequisites: approval of internship committee and adviser. Supervised professional experience with approved public and private employers in agricultural economics including banks, production credit associations, federal land banks, soil conservation service, and other agricultural related firms. Credit will not substitute for required courses. Designed for Master of Agriculture program.


5103 Mathematical Economics. Prerequisites: differential calculus and ECON 3113. Mathematical tools necessary for formulation and application of economic theory and economic models.

5113* Applications of Mathematical Programming. The application of concepts and principles of existing linear and nonlinear programming techniques to agricultural problems.
5023* Advanced Agricultural Prices. Prerequisite: 5103, STAT 4043. Demand and price structures, price discovery, time series and agricultural price research methods.

5213 Econometric Methods. Prerequisites: 5103 and ECON 4213 or STAT 4043. Application of econometric techniques to agricultural economic problems, theory and estimation of structural economic parameters.

5303 Agricultural Market Policy and Organization. Marketing firm decisions; structure, conduct and performance of agricultural industries; interregional trade theory; and government policies that influence decisions.

5403 Production Economics. Prerequisite: 5103. Analysis of micro static production economics problems; factor-product, factor-factor and product-product relationships; functional forms for technical unit and aggregate production functions; maximizing and minimizing choice rules; firm cost structure; scale relationships.

5503 Economics of Natural and Environmental Resource Policy. Prerequisites: 4503 or ECON 3313 and MATH 2103. Economics of long term resource use with particular emphasis on agricultural and forestry problems. Methods for estimation of nonmarket costs. Cost benefit analysis of long term natural resource use and environmental policy. Elementary computer simulation of long term resource use and environmental policy.

5603 Advanced Agricultural Finance. Prerequisite: 3603. Financial structure of agriculture; firm financial planning and management, financial intermediation in agriculture and agricultural finance in developing countries.

5703 Economics of Agriculture and Food Policy. Prerequisites: 4703 and 5103. Application of welfare criteria and economic analysis to agricultural, food and rural development problems and policies.

5713* Rural Regional Analysis. Prerequisite: 5103. Concepts of market and nonmarket based rural welfare; theories of regional growth as applied to rural areas; methods of regional analysis including computable general equilibrium; analysis of policies and programs for improving welfare of rural population groups.

5723* Rural Development Planning. Economics of market based planning for developing and developed countries; methods of incentive planning with emphasis on agricultural and rural project analysis; methods of agricultural and rural sector incentive planning with emphasis on general equilibrium results.

5733* International Agricultural Policy and Development. Review and evaluation of agricultural trade and development policies emphasizing developing countries. Objectives, constraints and instruments of national food and agricultural trade policy in an interdependent world. Efficiency, stability, distribution, equity and market structure in commodity trade.

5990* Advanced Studies. 1-6 credits, maximum 6. Open to graduate students with consent of instructor only. Investigation in designated areas of agricultural economics.

6000* Research Problems. 1-15 credits, maximum 24. Open to students pursuing graduate study in agricultural economics beyond the requirements for a master's degree. Independent research and thesis under the direction and supervision of a major professor.

6102 Teaching Practicum in Agricultural Economics. Lab 4. Prerequisites: two semesters of graduate study in agricultural economics. Philosophies of resident and nonresident teaching, general tasks performed, review, evaluation and lecture organization, preparation and presentation.

6103 Advanced Applications of Mathematical Programming. Prerequisites: 5103, 5113. General presentation of nonlinear optimization theory and methods followed by applications of nonlinear programming. Use of GAMS/MINOS optimization software package.

6113 Systems Analysis for Agriculture. Prerequisites: 5103, STAT 4043, knowledge of BASIC or FORTRAN. Methodology of systems modeling developed. Problem definition, design of abstract models, simulation of dynamic agricultural systems with time delays, storage, feedback and stochastic variation. Theory and application of modeling with differential equations and optimal control procedures.

6213* Advanced Econometrics. Prerequisites: 5213 or ECON 5243; STAT 4203 and 4213 recommended. Using advanced econometric techniques in applied research. Linear and nonlinear hypothesis testing, non-nested hypothesis tests, Monte Carlo hypothesis testing, stochastic simulation, ARIMA models, and multivariate time series modeling. Extensive use of SAS and SHAZAM statistical software packages.

6300 Agricultural Marketing Seminar. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Current developments in theory, techniques for evaluating marketing behavior, market legislation and market development.

6303* Agricultural Marketing. Prerequisite: 5303. Marketing theory, market structure and performance, governmental regulation and policy, and bargaining in agricultural markets.

6400* Seminar in Farm Management and Production Economics. 1-6 credits, maximum 6. Prerequisite: 5403 or consent of instructor. Scientific research methodology applied to problems of resource efficiency.

6403* Advanced Production Economics. Prerequisite: 5403. Micro dynamic production economic problems under risky conditions; recent developments in agricultural risk management, measuring utility, stochastic efficiency and decision theory; potential application of inventory, replacement and simulation game theoretic, Bayesian and nonlinear programming models in production economics research.

6700 Agricultural Policy and Rural Resource Development Seminar. 1-2 credits, maximum 2. Frontier issues in agricultural policy, natural resources and rural development.

Agricultural Education (AGED)

1511 Introduction to Leadership in Agricultural Sciences and Natural Resources. Introduction to the concept of leadership as a field of study. Emphasis placed on the application of acquired knowledge to practical problems.

2303 Personal Leadership Development in Agricultural Sciences and Natural Resources. How leaders identify and develop leadership skills and link them to their own unique vision, values, and personal strengths.

3101 Laboratory and Clinical Experiences in Agricultural Education. Preprofessional clinical experiences in agricultural education career areas. Requirements for admission to teacher education, student teaching and internships. Planning courses and experiences to enhance technical skills.

3103 Foundations and Philosophies of Teaching Agricultural Education. Lab 2. Prerequisite: 21 semester credit hours of agriculture with a 2.50 GPA. Roles and responsibilities of the agricultural education teacher; types of program offerings; steps of the teaching-learning process; place of agricultural education in relation to other educational programs in school systems.

3203* Planning the Community Program in Agricultural Education. Lab 2. Prerequisite: 3103. Determining resources and trends of local community with respect to agricultural production and agribusiness. Emphasis on agricultural education program policies, FFA chapter advise ment, planning and managing the instructional program, identification and completion of records and reports required of a teacher of agricultural education in Oklahoma.

3303 Agricultural Leadership: Theory and Practice. A study of the concepts and theories of leadership with emphasis on the development of leadership abilities in the individual for different group situations.

3333 Contemporary Issues in Leadership. Prerequisites: 3303, 3303. Explore current issues in the study of leadership. Themes based on current leadership research and writings that reveal new understandings of the leader's role as a servant, facilitator, and collaborator.

3403 Agricultural Agencies and Information Transfer. Prerequisites: junior standing or consent of adviser. Enabling legislation having an impact on federal and state agricultural agencies; corporate agricultural groups, cooperatives, federal, state and private agricultural research entities/organizations and farm organizations. Scope of U.S. and Oklahoma agriculture. Systems providing technical information, financing, markets and distribution of agricultural and food products. Theory involving the dynamics of change, diffusion of innovations and mediums of communication.

4101* Seminar in Leadership Education. Prerequisites: 2303, 3303. In depth exploration of leadership topics related to agricultural sciences and natural resources.
4103* Methods and Skills of Teaching and Management in Agricultural Education. Lab 2. Prerequisites: 3103, 3203; concurrent enrollment in 4103. Familiarization with the College of Agriculture, full admission to the University Teacher Education program, and concurrent enrollment in 4103. Facets of the teaching-learning process including teaching methods, basic teaching skills, proper classroom management techniques and motivational techniques and ideas. Preparation for student teaching which is to be completed during the same semester.

4113 Laboratory Instruction in Agricultural Education. Prerequisites: 3103, 3203; concurrent enrollment in 4103 and 4200. Methods of teaching agricultural education in a laboratory setting. A study of laboratory safety instruction, methods of teaching, and application of technical agricultural skills to the secondary program.

4200 Student Teaching in Agricultural Education. 10 credits. Lab 30. Prerequisites: 3203, junior standing in the College of Agriculture, full admission to the University Teacher Education program and concurrent enrollment in 4103. Full-time directed experience in an approved agricultural education department. Applications of methods and skills in agricultural education as related to selecting, adapting, utilizing, evaluating curriculum materials and experiences to meet educational goals and facilitate learning for individuals, responsibilities, interactions, of school personnel and parents. Study of professional education groups and organization and operation of school systems. Graded on a pass-fail basis.

4203* Professional Development in Agriculture. Prerequisite: junior standing. Preparation of professionals in agricultural business and industry and related areas who have career goals directed toward service, leadership, management, communications, production, processing, marketing and education outside the public school setting. Development of professionalism through relationship building, networking, interviews, community involvement, business correspondence, websites and the resume.

4300 Agricultural Education Internship. 3-6 credits, maximum 6. Prerequisites: professional course sequence and consent of adviser/internship coordinator. Supervised full-time internships in approved county extension offices, agricultural industries or government agencies, for students preparing career paths in agricultural education. Not intended for teacher certification. Maximum credit requires a 12-week internship in addition to a report and final seminar.

4303* Facilitating Leadership Education Programs. Prerequisites: 2303, 3303. Identification and application of methods and techniques for teaching leadership education programs in formal and non-formal educational settings. Focus on using experiential methods of teaching leadership.

4713* (1)International Programs in Agricultural Education and Extension. World hunger and its root causes. The function of international agencies, organizations, foundation and churches in improving the quality of life for people of the developing nations. Roles of agricultural education and extension at all levels for enhancing the effectiveness of indigenous programs of rural development and adult education.

4990* Seminar and Problems in Agricultural Education. 1-3 credits, maximum 6. Small group and/or individual study and research in problems relating to programs of occupational education in agriculture.

5000* Research and Seminar. 1-6 credits, maximum 6. Independent research and thesis under the direction and supervision of a major professor.

5100* Organizing Curriculum and Programs of Agricultural Education. 1-3 credits, maximum 6. Studies of student and community agricultural needs as bases for localizing, personalizing and utilizing a basic core curriculum and other components essential to effective local agricultural education programs.

5123 Adult Programs in Agricultural Extension Education. Determining adult needs, priorities, participation in educational activities and adoption of new ideas and practices. Designing, organizing, conducting, and evaluating adult education programs in agricultural and extension education.

5202* Grantseeking. Prerequisite: standing or consent of instructor. Students become proficient in writing proposals to obtain external funding from private and government agencies. Skills such as conceptualizing projects that are worth funding, identifying sources of funding, developing a workable proposal that follows the RFP guidelines, developing boilerplate information, conducting a review of literature to demonstrate a need for the project, developing timelines, and budgets.

5500* Directing Programs of Supervised Experience. 1-3 credits, maximum 6. Prerequisite: consent of instructor. Determining the supervised training needs and opportunities of individual students. Planning for supervision of agricultural education training programs and 4-H club projects. Analysis of training opportunities in production agriculture, agricultural businesses and individual career development.


5923* Advanced Methods of Teaching Agriculture. Advanced concepts and methods relevant for both formal and informal presentations. Effects methods may have on individuals involved in the learning experience. Demonstrations of proficiencies in the use of various advanced methodologies, technologies and concepts.

5863* Methods of Technological Change. Processes by which professionals research agents influence the introduction, adoption, and diffusion of technological change. Applicable to persons who work closely with people in formal and non-formal educational settings.

5900* Graduate Internship in Agriculture. 1-6 credits, maximum 6. Prerequisite: admission to Master of Agriculture program; consent of graduate coordinator. Supervised internship in agricultural education, government agency, industry, Cooperative Extension, or not-for-profit organizations.

5940* Program Evaluation in Agriculture and Extension Education. 1-3 credits, maximum 6. Methods of evaluating county extension programs, giving attention to sources of essential basic information, determination of problems and needs of people, functions of key personnel and the various groups of extension workers. Uses of committees, step-by-step procedures, coordinated county and state plans and characteristics of effective programs.

5960* Advanced Methods of Teaching Agriculture. Advanced concepts and methods relevant for both formal and informal presentations. Effects methods may have on individuals involved in the learning experience. Demonstrations of proficiency in the use of various advanced methodologies, technologies and concepts.

5990* Problems in Agricultural and Extension Education. 1-3 credits, maximum 8. Study of what leadership is and how current leadership styles have an impact on the success of present day agricultural organizations. Utilization of extensive bank of videotapes of current leaders as reference base for study.


6000 Research in Agricultural Education. 1-16 credits, maximum 16. Prerequisite: approval of major advisor. Open to students pursuing graduate study beyond the requirements for a master’s degree. Independent research and thesis under the direction and supervision of a major professor.

6100* Developments in Agriculture and Extension Education. 1-3 credits, maximum 6. Developing trends in agricultural and extension education. Pending and anticipated organizational and structural changes and changing emphases in goals and objectives. Functional relationships with other agencies.

6103* History and Philosophical Foundations of Agricultural and Extension Education. Prerequisite: graduate standing. History and philosophical foundations of agricultural and extension education. Philosophy and its role in life, rise of education in America, philosophical foundations of education in America, legislation having an impact on agricultural and extension education, education in agriculture, and current issues in agricultural extension education.

6120* Teaching Agriculture in Higher Education. 1-3 credits, maximum 6. The teaching-learning matrix functioning in both undergraduate and advanced study in the field of agriculture. Discrimination and use of recently developed instructional methods and trends.

6200* County Extension Program Development. 1-3 credits, maximum 6. A systematic study and use of methods of developing county extension programs, giving attention to sources of essential basic information, determination of problems and needs of people, functions of key personnel and the various groups of extension workers. Uses of committees, step-by-step procedures, coordinated county and state plans and characteristics of effective programs.

6223* Program Evaluation in Agriculture and Extension. Prerequisite: graduate standing. Program evaluation theory and methodology (quantitative and qualitative) presented through a service learning framework. Problem-based approach having students submit a proposal that addresses an evaluation need presented by a community-based program.
6250 Seminar in Advanced Qualitative Research Methods. 1-2 credits, maximum 2. Prerequisite: AGED 5983 or other graduate level social science research methods. Advanced qualitative research methods and analysis techniques presented in a Socratic context. Active engagement in qualitative research project to benefit from and contribute to this forum. 

Agriculture (AG) 

1011 Orientation. Required of all freshman in the College of Agricultural Sciences and Natural Resources. Methods of study, advisement system, organization of curriculum and discussion of requirements and career opportunities in various fields of agriculture. Graded on pass-fail basis. 

2003 (N)Agriculture and the Environment. A study of agricultural ecosystems for the non-agriculture major. Discussion of contemporary issues related to agriculture and the environment including conservation of natural resources, water quality, use of fertilizer and chemicals, intensive animal production, animal well-being, land utilization, and use of genetically engineered plants and animals. 

2112 Microcomputer Techniques in Agriculture. Lab 2. Operation and capabilities of microcomputers in agricultural applications. Simple programming, data analysis, graphical display, spreadsheet, word processing. 

3010 Internships in Agriculture. 1-3 credits, maximum 12. Supervised internships with business, industry or governmental agencies including cooperating veterinarians. Graded on pass-fail basis. 

3080 International Experience. 1-18 credits, maximum 36. Prerequisite: consent of the associate dean of the college. Participation in a formal or informal educational experience outside of the USA. 

3090 (i)Study Abroad. 1-18 credits, maximum 36. Prerequisites: consent of the Study Abroad office and associate dean of the college. Participation in an OSU reciprocal exchange program. 

4010 Honors Seminar. 1-6 credits, maximum 6. Role of agriculture in society and adjustments to change in the economy. 

American Studies (AMST) 

2103 (H)Introduction to American Studies. Interdisciplinary study of American civilization through case studies of four different time periods in order to understand the multiple roles of culture in American life. 


3253 (H)Globalization and American Culture, the world looks at America. Transmission, reception and influence of American culture in one or more of the following: Europe, Asia, Latin America, the Middle East. The cultural history of globalization and American culture. 

3313 (H)Science, Technology and American Cultures. American science and technology as systems of cultural representation, as communities of cultural practices, as mutually determined by other forms of cultural representation such as religion, social thought, art, architecture, literature, and music. 

3423 (H)American Popular Culture. Emergence and development of American Popular culture forms, rituals, and consumerism. Paradigms and festivals, circuses and minstrelsy; motion pictures; popular music; sports; comic books; the Internet and cyberspace. Specific attention to issues of race, class and gender. 

3713 (H)History of American Children’s Culture. Interdisciplinary study of the history of culture for and by children. Children’s literature, toys, folklore, music, clothing, movies, games, sports, tv shows, computer games, clubs and organizations. 

3723 (H)Cultural History of American Sports and Everyday Life. Representations of sport in art, music, literature, and folklore as a window into the social history of American ideas and values: sport and community formation; cultural dimensions of sport performance. Sports rituals; athlete heroes, issues of race, class and gender; football; basketball; baseball; boxing; stock car racing. 

3950 Special Topics in American Studies. 3 credits, maximum 6. Particular topics (popular culture, regionalism, myth, subcultures, race, ethnicity) to illustrate the use of interdisciplinary methods in American studies. 

4433 (H)Hollywood Genre Film. Study of one or more Hollywood film genres (romantic comedy, film noir) with the objective of understanding the American social, historical, and aesthetic contexts of specific genres. 

4973 Senior Seminar in American Studies. Writing of senior thesis based on original research and its analysis and evaluation of the independent project based on practical community experience. 

Animal Science (ANSI) 

1124 Introduction to the Animal Sciences. Lab 2. Species adaptability, product standards and requirements, areas and types of production, processing and distribution of products, includes meat animals, dairy and poultry. 

1133 Fundamentals of Food Science. Food industry from producer to consumer and the current U.S. and world food situations. 

1223 Exploring the Science of Animal Agriculture. Lab 2. An introductory course describing the principles, methods, applications and value of biological research with farm animals. Course also offered for honors credit. 


3021 Sheep Production. Lab 2. Prerequisites: 1124 and 2123. Modern production and management practices for sheep operations. No credit for animal science students with credit in 4542. 

3031 Swine Production. Lab 2. Prerequisites: 1124 and 2123. Modern production and management practices for swine operations. No credit for animal science students with credit in 4643. 

3033 Meat Technology. Lab 3. The basic characteristics of meat and meat products as they relate to quality. Product identification, economy, nutritive value, preservation and utilization. No credit for students with credit in ANSI 2253 or 3333. 

3101 Undergraduate Seminar. Prerequisites: 60 credit hours and animal science major status. An in-depth consideration of the various areas of specialization in the field of animal science and their associated career opportunities and obligations. 

3113 Quality Control. Lab 2. Prerequisites: introductory microbiology and organic chemistry. Application of the principles of quality control in food processing operations to maintain the desired level of quality. 

3154 Food Microbiology. Lab 4. Prerequisites: introductory microbiology and organic chemistry. Relationship of microorganisms to food manufacture and preservation, to food spoilage and microbial food poisoning and to various aspects of primary food production. Same course as MICRO 3154. 

3182 Meat Grading and Selection. Lab 4. Prerequisite: 2253. Classifying and grading carcasses and wholesale cuts of beef, pork and lamb; factors influencing quality and value. 

3210 Animal and Product Evaluation. 1-2 credits, maximum 4. Prerequisite: consent of instructor. Advanced instruction in evaluating slaughter and breeding animals, and grading and evaluating meat, poultry and dairy products. 


3333 Meat Science. Lab 3. Prerequisites: 2253, CHEM 1215 or equivalent. Anatomical and basic chemical and physical characteristics of meat animals studied. The application of scientific principles to the processing and economic utilization of meat animals, as well as in the manufacture of meat products, emphasized in the laboratory. 

3373 Food Chemistry. Lab 2. Prerequisite: 3543 or organic chemistry. Basic composition, structure and properties of foods and the chemical changes or interactions that occur during processing and handling. 

Animal Science 217
the examination of foods.

Analysis of Food Products
3753

and diet management for pets and companion rations for each of the classes of livestock.

218

Animal Science

4843

Applications of Biotechnology in Animal Science.

Lab 3. Prerequisites: 3423 and BIOCH 3653. Training in current biotechniques used in protein, hormone and molecular genetic research in food and animal science. Theory and applications of the various techniques.

4863

Capstone for Animal Agriculture. Lab 2. Prerequisite: senior standing. Examination of the role of animal agriculture in society, the importance of research and current issues. Oral and written reports.

4900

Special Problems. 1-6 credits, maximum 6. Prerequisite: consent of instructor. A detailed study of an assigned problem by a student wishing additional information on a special topic.

4910*

Animal or Food Industry Internship. 3-12 credits, maximum 12. Prerequisite: consent of instructor. Full-time internship at an approved production, processing or agribusiness unit or other agency serving animal agriculture. Maximum credit requires a six-month internship in addition to a report and final examination. Graded on a pass-fail basis.

4973

Rangeland Resources Planning. Lab 3. Prerequisites: 3612 and AGRON 4954. Inventory or ranch resources, survey and evaluation of ranch practices, and economic analysis. Development of a comprehensive ranch management plan. Managing rangeland and ranch resources in a social context. Written and oral reports. Field trips required. Same course as AGRON 4973.

5000*

Research and Thesis. 1-6 credits, maximum 6. Independent research planned, conducted and reported in consultation with a major professor.

5010*

Special Problems. 1-3 credits, maximum 6. Special problems in areas of animal science other than those covered by the individual graduate student as a part of his research and thesis program.

5110* Seminar. 1 credit, maximum 3. A critical review and study of the literature; written and oral reports and discussion on select subjects.

5113* Basic Reproductive Physiology. Prerequisite: ZOOL 3204. Female and male reproductive processes, the influences of environmental factors upon these processes and the application of reproductive physiology to animal production.

5120*

Special Topics in Food Science. 1-4 credits, maximum 4. Prerequisites: graduate standing and/or consent of instructor. Advanced topics and new developments in food science especially with reference to foods of animal origin.

5213*

Advances in Meat Science. Prerequisites: BIOCH 4113 and ZOOL 3204 or equivalent. Development of muscle and its transformation to meat. Properties of meat and their influence on water-binding, pigment formation, texture and fiber characteristics.
5303* Advanced Animal Breeding. Prerequisites: 3433 or equivalent and STAT 4013. Basic concepts of population genetics as related to theoretical animal breeding including heritability, genetic correlations, selection methods, inbreeding and heterosis.

5733* Advanced Ruminant Nutrition. Lab 2. Prerequisite: 3653. Factors influencing nutrient requirements of ruminants for maintenance, growth, reproduction, and lactation, and their implications with regard to husbandry practices and nutritional management of livestock; application of current concepts of ruminant livestock nutrition; use of microcomputer programs in diet evaluation and formulation, beef gain simulation, and problem solving.

5743* Rumenology. Prerequisite: 3653 or equivalent. Physiology of development of the ruminant digestive tract; the nature of, and factors controlling, digestive processes which include the relative nature and roles of the rumen bacteria and protozoa.

5753* Animal Nutrition Techniques and Laboratory Methods. Lab 2. Prerequisite: CHEM 3015 or equivalent. Collection, handling, and processing of biological materials. Record keeping, pipetting, preparation of reagents, and conducting routine nutritional analysis. Theory of operation of major laboratory equipment. Application of current techniques to problem solving in animal nutrition research.

5763* Advanced Nonruminant Nutrition. Prerequisite: BIOL 3653. An in-depth study of the digestion, absorption and metabolism of nutrients in nonruminant domesticated farm animals. Unique metabolic characteristics of nonruminant species contrasted with ruminant animals. Fundamentals of energetics as related to animal performance.

5772* Protein Nutrition. Prerequisite: BIOL 5753. Nutritional, biochemical and clinical aspects of protein metabolism as it relates to nutritional status.

5782* Vitamin and Mineral Nutrition. Prerequisite: BIOL 3653. Development of the concept of dietary essential minerals and vitamins. Individual minerals and vitamins discussed for animal species from the standpoint of chemical form, availability, requirements, biochemical systems, deficiencies and excesses, and estimation in foods and feed.

6000* Research and Thesis. 1-10 credits, maximum 30. Prerequisite: M.S. degree. Open only to students continuing beyond the level of the M.S. degree. Independent research, planned, conducted and reported in consultation with and under the direction of a major professor.

6003* Population Genetics. Prerequisites: 5303 or equivalent and STAT 4023. Population concept of genetics with emphasis on qualitatively inherited traits and statistical techniques utilized in population genetics. Gene and genotypic frequencies, estimation of genetic parameters within a population and the forces which can alter the magnitude of these genetic parameters and inbreeding.

6010* Special Topics in Animal Breeding. 1-3 credits. Prerequisite: consent of instructor. Advanced topics and new developments in animal breeding and population genetics.

6110* Seminar. 1 credit, maximum 3. A critical analysis of the objectives and methods of research in the area of animal science. Review of the literature, written and oral reports and discussion on select topics.

Anthropology (ANTH)

2353 General Anthropology. Anthropology, emphasizing the study of human physical evolution (physical anthropology) and cultural evolution (archaeology).

3353* (S) Cultural Anthropology. Introduction to culture, various subdisciplines of cultural anthropology, anthropological concepts and capsule ethnographies of assorted ethnic groups.

3823 North American Indian Cultures. Pre-contact and traditional subsistence patterns, social organization and ideology with emphasis on specific groups in each culture area.

4123* Archaeology of North America. Factors influencing the initial settlement of North America, the spread and diversification of hunting and gathering economies, the rise of agricultural systems and emergence of extensive and complex political units.

4833* (S) Racial and Cultural Minorities. Ethnic and racial groups in contemporary pluralistic society, including a cultural-historical perspective on their origins, social relations, value systems and goals.

4823* Contemporary Native Americans. Cultural adaptations of North American Indians within both contemporary 'traditional' communities and urban settings. Federal programs and current problems as they relate to the adaptational processes.

4883* (S) Comparative Cultures. Compares environments, economies, social and political organizations and other aspects of culture among selected literate and preliterate societies.

4990* Special Topics in Anthropology. 1-3 credits, maximum 6. Prerequisite: consent of instructor. Directed readings or research on significant topics in anthropology.

Applied Behavioral Studies in Education (AB SE)

6610* Doctoral Internship in School Psychology. 3-6 credits, maximum 6. Prerequisites: admission to school psychology doctoral program, completion of all course work, completed readiness for internship form, and approved by school psychology faculty. Supervised experience of doctoral school psychologists for final preparation to enter the profession of school psychology.

Architecture (ARCH)

1112 Introduction to Architecture. Lab 2. An introduction to the School of Architecture and OSU resources and how to use them. Introduction to the professions of architecture and architectural engineering and the issues facing these professions in the next century. Introduction to the educational processes and objectives required for becoming a professional architect or architectural engineer.

1216 Architectural Design Studio I Lab 16. Architectural graphics and design fundamentals. Students who have not received a grade for 1216 will be given first priority in enrollment. Students who have received a grade in this course will be admitted on a space available basis and at the discretion of the school head and architecture adviser.

2003 (H) Architecture and Society. Design, planning and building considered in their social and aesthetic contexts.

2024 Statics and Strength of Materials. Lab 2. Prerequisites: grade of "C" or better in PHYSC 1114 or PHYSC 2014 and MATH 2145. Results of force systems, static equilibrium of rigid bodies and statics of structures. Shear and bending moments, deformation and displacements in deformable bodies.

2100 Architectural Studies. 2-4 credits, maximum 4. Lab 6-12. Beginning studies in graphics and design in architecture.

2116 Architectural Design Studio II Lab 16. Prerequisite: grade of "C" or better in 2116. Students who have not received a grade for 2116 will be given first priority in enrollment. Students who have received a grade in this course will be admitted on a space available basis and at the discretion of the school head and architecture adviser. Problems in architectural design.

2216 Architectural Design Studio III Lab 16. Prerequisite: grade of "C" or better in 2116 and 2116. Students who have not received a grade for 2216 will be given first priority in enrollment. Students who have received a grade in this course will be admitted on a space available basis and at the discretion of the school head and architecture adviser. Problems in architectural design.

2263 Building Systems and Materials. Prerequisite: grade of "C" or better in 2116. Architectural, structural, environmental control systems and materials in architecture.


3083 (H) History and Theory of Baroque Architecture. Prerequisite: 2003. History and theory of renaissance architecture in the western world particularly the later, baroque period.

3100 Special Topics in Architecture. 2-6 credits, maximum 12. Subjects to be selected by the faculty in architecture from advances in state-of-the-art areas.
3116
Architectural Design Studio IV. Lab 16. Prerequisites: grade of "C" or better in 2216 and admission to third year. Problems in architectural design.

3126
Structures: Steel, Timber and Concrete. Lab 4. Prerequisite: grade of "C" or better in ENSC 2143. Analysis and design of steel, timber and concrete structures used in architecture.

3134
Environmental Control: Thermal Systems and Life Safety. Lab 2. Prerequisite: MATH 1715 or MATH 1513. A survey of the fundamentals of thermal comfort, energy concerns and mechanical systems for buildings as well as the basic principles of life safety.

3143
Structures: Analysis I. Prerequisite: grade of "C" or better in 2143. Structural theory for applications in architecture.

3216
Architectural Design Studio V Lab 16. Prerequisite: grade of "C" or better in 3116. Problems in architectural design.

3223
Structures: Timbers. Lab 2. Prerequisite: grade of "C" or better in 3323. Analysis and design of timber structures used in architecture.

3224
Structures: Steel II. Lab 2. Prerequisites: grades of "C" or better in 3126 and 3143. Design and analysis of multi-story steel frames, trusses, arches and other architectural structure components.

3253
Computer Applications in Architecture I. Prerequisite: concurrent enrollment in ARCH 3216. Introduction to 2-D and 3-D AUTOCAD and plotting and their application in the design process.

3323
Structures: Steel I Lab 2. Prerequisite: grade of "C" or better in 3323. Analysis and design of steel structures used in architecture.

4033*
Advanced Architectural Acoustics Design. Prerequisite: 3433. The analysis and design of acoustically critical spaces including open-plan offices, music facilities, studios, theaters, etc. The course includes a design project of the students’ choice.

4073*
(H)History and Theory of Early Modern Architecture. Prerequisite: 2003. History and theory of modern architecture in the western world from the industrial revolution to the early twentieth century.

4083

4123*
Structures: Concrete I Lab 2. Prerequisite: grade of "C" or better in 3223. Analysis and design applications in architectural problems using concrete structures.

4143*
Structures: Foundations for Buildings. Lab 2. Prerequisite: grade of "C" or better in 3126. Interaction of material supports for structural concrete in architecture. Subsoil conditions and design of foundation systems and retaining walls for buildings.

4183*

4193*
Marketing Professional Services. Prerequisite: 3116. Business development aspects of design firm management, including: marketing plan development; marketing organization; strategies and tools; selling techniques and contract negotiation.

4216*
Architectural Design Studio VI Lab 6. Prerequisites: grade of "C" or better in 3216. Problems in architectural design.

4225*
Structures: Concrete II Lab 4. Prerequisites: grades of "C" or better in 3126, 3454, and 4143. Analysis and design of multi-story reinforced concrete frames and prestressed and post-stressed structural components used in architecture applications.

4373*
Field Study in Europe I Prerequisite: senior standing in architecture or consent of instructor. On-site analysis and study of European architecture, culture and urban design.

4417
Architectural Design Studio VII Lab 20. Prerequisite: grade of "C" or better in 4517. Problems in architectural design.

4443*
Structures: Analysis II Lab 2. Prerequisites: grades of "C" or better in 3454, and MATH 3263. Mathematical formulation of architectural structural behavior. Matrix applications, finite element, finite differences, stability considerations and three-dimensional structural modeling.

4517
Architecture Design Studio VI Lab 20. Prerequisite: grade of "C" or better in 3216. Problems in architectural design.

5000*
Special Problems. 1-6 credits, maximum 6. Lab 3-18. Prerequisite: consent of instructor and head of the School. Theory, research or design in related disciplines. Plan of study to be determined jointly by student and graduate faculty.

5023*
Masonry Design and Analysis. Prerequisite: grade of "C" or better in 4213. Analysis and design of low-rise masonry structures and multi-story masonry shear walls including code requirements, analysis techniques, design of components and detailing of architectural engineering contract documents, conforming to the relevant codes.

5083*
History and Theory of Japanese Architecture. Prerequisite: admission to the professional school or consent of instructor. Historical Japanese Architecture from 200 BC to 1980; Shinto, Buddhism, Zen Sukiya, Zukuri, Minka and contemporary subjects.

5100*
Special Topics. 3-6 credits, maximum 15. Subjects to be selected by the graduate faculty in architecture to cover state-of-the-art advances.

5118*
Architectural Design Studio VII Lab 16. Prerequisites: grades of "C" or better in 3126, 3134, 3233, 3163, 4216. Enrollment in appropriate architecture seminar required. Problems in architectural design.

5133*

5143*

5173*
History and Theory of Architecture: Medieval. Prerequisite: 2003. Architecture of Western Europe from the Dark Ages to the beginning of the Renaissance including Romanesque and Gothic.

5193*
Management of Architectural Practice. Prerequisite: fifth-year standing in architecture or architectural engineering or consent of instructor. Principles of management as applied to the private practice of architecture and architectural engineering.

5217*
Architectural Design Studio VIII. Lab 16. Prerequisite: grade of "C" or better in 5116 or consent of instructor. Problems in architectural design.

5233*
Advanced Architectural Lighting Design. Prerequisite: 3433. Lighting applications in contemporary architectural design, including offices, schools, churches and health care facilities. Applications of the principles learned to a design of the student's choice.

5293*
Architectural Project Management. Prerequisite: fifth-year standing in architecture or consent of instructor. Principles of management as applied to architectural and architectural engineering projects.

5373*
Field Study in Europe II. Prerequisite: senior standing in architecture or consent of instructor. On-site analysis and study of European architecture, culture and urban design.

6000*
Special Problems. 1-15 credits, maximum 15. Lab 3-18. Prerequisite: consent of instructor and head of School. Theory, research or design investigation in specific areas of study in the field of architecture and its related disciplines. Plan of study determined jointly by student and graduate faculty.

6053*
Computer Applications in Architecture. Lab 3. Prerequisite: MECDT 4013 or equivalent or consent of instructor. State-of-the-art applications of computers to the practice of architecture and architectural engineering.

6073*
History and Theory of Non-Western Architecture. Prerequisite: graduate standing or consent of instructor. Architecture in the non-Western and pre-Columbian world.
History and Theory of Contemporary Architecture. Prerequisite: graduate standing or consent of instructor. American architecture beginning in the 16th century through the 20th century.

Special Topics. 3-6 credits, maximum 15. Subjects selected by the graduate faculty in architecture to cover state-of-the-art advances.

Creative Component Research. Prerequisite: admission to graduate program. Data gathering, analysis and program formulation related to creative component.

Graduate Design Studio I Lab 20. Prerequisite: admission to graduate program. Problems in architectural design.

Financial Management for Architects and Engineers. Prerequisite: 3116. Financial aspects of design firm management, including fundamentals of finance, profit planning and control, cash management and analysis of financial statements.

Creative Component in Architectural Engineering. Lab 18. A design project based on a program previously developed by the student to include a written report and supporting documents when appropriate. Must be approved by the project adviser and completed in the final semester of the graduate program.

Creative Component in Architecture. Lab 20. Prerequisite: 6117. A design project based on a program previously developed by the student to include a written report and supportive documents when appropriate. Must be approved by the project adviser and completed in the final semester of the graduate program.

Structures: Analysis III. Prerequisite: grade of "C" or better in 4443. Analysis techniques for structural components including stability, space frames, computer applications, guyed towers and project research.

Architecture Seminar II. Seminar for graduate students only. Architectural criticism.

Structures: Steel III. Prerequisite: grade of "C" or better in 4144. Plastic analysis and design of structural steel frames utilizing load and resistance factor design.

Structures: Concrete III. Prerequisite: grade of "C" or better in 5244. Design of prestressed concrete structures, including pre- and post-tensioning.

Art (ART)

1103 Drawing I. Lab 6. A freehand drawing experience designed to build basic skills and awareness of visual relationships. A sequence of problems dealing with composition, shape, volume, value, line, gesture, texture and perspective. A variety of media explored.

1113 Drawing II. Lab 6. Prerequisite: 1103. Objective and subjective approaches to visual problem solving in a variety of black and white and color media. The analysis and manipulation of form, light, space, volume, and the formal aspects of perspective.

1203 Color and Design. Lab 6. Introduction to visual problem-solving. Organization of the two-dimensional plane: line, shape, value, texture, and color theory dealing with its visual and psychological aspects.

1603 (H) Introduction to Art. An introduction to the analysis and interpretation of visual arts. Visual, emotional and intellectual aspects of art in painting, sculpture, printmaking and architecture.

2113 Life Drawing. Lab 6. Prerequisite: 1113. Intensive life drawing with emphasis on preliminary linear construction and structural aspects of the figure, including the study of general body proportions, rapid visualization and figure-ground relationships.

2203 Three-dimensional Design. Lab 6. Prerequisite: 1103. Exploration of three-dimensional form and space stressing organization of design elements, development of concepts and manipulation of materials. Investigation of linear space, modular ordering, mass-volume and color through projects of a conceptual and applied nature.

2213 Color Theory. Lab 6. Prerequisite: 1103. Intensive, structured investigation into the nature and properties of color. Hue, value, chroma, and additive color mixing theory as well as the expressive qualities, symbolic potential, and psychological impact of pigment color.

2403 Illustration I. Lab 6. Prerequisite: 1113 and 2.5 graduation/retention GPA. Introduction to historic and contemporary illustration and consideration of a wide range of illustrative styles. Required experiments with media and consideration of alternate ways of illustrating a message through conceptual and compositional variations.

2413 Typography I. Lab 6. Prerequisites: 1113 and 2.5 graduation/retention GPA. An investigation of letter forms, their characteristics and a study of spacing, leading, type selection, layout alternatives, type specification and copy fitting. Preliminary introduction to typography as a communication medium. An understanding of typographic terminology and measuring systems while developing hand skills and introducing computer technology.

2423 Graphic Design I. Lab 6. Prerequisite: 1113 and 2.5 graduation/retention GPA. Exploration of basic design principles—line, form and color, as visual communication. Problem solving, generation of ideas, development of concepts and the integration of word and image. Technical presentation skills.

2603 (H) Art History Survey I. A study of the arts, artists, and their cultures from prehistoric times through the Early Renaissance.

2613 (H) Art History Survey II. A study of the arts, artists, and their cultures from the Early Renaissance to the present.

2623 Research Methods for Art History. Prerequisite: 1603. An introduction to research methodology and writing art history. Required of art history majors.

3110 Life Drawing Studio. 3 credits, maximum 9. Lab 6. Prerequisite: 2113 or consent of instructor. The development of formal and expressive aspects of drawing by direct observation of the figure and its environment. Emphasis on media experimentation, aesthetic considerations, personal concepts, and anatomy.

3123 Oil Painting. Lab 6. Prerequisites: 1113, 2203, or consent of instructor. The development of skills in oil painting stressing form and content, visual perception and individual expression. Technical instruction applicable to individual problems and needs.

3133 Watercolor Painting. Lab 6. Prerequisites: 1103, 2203, or consent of instructor. The development of skills in watercolor painting stressing form and content, visual perception and individual expression. Structured assignments in color mixing, wet-on-dry techniques, wet-into-wet techniques, brush handling, paper supports and surface manipulation.


3343 Jewelry and Metals. Lab 6. Prerequisites: 1113, 2203, or consent of instructor. Fabrication and forming techniques for non-ferrous metals. Cold joinery, silver soldering, surface treatment and elementary stone setting. Applications toward either wearable or small scale sculptural format.

3403 Illustration II. Lab 6. Prerequisites: 2403, 2413, 2423 and portfolio review. Exploration of illustrative solutions to maximize visual interest via varied viewpoints, concepts and altered reality. Projects involving different career areas within the field of illustration. Requirements and advantages of each area.

3413 Typography II. Lab 6. Prerequisites: 2403, 2413, 2423 and portfolio review. Exploration of typographic communication through a variety of problems. Type as the visual solution with emphasis on its functional, decorative and creative applications. Solution of more complex typographic problems, dealing with a large body of information via the development of grid systems.

3423 Graphic Design II. Lab 6. Prerequisites: 2403, 2413, 2423 and portfolio review. Use of computer and traditional methods to enhance production skills and solution of design projects from concept to the evaluation and design of symbols and logos and their various applications, leading to an understanding of system design. Introduction to graphic design production and the preparation of art for reproduction.

3443 Computer Graphics I. Lab 6. Prerequisites: 2403, 2413 and 2423 and portfolio review. Use of computer software to capture, create and alter electronic images for use in graphic design and illustration applications with an emphasis on concept and thematic development.
Printmaking: Relief. 3 credits, maximum 9. Lab 6. Prerequisites: 1113 or consent of instructor. Methods of clay preparation, hand building and forming methods, methods of decoration and glazing, firing and kiln construction. Involvement with ceramic materials and processes.

3600 Writing Methods in Art History. Prerequisite: concurrent enrollment in upper-division art history course. Supervised research and writing experience to be taken in conjunction with another upper division art history course.

3603 (H) History of Classical Art. Stylistic, philosophical and formal qualities of art in the Classical world. The creation of the Greek ideal and its dissemination in the Roman world through architecture, sculpture, and painting.

3613 (H) History of Medieval Art. Architecture, sculpture, painting and mosaic in the Christian world, c. 400-1400. Early Christian and Byzantine periods in Southern Europe and concurrent developments in the North, including Carolingian, Romanesque and Gothic.

3623 (H) History of Italian Renaissance Art. Architecture, sculpture and painting in Italy, c. 1450-1550. Major artists in their local contexts (e.g. Leonardo in Milan, Michelangelo in Florence, and Titian in Venice).

3633 (H) History of Baroque Art. Art in 17th century Europe. Architecture, sculpture and painting of the Catholic Reformation (e.g. Caravaggio and Bernini in Italy, Velasquez in Spain, Rubens in Flanders), concluding with painting in non-sectarian Protestant Netherlands (Rembrandt and Vermeer).

3643 History of Graphic Design. Evolution of graphic communication from prehistoric times to the present. Investigation of the origins of printing and typography in Europe leading to the design of the printed page, the impact of industrial technology upon visual communication and the study of the growth and development of modern graphic design.

3653 (H) History of 19th Century Art. Art of 19th century Europe—ideals, conflicts, escapes and triumphs, beginning with the French Revolution and ending in 1900.

3663 (H) History of American Art. Visual arts in America from the Colonial period to the present. Major styles, ideas and uses of material in architecture, painting, sculpture and design.


3693 (H) Survey of Asian Art. Arts of India, China, Japan and related countries in their historical and cultural settings. Traditions of painting, sculpture and architecture from their beginnings to the modern period.

3700 Printmaking: Relief. 3 credits, maximum 9. Lab 6. Prerequisites: 1113 or consent of instructor. Understanding and control of carving, processing and creating prints from wood, linoleum and plastic. Development of images utilizing both traditional and contemporary approaches to relief printmaking.

3720 Printmaking: Intaglio. 3 credits, maximum 9. Lab 6. Prerequisites: 1113 or consent of instructor. Understanding and control of intaglio techniques; preparation, processing, and editioning of images from metal plates. Development of concepts and images through traditional and contemporary approaches to the intaglio process.

3730 Printmaking: Lithography. 3 credits, maximum 9. Lab 6. Prerequisites: 1113 or consent of instructor. Understanding and control of the procedures of drawing, processing and printing editions from stones and metal plates. Development of concepts and images through the medium of lithography.

4100 Advanced Drawing. 3 credits, maximum 9. Lab 6. Prerequisite: 3123. Investigation of drawing stressing thematic development, abstract ideas and individual imagery.

4120 Oil Painting Studio. 3 credits, maximum 9. Lab 6. Prerequisite: 3123. Oil painting with emphasis on personal development of visual ideas and technique.

4130 Watercolor Studio. 3 credits, maximum 6. Lab 6. Prerequisite: 3133. Structured assignments with exploration of individual concepts, ideas and imagery to reinforce growth of technical skills and personal painting style in watercolor.

4330 Sculpture Studio. 3 credits, maximum 9. Lab 6. Prerequisite: 3333. A broad-based course which allows students to pursue individual interests using a variety of materials and processes. Emphasis on further development of concepts, skills and techniques.

4340 Jewelry and Metals Studio. 3 credits, maximum 9. Lab 6. Prerequisite: 3343 or consent of instructor. Metalworking processes including casting, rubber modeling, and advanced stone setting. Consideration of non-metal media. Emphasis on development of materials and ideas through conceptual problems.

4420 Graphic Design Studio. 3 credits, maximum 9. Lab 6. Prerequisite: 3423, 3443 or consent of instructor. Design and production of projects suited to the professional portfolio. Discussion of practical issues including career options, resume and portfolio preparation, and interview techniques.

4430 Illustration Studio. 3 credits, maximum 9. Lab 6. Prerequisites: 3403, 3443 or consent of instructor. Conceptual development and production of illustrations in series. Development of individual style and assembly of a professional and consistent portfolio.

4450 Computer Graphics Studio. 3 credits, maximum 9. Lab 6. Prerequisites: 3403 or 3423, 3443 or consent of instructor. Use of computer software to create three-dimensional objects in an artificial three-dimensional space leading to storyboard design, animation scripts and the production of animation sequences to video.

4493 Portfolio Capstone. Lab 6. Prerequisites: senior standing and consent of instructor. Final preparation of a professional portfolio, culminating in an extensive design project and the design, organization and production of an exhibition of work. Professional study on setting fees, writing contracts, working with an agent and other business practices.

4500 Ceramics Studio. 3 credits, maximum 9. Lab 6. Prerequisite: 3503. Continued explorations of ceramic arts: glazes, clay bodies, methods of forming, decorating and firing. Continued emphasis on the relation between visual unity and individual expressive concepts as these apply to both utilitarian and conceptual forms.

4603 (H) History of Ancient Egyptian Art. Broad survey of ancient Egyptian art and architecture from Pre-dynastic to the beginning of the Christian Era under Roman rule (4000 B.C.-320 A.D.). Discussion within the context of religious meaning and overall cultural development of ancient Egypt.

4613 Art Since 1945. Prerequisite: 3683. Art and art theory from 1945 to the present. Major trends of abstract expressionism, pop art, minimalism, photorealism and conceptual art. Theories and intellectual bases of each movement as well as major critical responses.

4653 (H) History of Indian Art. The history and culture of South Asia (India and Pakistan) are explored through its arts—architecture, sculpture, painting and design.

4663 (H) History of Chinese Art. The arts of China in their historical, cultural, religious and social context. Painting, sculpture, architecture, porcelain, furniture and decorative arts.

4673 (H) History of Japanese Art. The arts of Japan from the beginning to the modern period in their historical and cultural setting. Cross-cultural contacts with China and the West. Architecture, sculpture, painting, landscape architecture, prints and decorative arts.

4800 Special Studies in Art. 1-3 credits, maximum 9. Prerequisites: junior standing and consent of instructor. Courses in media exploration, special subjects and current issues. Offered on campus or through extension workshops.

4810 Museum Internship. 1-3 credits, maximum 6. An on-site museum experience including exhibition selection and preparation, collection cataloging and research, and museum administration.

4820 Graphic Design Internship. 1-6 credits, maximum 6. Prerequisites: 3403 or 3423 or consent of instructor. An on-site graphic design work experience that provides professional practice under the supervision of a design professional.

4830 Apprenticeship. 1-6 credits, maximum 6. Professional opportunity to work with artists of national and international reputation.

4900 Directed Study in Art. 1-3 credits, maximum 9. Lab 1. Prerequisites: junior standing and written permission of department head. Self-designed special topics in studio art or graphic design. By contract only.

4910* Directed Study in Art History. 1-3 credits, maximum 9. Lab 1-6. Prerequisites: junior standing and written consent of department head. Self-designed special topics in art history. By contract only.
Art in Context. Prerequisites: senior standing. Capstone course studying the role of visual arts in their historical, social and cultural context and in comparison to other disciplines of creative or performing arts, humanities and science.

Senior Honors Project. Prerequisites: departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors thesis or project under the direction of a faculty member. Required for graduation with departmental honors in art.

Graduate Studies in Art. 1-6 credits, maximum 12. Prerequisite: B.A., B.F.A., or 15 upper-division hours in a discipline; consent of instructor. Projects in art with emphasis on portfolio preparation.

Graduate Studies in Art History. 1-6 credits, maximum 12. Prerequisite: B.A., B.F.A., or 15 upper-division hours in a discipline; consent of instructor. Advanced research in art history.

Arts Management (AM)

Principles of Arts Management. Basic principles of managing performing arts and art museum organizations. Relationships of arts organizations to the community, budgeting, structure, income sources.

Arts Marketing and Audience Development. An examination of marketing arts events. Public relations and promotions, subscription sales, event sales and box office management, and developing new audiences.

Fundraising and the Arts. Basic charitable fundraising strategies including development of ongoing donor programs, fundraising events, planned giving, corporate and business sponsorships and grantwriting.

Law and the Arts. Legal and contractual issues specific to fine and performing arts organizations. Establishment and maintenance of 501c not-for-profit organizations, unions and contracts, ADA compliance and OSHA.

Arts Management Creative Project. 1-3 credits, maximum 6. Creative project.

Arts Management Internship. 1 credit, maximum 4. Fifteen week management internship with professional arts organization. Must repeat four times. A minimum of one internship taken with a gallery or museum and one internship with a performing arts organization.

Arts and Sciences (A&S)

Freshman Orientation. Orientation for freshmen. Study techniques, evaluation of one's abilities and the making of proper educational and vocational choices.

Honors Freshman Orientation. Prerequisite: Honors Program participation. Orientation for freshmen to Arts and Sciences Honors program, introduction to University academic expectations, techniques for achieving academic success, and substantive introduction to material in selected academic disciplines. No credit for students with credit in A&S 1111.

Special Topics. 1-3 credits, maximum 6. Selected interdisciplinary topics presented in lecture or seminar format.

Arts and Sciences Honors Supervised Research. Prerequisites: Honors Program participation, consent of instructor and A&S Honors Program director. Introduction to research or other creative activity in student's major field through participation in professor's research or creative activities.

International Experience. 1-18 credits, maximum 36. Prerequisite: consent of the associate dean of the college. Participation in a formal or informal educational experience outside of the USA.

Study Abroad. 1-18 credits, maximum 36. Prerequisites: consent of the Study Abroad office and associate dean of the college. Participation in an OSU reciprocal exchange program.

Colloquium in Area Studies. Interdisciplinary studies in one area: African, Asian, Latin American, Russian and East European, Native American, Ancient and Medieval, or Women's studies. Individual undergraduate research projects.

A&S Internship. 1-3 credits, maximum 6. Prerequisite: junior standing. Practicum or internship experiences not included in departmental offerings. Before enrolling, students must have an individual contract approved by the sponsoring Arts and Sciences professor and the dean of Arts and Sciences (or administrative officer). For use in special circumstances by Arts and Sciences departments that do not have an internship course.

Special Topics. 1-3 credits, maximum 6. Selected interdisciplinary topics presented in lecture or seminar format.

Liberal Studies Senior Project. Prerequisite: consent of instructor. Research report or other creative activity undertaken to satisfy capstone requirement for liberal studies degree.

Job Search Strategies for Arts and Sciences Majors. Prerequisite: junior standing. Identification of individual goals and transferable skills, exploration of career options, job market research and development of employment search tools.

Developmental Workshop in Selected Academic Fields. 1-3 credits, maximum 9. Arts and Sciences discipline-based material. Study groups, lectures and seminars.


The Solar System. Recent discoveries about the sun, planets, moons, asteroids, meteoroids, and comets; formation and future of the solar system; interplanetary travel, colonization, terraforming, and the search for extraterrestrial life. Offered in the fall semester. No credit for those with credit in 1104.

(N)Stars, Galaxies and the Universe. Recent discoveries about the structure and life cycles of stars, galaxies and the universe: the search for extraterrestrial intelligence; interstellar travel, black holes, wormholes, and tachyions. Offered in the spring semester. No credit for those with credit in 1104.

Aviation Education (AVED)


Primary Flight Laboratory. Lab 4. Meets the flight requirements for the FAA Private Pilot Certificate. Flight instruction conducted under FAR Part 141. Special fee required. Graded on a pass-fail basis.


History of Aviation. History of aviation from its early developments to the present. Historic events and the role of government as they relate to the evolution of the regulatory infrastructure of the aviation industry.

Commercial Flight Laboratory I. Lab 4. Prerequisite: 1222. First of three flight laboratories required for FAA commercial flight certificate with instrument rating. Flight instruction conducted under FAR Part 141. Special fee required.

Commercial Flight Laboratory II. Lab 4. Prerequisite: 2122. Dual instrument flight instruction to meet requirements for FAA instrument rating. Flight instruction conducted under FAR Part 141. Special fee required.

Commercial Flight Laboratory III. Lab 4. Prerequisite: 2132. Final flight lab to meet requirements for the FAA commercial pilot certificate. Flight instruction conducted under FAR Part 141. Special fee required.

Impact of Aviation and Space Exploration on Society. Survey of significant events and ideas and their economic and social impact on society.

Theory of Instrument Flight. Prerequisite: 1403. Instrument flight rules, the air traffic system and procedures, the elements of forecasting weather trends. Preparation for FAA instrument computer-based knowledge exam.

2633 Air Traffic Control and the National Airspace System. Prerequisite: 1113. In-depth knowledge in the subject of air traffic control and the national airspace system facilities, equipment and associated development. Enroute and terminal control areas, computerization and automation, flight service systems, ground-to-air systems and integrated telecommunications networks.


3243 Human Factors in Aviation. Prerequisite: PSYC 1113. The study of people interacting with the aviation environment. Individual and group performance, equipment design, physical environment, and procedure development.

3333 Advanced Aircraft Systems. Prerequisite: 2313. Study of complex aircraft systems. Electronic flight instruments, inertial navigation, and aircraft monitoring systems.

3341 Multi-engine Flight Laboratory. Lab 2. Prerequisites: Private Pilot Certificate and FAA Third-class Medical Certificate. Dual flight instruction to meet requirements for the FAA multi-engine rating. Flight instruction conducted under FAR Part 141. Special fee required.

3441 Aerobatic Flight. Lab 2. A minimum of ten hours dual flight training. Basic, intermediate and advanced aerobatic flight maneuvers including sequencing and dimensional box spacing. Special fee required.

3443* Aviation Law. Prerequisite: LSB 3213. Insight pertinent to federal governing bodies in addition to local and international laws forming the present structure of aviation law. Practices and pitfalls in aviation activities and a basic legal research capability.

3513 Aviation Management. Prerequisite: 50 credit hours. Managing the major elements of the aviation industry including aircraft manufacturing and air transportation system.

3523 Airport Planning and Management. Prerequisite: 50 credit hours. Overview of the major functions of airport management including master planning. Study of the socio-economic effects of airports on the communities they serve.

3533 Aircraft Turbine Engine Operation. Principles of physics and gas laws pertaining to turbine powered aircraft operation. Turbine powerplant systems theory with emphasis on safe and efficient operation of turbine powered aircraft.

3553* General Aviation Management. Prerequisite: 50 credit hours. Functions of management in general aviation and airport operations including information systems, maintenance, regulatory impact, physical facilities, flight operations, political forces and administration.

3563 Aviation Marketing. Prerequisite: 50 credit hours. Marketing aviation products for the major elements of the aviation industry.

3573 Aviation Finance. Prerequisite: 50 credit hours. Financing the major elements of the aviation industry including general aviation, aircraft manufacturing and airports.

3663* Air Transportation: The Industry. Prerequisite: 50 credit hours. Broad understanding of the air transportation industry and an in-depth knowledge of the organizational structures, managerial functions and operational aspects of today's major, national, and regional air carriers. Historical perspectives, regulators and associations, economic characteristics, labor relations and marketing of modern air carriers.

4010* Specialized Studies in Aviation. 1-3 credits, maximum 6. Prerequisite: 55 credit hours. Independent studies, seminars, and training within selected areas of aviation.

4113* Aviation Safety. Prerequisite: 55 credit hours. Overview of flight safety including studies in human factors, weather, aircraft crashworthiness, accident investigation, and aviation safety programs. Students will be introduced to elements of aviation safety in ground and flight operations.


4200 Internship in Aviation. 1-12 credits, maximum 12. Prerequisite: 55 credit hours. Individually supervised internship in aviation career areas. Directed field experience related to the participant's area of concentration.

4213* Current Trends and Issues in Aviation. Prerequisite: 3663. Analysis of current issues facing management in various segments of the aviation industry. Specific areas include issues affecting the airline industry and general aviation. Application of previously learned concepts to case studies of practical problems to develop deeper understanding of the subject.

4232 Flight Instructor: Airplane Flight Laboratory. Lab 4. Prerequisites: 2142, 4133. Dual flight instruction to meet the requirements for the FAA flight instructor; airplane certificate. Flight instruction conducted under FAR Part 141. Special fee required.

4303* Aviation Weather. Prerequisite: GEOG 3033. Familiarization with weather products needed to enhance flight safety.

4331 Flight Instructor: Instrument Flight Laboratory. Lab 2. Prerequisite: 4231. Dual flight instruction to meet the requirements of adding an instrument flight instructor rating to the flight instructor certificate. Flight instruction conducted under FAR Part 141. Special fee required.

4333* Advanced Aircraft Performance. Prerequisite: 50 hours. A study of advanced aircraft performance including appropriate physical laws, atmospheric properties and power plant technology.

4643* Aviation Navigation Global Positioning Systems. Prerequisite: 50 credit hours. Overview of the theory and operation of the GPS in the private and public sector.

4653 (I) International Aviation Issues. Prerequisite: 50 hours. The fundamental knowledge, comprehension and the abilities to apply, analyze, synthesize and evaluate international aviation issues.

4703* Crew Resource Management. Prerequisites: 2142, 3243. Decision making and communication to improve effective crew management. Ten hours in a dual flight control multi-engine simulator. Special fee required.

4771 Flight Instructor: Multi-engine Flight Laboratory. Lab 2. Prerequisite: 4231. Dual flight instruction to meet the requirement for adding a multi-engine flight instructor rating to the flight instructor certificate. Flight instruction conducted under FAR Part 141. Special fee required.

4943* Basic Aircraft Accident Investigation. Prerequisite: 50 credit hours. A study of statutes, regulations and regulatory agency requirements that influence aircraft accident investigation.

4953* Corporate Aviation Management. Prerequisites: 2142 and 3341. Study of management principles and practices of corporate aviation. Equipment acquisition, government regulations, aircraft maintenance management, and investment decision-making.

4990 Pilot Proficiency Flight. 1-2 credits, maximum 4. Lab 32. Required for students entering the aviation education program who possess all FAA certificates/ratings required for the aviation sciences degree.

5000* Master's Report or Thesis. 1-3 credits, maximum 3. Master's degree enrollment for a total of two credit hours if writing a report or three hours if writing a thesis.

5020* Seminar in Aerospace Education. 1-3 credits, maximum 6. Prerequisite: consent of instructor. Individual research problems in aerospace education.

5053* Guided Reading and Research. Prerequisite: consent of instructor. Guidance in reading and research required for the M.S. in aviation and space program.

5103* Aviation Career Development. Aviation career development in private and public aviation organizations.

5113* Aviation Safety Program Development. Prerequisite: 4113. A detailed examination of risk management and accident prevention in the aviation industry. Organization and operation of safety programs including OSHA requirements, performance measurements, cost analysis, and systems safety analysis.

5200* Graduate Internship in Aviation and Space. 1-6 credits. Master's degree enrollment for a total of directed field experiences in aerospace education for master's students.

5203* Aeromedical Factors. Prerequisite: 3243. The study of aeromedical factors that influence pilot performance. The study of life support equipment designed to increase aviation safety.
5000* Research. 1-6 credits, maximum 6. For M.S. thesis.

5753* Biochemical Principles. Prerequisite: CHEM 3153 or equivalent. Chemistry of cellular constituents; introduction to the chemical processes in living systems. The first in a series of courses for graduate students in biochemistry and related fields.

5824* Biochemical Laboratory Methods. Lab 6. Prerequisites: 4113 or 5753, or concurrent enrollment, and consent of instructor. Lecture and laboratory course in basic biochemistry and molecular biology methods for separation and analysis of biological materials, including chromatography, electrophoresis, centrifugation, use of radioisotopes, molecular cloning, and DNA sequencing.

5853* Metabolism. Prerequisite: 5753 or 4113. Reaction sequences and cycles in the enzymatic transformations of fats, proteins and carbohydrates; energy transfer, biosynthesis and integration in the metabolic pathways.

5930* Advanced Biochemical Techniques. 1-4 credits, maximum 10. Prerequisites: 5753, 5824 or concurrent registration, and consent of instructor. Lecture and laboratory course in advanced research techniques, designed to supplement 5824. In subsequent semesters, individual research problems pursued in laboratories of department faculty for six weeks and one credit hour each.

6000* Research. 1-15 credits, maximum 60. For Ph.D dissertation.

6110* Seminar. 1-2 credits, maximum 2 for Ph.D. or 1 for M.S. candidates. Graded on pass-fail basis.

6740* Physical Biochemistry. 1-2 credits, maximum 2. Prerequisites: one semester each of biochemistry, calculus and physical chemistry. Two independent modules dealing with applications of physical chemistry and math to biological phenomena: 1) numerical analyses and selected spectroscopic methods, and 2) thermodynamics and transport properties. Modules may be taken together as two credits or individually for one credit.

6763* Nucleic Acids and Protein Synthesis. Prerequisite: 4113 or 5753. Structure and biological function of nucleic acid containing structures with emphasis on recombinant DNA methodologies, information content, nucleic acid-protein interaction, regulation and rearrangement.
Protein Structure and Enzyme Function. Prerequisite: 4113 or 5753. Theory of and methods for studying the physical and chemical basis of protein structure and function; and the enzyme catalysis, including kinetics, chemical modification and model studies. Examples from current literature.

Biomembranes and Bioenergetics. Prerequisite: 5853 or consent of instructor. Components, organization and biosynthesis of plasma, mitochondrial and photosynthetic membranes, emphasizing structure-function relationships. Mechanism of metabolites, protons and electrons transport. Energy conservation in bioenergetic apparatus such as mitochondria, chloroplasts or bacterial chromatophores.

Plant Biochemistry. Prerequisite: 4113 or 5753. Biochemistry of processes and structures of special importance to plants, such as photosynthesis, cell walls, nitrogen fixation, secondary metabolites and storage proteins.

Selected Topics in Biochemistry. 1-3 credits, maximum 15. Prerequisite: 5853. Recent developments in biochemistry. Subject matter varies from semester to semester; students should inquire at the department office before enrolling.

Biological Science (BIOL)

1114 (L,N) Introductory Biology. Lab 3. Introduction to the integration between structure and function among all levels of biological organization. Application of principles of evolution, genetics, physiology and ecology to understanding the integrated and interdependent nature of living systems through discussions emphasizing the process of science. Current issues and local research and observation and investigation in both lecture and lab. Recommended for non-science and science majors.

3024* General Genetics. Prerequisite: BOT 1404, or ZOOL 1604, or equivalent. Inheritance in plants, animals and microorganisms; molecular and classical aspects.

3034* General Ecology. Lab 4. Prerequisites: BOT 1404, ZOOL 1604 or equivalent; MATH 1513 or 1715. Physical and biotic environment, responses of organisms to the environment, community ecology, natural ecosystems, and man's interaction with ecosystems.

3223 (N) Survey of Human Diseases. Prerequisite: 1114 or equivalent. Types of diseases, such as metabolic, genetic, infectious. Biological processes involved in disease. Impact of disease on human activity and of human activity on disease patterns. For the nonbiology major.

3232 (N) Human Reproduction. Prerequisite: 1114. Human reproduction is dealt with in terms of anatomy, physiology, embryology, genetics and evolution. Birth control, and teratogenic substances as well as pregnancy and childbirth. For the nonbiology major.

3243 (N) Biological Rhythms in Humans and Other Organisms. Prerequisite: 1114 or equivalent. Biological rhythms in humans and other organisms. Fundamental concepts and questions related to biological timing, its properties, mechanism and adaptive value. The implications of rhythms in human behavior and medicine.

3253 (N) Environment and Society. Prerequisite: 1114 or equivalent strongly recommended. The impact of human activities and population growth on the natural world. Analysis of the potential of technological and societal changes to have an impact on the environment. For the nonbiology major.

3263 (N) Plants and People. Prerequisite: 1114 or consent of instructor. Types of plants, form and function, history of uses of plants and plant products for food and beverages, fiber, medicinal purposes, and in people's surroundings. For the nonbiology major.

3604 Biological Principles for Teachers. Lab 2. Prerequisites: 1114, CHEM 1314, ZOOL 3204. Capstone course in biology for potential science teachers. Review of biological phenomena and principles as related to the curriculum.

5100* Current Topics in Biology for Teachers. 1-4 credits, maximum 4. Prerequisite: approval of instructor. Acquaints the primary or secondary teacher with recent advances in biology. May include lecture, laboratory or field work.

Biomedical Sciences (BIOM)


5013* Medical Biostatistics. Prerequisite: graduate standing. Fundamentals of biostatistics including parametric and non-parametric statistical methods with applications to biomedical research, clinical epidemiology and clinical medicine.

5020* Biomedical Sciences Seminar. 1-4 credits, maximum 4. Prerequisite: graduate standing. Literature and research problems in biomedical sciences.

5117* Gross and Developmental Anatomy. Lab 3. Prerequisite: graduate standing in the biomedical sciences program. General and specific concepts of regional morphology through didactic presentations and laboratory dissections. Emphasis on the range of normal for the various organ systems and their interrelationships. Application of anatomical knowledge in clinical situations.

5124* Histology. Lab 4. Normal microscopic tissue architecture. Lecture and laboratory presentation for the histologic concepts of the basic tissues and organ systems. Basis for pathologic and physiological principles.

5133* Neuroanatomy. Lab 2. Prerequisite: graduate standing in the biomedical sciences program. A continuation of gross anatomy to include anatomy of the head region. Emphasis on neuroanatomy. Laboratory sessions on head and brain dissection and special demonstrations. The relationship of basic principles with osteopathic medicine and neurology in clinical correlation sessions.

5215* Medical Biochemistry. Broad survey of the chemical classes and metabolic processes that are consistent with the normal functions of biosystems. Functions and interrelationships of these processes in human metabolism to provide a foundation for understanding the chemistry of disease states when discussed in the second-year program.

5316* Medical Microbiology and Immunology. Lab 2. Prerequisite: 5215. Similarities and differences among pathogenic microorganisms. Characteristics, pathogenesis and control of medically important microorganisms and disorders of the immune system. Laboratory exercises on the basic serological and microbiological procedures used in the diagnosis of infectious diseases.

5415* General Pathology I. Prerequisites: graduate standing. The reaction of the body to diseases and the description and identification of basic disease processes in terms of morphology, physiology and chemistry. Major processes such as cell injury, cell death, healing, neoplasia, inflammation, aging, development and aging. Basic disease processes and ability to recognize and describe basic disease processes from gross and microscopic specimens.

5425* General Pathology II. Prerequisite: graduate standing. Continuation of General Pathology I.

5513* Pharmacology I. Prerequisite: 5215, 5616. General principles of drug action, drugs acting on the autonomic nervous system, and drugs used in treating infectious diseases and cancer. The mode of action, pharmacogenetics, physiological effects, toxic indications, and adverse reactions to these drugs.

5523* Pharmacology II. Prerequisite: 5513. Continuation of Pharmacology I.

5616* Medical Physiology. Prerequisite: 5215. The integration of structure and function of the human body with a functional analysis of the organ systems. Comprehension of the physiological principles and control mechanisms that maintain homeostasis. Discussion of all systems of the body, and analysis of various interrelationships. The fundamental dynamic view of the body as a whole and subsequent clinical learning is dependent. Problem-solving techniques utilized to develop and examine student understanding.

6000* Research and Dissertation. 1.15 credits, maximum 45. Lab 1-15. Prerequisite: consent of major advisor. Research in biomedical sciences for Ph.D. degree.

6010* Topics in Biomedical Sciences. 1-3 credits, maximum 3. Prerequisite: consent of instructor. Tutorials in areas of biomedical sciences not addressed in other courses.

6023* Research Methods and Design. Prerequisite: graduate standing. Introduction to concepts of research design, methodology, sampling techniques, internal and external validity and the scientific method.

6113* Human Embryology. Lab 2. Prerequisite: 5117 or consent of basic science instructor. Formation of the fetus from conception through development of the organs and organ systems with discussions of congenital malformations.
6124* Advanced Histology. Lab 4. Prerequisite: 5124. Histochemical techniques used in the identification of cells or tissues based on the localization of cell organelles or cell products using electron microscopy, immunofluorescence, cryosectioning, and immunoperoxidase labeling.

6123* Biology of Transplantation. Prerequisites: basic course in immunology; graduate standing; consent of instructor. The biology of organ and cell transplantation, including study of immune aspects, technical aspects, organ donation and preservation, transplant tolerance, genetic manipulation of graft tissues, use of fetal/stem cells in transplantation, and biomedical ethics related to transplantation.

6143* Biomedical Electron Microscopy. Lab 4. Prerequisite: graduate standing. The theory and application of transmission and scanning electron microscopy in a biomedical setting.

6153* Islet Cell Biology and Diabetes. Prerequisite: graduate standing; consent of instructor. An overview of the current knowledge in the field of islet cell biology and the clinical aspects of diabetes.

6163* Cellular and Molecular Neurobiology. Prerequisites: 5215, 5616. Current aspects of cellular and molecular neurobiology, including cell biology of neurons and glia, communication between neurons and the molecular and cellular aspects of brain development and plasticity.

6175* Molecular and Cellular Biology. Prerequisite: course coordinator. Cell biology, including cellular macromolecules, energetic, metabolism, regulation, organization and function of cellular organelles, flow of genetic information and the regulation of selected cell activities.

6214* Advanced Topics in Medical Biochemistry. Prerequisite: 5215 or concurrent enrollment. Chemical basis of protein, carbohydrate, lipids, nucleic acid, sterol and porphyrin structure, function and metabolism as related to health and disease.


6233* Enzyme Analysis. Lab 2. Prerequisite: 6214. Characteristics, separation, detection, assays, kinetics, mechanisms of catalysis, inhibition or inactivation, and clinical applications of enzyme analysis.

6243* Human Nutrition. Lab 2. Prerequisite: 5215. Role of vitamins and minerals in maintaining normal metabolism, role of nutrients in providing athletic and immune system performance, and pathophysiology associated with nutrient deficits and nutrient excesses. Role of drugs in inducing cancer and increasing nutrient requirements.

6253* Biochemistry of Hormone Action. Prerequisite: 6233. Biochemical mechanisms behind peptide and steroid hormone action.

6263* Techniques in Molecular Biology. Lab 4. Prerequisites: 5215, 5316, consent of instructor. Transformation of bacteria and mammalian cells; purification of nucleic acids; cloning of DNA fragments; labeling of nucleic acids with non-radioactive probes; analysis of DNA and RNA by electrophoresis and hybridization; DNA sequencing; design, synthesis and use of oligonucleotides; site-directed mutagenesis; detection of rare nucleic acids by the polymerase chain reaction and expression of proteins.

6313* Diagnostic Parasitology. Lab 2. Prerequisite: 5316. Animal parasites of humans with a focus on the laboratory identification of the medically important protozoan and helminthic diseases.

6323* Diagnostic Virology. Lab 4. Prerequisites: 5215, 5316. Viruses causing disease in humans with emphasis on the laboratory diagnosis, prevention, and treatment of viral diseases.

6513* Neuroimmunology. Prerequisites: 5125, 5136. The experimental basis of immunology and immunopathology.

6534* Microbial Physiology. Lab 2. Prerequisites: 5215, 5316. The chemical composition, growth and metabolism of prokaryotic organisms including regulation and control of metabolic pathways with emphasis on metabolism unique to microorganisms.

6535* Molecular Virology. Lab 2. Prerequisites: 5215, 5316. Consent of instructor. The fundamental molecular biology of the virus life cycle using one virus as a model to examine penetration, gene regulation, replication, assembly and egress, as well as host immunological response and epidemiology.

6413* Graduate General Pathology and Laboratory Medicine. Lab 2. Prerequisite: graduate standing. An introduction to the structural and functional abnormalities at the tissue level that manifest as disease states in organ systems, with emphasis on a patho-physiological approach to etiology and pathogenesis of disease.

6513* Neuropharmacology. Prerequisites: 5513, 5523. The pharmacology of agents affecting conscious nervous system (CNS) function, the interaction of drugs with receptors, and the action of endogenous neuromodulators at CNS sites of action.

6523* Cardiovascular Physiology and Pharmacology. Prerequisites: 5513, 5523. Physiologic and pharmacologic mechanisms of cardiac and vascular smooth muscle function and control at the molecular, cellular, tissue and organ system levels.

6533* Principles of Drug Action. Prerequisites: 5513, 5523. The molecular basis of drug uptake, distribution, physiologic action, and elimination from the body including pharmacogenetics, drug allergy, drug resistance, drug tolerance and physical dependence, and chemical mutagenesis, carcinogenesis, and teratogenesis.

6543* Neurochemistry. Prerequisites: 5215, 5616. Introduction to the fundamental aspects of neurochemistry using both cellular and molecular approaches.

6553* Neurochemical Basis of Disease. Prerequisites: 5215, 5616, 6543. Introduction to the cellular and molecular aspects of disease states as they relate to changes in neurochemistry.

6563* Neuroendocrinology. Prerequisites: 5513, 5523, 5616. The molecular, structural and cellular bases of the bidirectional communication between the immune and neuroendocrine systems.

6573* Neurotoxicology. Prerequisites: 6543, graduate standing. Fundamental aspects of neurotoxicology using both cellular and molecular approaches.

6613* Environmental Physiology. Prerequisite: 5616. Environmental parameters, including barometric pressure, temperature, light, gravity, noise, and crowding, having an impact on homeostatic mechanisms in the normal human with special emphasis on acute and chronic adaptations in response to changes in environmental parameters.

6623* Epithelial Transport and Electrophysiology. Prerequisites: 5215, 5616. Transport processes across biological membranes and various electrophysiological methods related to membrane transport.

6633* Cell Signaling. Prerequisite: 5215, graduate standing. Fundamental aspects of cell signaling in the cells and between cells.

6643* Neurophysiology. Prerequisite: 5616. Fundamental concepts of the motor and sensory components of the nervous system with emphasis on integrative mechanisms.

Biosystems and Agricultural Engineering (B.A.E.)

1012 Data Analysis in Biosystems Engineering. Lab 2. Prerequisite: engineering major. Introduction to application of computer-based tools in biosystems engineering. Introduction to the conduct, analysis and reporting of laboratory experiments.

1022 Experimental Methods in Biosystems Engineering. Lab 2. Prerequisite: 1012 or consent of instructor. An introduction to the basics of instrumentation, measurement techniques, and data analysis, with an emphasis on written communication skills. Lecture and laboratory exercises, that address measurement principles including accuracy, precision and error analysis.

2012 Introduction to Engineering in Biological Systems. Prerequisites: BIOL 1114, MATH 2233. Introduction to the engineering aspects of various biological systems. Case studies that emphasize the interface between engineering and biology in plant systems, mammalian systems, bioenvironmental systems, and industrial biological processes.
2022 Physical Properties of Biological Materials. Lab 2. Prerequisites: 1022, BIOL 1114, PHYS 2014. Basic engineering fundamentals applied to characterization and determination of physical properties of biological materials. Physical characteristics, water relations, and rheological, thermal, and electromagnetic properties of biological materials, including soils. Principles and techniques for measurement and determination of properties.


2023 Instruments and Controls. Lab 2. Prerequisites: ENSC 2613, MATH 2233. Design of control and instrumentation systems including sensor and actuator principles, interface electronics, system identification, modeling, and performance specification. Applications in biological and agricultural systems. Design project required.

3113 Engineering Analysis of Biological Systems. Prerequisites: 2012, ENSC 2123, 3233, MATH 2233. Application of engineering analysis and modeling to biological systems of plants, animals and ecosystems. Bioenergetics, homeostasis, enzyme kinetics, bioregulation, motility, photosynthesis and respiration, microbial processes, and ecosystem dynamics.


3313 Natural Resources Engineering. Lab 3. Prerequisites: 2022, ENSC 3233. Principles and practices of engineering analysis and design applied to hydrology, water quality, erosion and sedimentation, forestry, irrigation, and animal waste management.

3413 Processing Biological Materials. Prerequisites: 2022; ENSC 3233. Principles of size reduction, sorting, grading, dehydration, refrigeration, and air handling. Equipment and systems for materials handling, drying, and storage.

4001 Seminar. Prerequisite: senior standing. Topics in the practice of the engineering profession, including technical communication, engineering ethics, safety, environment, career development, and lifelong learning strategies.

4012 Senior Engineering Design Project I Lab 2. Prerequisites: 3023; senior standing; admission to professional school, or consent of instructor. Team work on professional level design projects, using design procedures to develop specifications, propose alternative solutions, consider external constraints, develop drawings or plans, construct, test and evaluate designs.

4022 Senior Engineering Design Project II. Lab 2. Prerequisite: 4012. Second of two-semester sequence of senior design courses.

4213* Precision Agriculture. Lab 2. Prerequisites: MATH 1513, senior standing. Introduction to the concepts of precision agriculture including analysis of spatial variability, relationships of fertility and crop response, geographical information systems, variable rate technology, optical, thermal, and electromagnetic properties, and crop yield monitoring. Case studies included for detailed analyses. Same course as SOIL 4213.

4223* Machinery for Production and Processing. Prerequisite: 3213. Analysis and design of machines and machine systems for production and processing of biological materials. Soil dynamics with emphasis on traction and soil compaction. Interactions of machines with biological systems.

4283* Bioprocess Engineering. Prerequisites: 3113 or consent of instructor, ENSC 3233. Application of fundamental engineering principles to biotechnical and biological processes. Introduction to cellular processes, fermentation technology, biological mass transfer and kinetics, bioreactor design and scale-up, and downstream processing. Same course as CHE 4283.

4313* Hydrology. Prerequisites: 3313, ENSC 3233. Basic principles of surface and groundwater hydrology and their application in engineering problems. Groundwater, weather, and climate, precipitation, evaporation, transpiration, subsurface waters, stream flow hydrographs, hydrologic and hydraulic stream routing, probability of hydrologic events, application of hydrologic models.

4353* Mechanical Design II. Prerequisites: ENGS 2013, ENSC 2122, MAE 3323. Design of power transmission systems, including belts, chains and gears. Selection of electric motors, actuators, encoders, and related electromechanical components. Selection and application of hydraulic and pneumatic components in machine design applications. Design practice in the form of short projects integrating the various segments covered in the course. Same course as MAE 4353.

4400 Special Problems. 1-4 credits, maximum 4. Investigations in specialized areas of agricultural engineering.

4413* Food Engineering. Prerequisites: 3013, 3413; ENSC 2123, 2213. Analysis and design of various unit operations in food processing including thermal processing, drying, evaporation, freezing, processing non-Newtonian fluids, and quality changes during processing.

5000 Thesis and Research. 1-6 credits, maximum 6. Prerequisite: consent of major professor.

5030* Engineering Practice. 1-12 credits, maximum 12. Prerequisite: B.S. degree in agricultural and biological engineering. The identification, analysis and synthesis of an authentic problem in agricultural and biological engineering. Solution of the problem will involve making engineering decisions tempered by real-time restraints, economic realities, and limited data with due consideration for environmental and social implications.

5313* Watershed Modeling and Water Quality. Lab 6. Prerequisites: 4313 or equivalent, CHEM 1314. A computer modeling course with an emphasis on chemical and physical processes governing nonpoint source pollution (nitrogen, phosphorus, sediment) at the basin scale. In the laboratory use of state-of-the-art models applied to a variety of agricultural systems. Hands on use of comprehensive hydrologic water quality models that utilize spatial data in a geographic information system. Models and parameter uncertainty, digital data sources, parameter estimation, and model testing, calibration and validation.

5324* Modeling and Design in Stormwater and Sediment Control. Lab 3. Prerequisite: 4313 or equivalent. Analysis and design of stormwater, sediment and water quality systems with a focus on application to urban areas and developments in the urban-rural fringe. Advanced concepts in hydrologic modeling with kinematic, diffusion and dynamic modeling of flow; soil erosion, sediment transport and sediment control; stormwater quality modeling and the impact of best management practices. In laboratories, use of hydrologic, sediment, and water quality models in analysis and design for real world problems.

5413* Instrumentation in Biological Process Control System. Prerequisite: 3023 or equivalent. Analysis of transducers for on-line measurement and control of biological processes. Emphasis on selection of measurement techniques and transducers to sense physical properties of biological materials. Application to agricultural and food processing industries.

5423* Food Rheology. Lab 2. Prerequisite: ENSC 3233. Characterization and analysis of the rheological properties of food products. Focus on measurement techniques and equipment, including tube and rotational type instruments, with specific applications in food processing.

5501* Seminar. Discussion of current literature with special emphasis on research and experimental techniques.

6000 Research and Thesis. 1-10 credits, maximum 30. Prerequisite: approval by the student’s advisory committee. Independent research and doctoral thesis preparation under the cognizance of a graduate faculty member in the student’s field of specialization.

6100 Teaching Practicum in Biosystems Engineering. 1-3 credits, maximum 6. Lab 2-6. Prerequisite: one semester of doctoral study in Biosystems Engineering, or consent of instructor. Philosophies and techniques of resident and non-resident teaching including experiences in preparation, presentation, and evaluation of lectures, laboratories, extension, or continuing education programs. Graded on a pass-fail basis.

6313* Stochastic Methods in Hydrology. Prerequisites: CIVE 5843, STAT 4033. Stochastic and statistical hydrologic and water quality analyses of surface water and groundwater systems. Analysis of urban and rural drainage and detention systems. Same as CIVE 5843.

6333* Fluvial Hydraulics. Prerequisite: 3013 or equivalent. Principles of sediment detachment and transport in fluvial systems. Design of stable channels and flow resistance relationships for sediment-laden flows.
3233* Plant Anatomy. Lab 3. Prerequisite: 1404. Structure of cells, tissues and organs of plants. Consideration of structure as related to ontogeny, phylogeny and function.

3460 Plant Physiology Laboratory. 1-2 credits, maximum 2. Lab 2-4. Prerequisite: 3463 or concurrent enrollment. Skills in techniques for working with plants, experiments involving nutrition, transpiration, photosynthesis, water relations, translocation, hormones, growth and development. Students having credit in PLML 3014 should enroll for one hour; all others enroll for 2 hours credit.

4123* Botanical Limnology. Lab 3. Prerequisite: BIOL 1404 or equivalent strongly recommended. Taxonomy, ecology, and physiology of freshwater algae and vascular aquatic plants, with special reference to their role in overall limnological dynamics. Field trips required. No credit for students with credit in 5213.

4374* Agrostology. Lab 4. Prerequisite: 1404. Grasses and the principles involved in their classification. Field trips required.

4400 Undergraduate Research. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Undergraduate research projects in botany.

4993 Solicitor Honors Thesis. Prerequisites: departmental invitation, senior standing, Honors Program participation. A research project under the direction of a faculty member resulting in a written report to be judged by a second faculty member as well. An oral presentation at the annual departmental seminar. Required for graduation with departmental honors in botany.

5000* Research. 1-6 credits, maximum 6. Research required for the M.S. degree.

5023* Community Ecology. Prerequisite: BIOL 3034 or equivalent. Plant and animal communities, community theory, the role of competition, predation, and demography in structuring plant and animal communities, succession, current controversies in ecology, with emphasis on the primary literature.

5104* Mycology. Lab 4. Prerequisite: graduate standing. A systematic study of the fungi, with emphasis on taxonomy, comparative morphology and fungal biology. Taught in the Department of Plant Pathology. Same course as PLP 5104.

5110* Problems in Botany. 1-5 credits, maximum 12. Prerequisite: consent of instructor. Special studies in any area of botany.

5153* Ecosystem Analysis. Prerequisite: BIOL 3034; CHEM 3015 or equivalents. Theory and principles of ecosystem ecology focusing on metabolism and biogeochemical cycles in terrestrial and aquatic systems. Application of principles to current issues of environmental change and management. Same course as ZOOL 5153.

5213* Botanical Limnology. Lab 3. Prerequisite: BIOL 1404 or equivalent strongly recommended. Taxonomy, ecology and physiology of freshwater algae and vascular aquatic plants, with special reference to their role in overall limnological dynamics. Field trips required. No credit for students with credit in 4213.

5423* Plant Mineral Nutrition. Prerequisite: 3463 or equivalent. Uptake, translocation, metabolism, and biochemical function of mineral nutrients in higher plants.

5533* Advanced Ecology. Prerequisite: strongly recommended to have taken 5023 or BIOL 3034 or equivalent. Physiological and evolutionary aspects of plant ecology as revealed by recent research. Spring recess field trip required.

5753* Physiology of Plant Growth and Development. Prerequisite: 3463 or equivalent. Molecular mechanisms of growth and development, subcellular organization and function, plant hormones, photomorphogenesis, germination and dormancy, senescence and abscission, plant rhythms. Application of physiological principles to agriculture.

5813* Plant Developmental Genetics. Prerequisite: BIOL 3024 or equivalent. Discussion of morphogenesis, embryogenesis, gametogenesis, and the regulation of gene expression during plant development. Emphasis on recent genetic, experimental, and molecular studies of development in higher plants.

5850* Botany Seminar. 1 credit, maximum 6. Required of senior and graduate majors.

6000* Research. 1-15 credits, maximum 60. Independent research for the doctoral dissertation.
International Business. Prerequisite: MGMT 3123. Development of international business strategy based on the integration of economic, accounting, financial, management and marketing concepts.

**4010 Business Projects.** 1-6 credits, maximum 6. Prerequisite: consent of instructor. Special advanced topics, projects and independent study in business.

**4050 Business Colloquium.** 3-9 credits, maximum 9. Prerequisites: junior standing and consent of the instructor and the dean. Study of an interdepartmental and interdisciplinary nature of various important issues and aspects of the business and economic environment. Provides an intellectual MBA experience. Enterprising student with a strong interest in scholarship.

**4113 New Venture Creation.** Prerequisite: business core courses or consent of instructor. Steps involved in starting a new business. Development of a business plan for a venture of student’s choosing. Examination of franchising or acquisition of an existing business as alternative steps to business ownership.

**5013 Research Methods for Business.** Prerequisite: STAT 2023, admission to MBA program or approval from MBA director. Role of Bayesian and inferential statistics in business research and management decision making. Measurement, sealing, survey methods, and forecasting. Applications to marketing; managerial, human resource, financial, and production planning; and other related business topics. Use of computers in statistical analysis.

**5113 Entrepreneurship and Venture Management.** Prerequisite: admission to MBA program or consent of MBA director. Experience in corporate creation and problems faced by entrepreneurs in early growth stages of business ventures. An interdisciplinary problem-solving approach with emphasis on "live" case studies and plans for new business ventures. Emphasis is on entrepreneurship rather than problems faced by going concerns.

**5200 Selected Master of Business Administration Topics.** 3-6 credits, maximum 6. Prerequisite: admission to the Master of Business Administration program. Selected topics dealing with business decision making and contemporary business issues.

**5613 The External Environment of Business.** Prerequisite: admission to MBA program or approval from MBA director. Social, ethical, regulatory and political forces as they impact on the organization. Attention to organizational response to these forces through management policies and strategies.

**5713 Analysis of the Multinational Firm.** Prerequisite: admission to MBA program or consent of MBA director. Identification and analysis of the managerial, financial and market problems facing the multinational firm. Focus is empirical, and stressing application of ecological and quantitative tools to the study of the multidimensional nature of the international business environment.

**6000 Research and Thesis.** 1-9 credits, maximum 30. Prerequisite: approval of advisory committee.

**6100 Seminar in Business Administration.** 3-6 credits, maximum 6. Prerequisite: consent of instructor. Intensive, exploratory in nature; focused on research methodology.

**Business Communications (BCOM)**

**3113 Written Communication.** Prerequisite: 50 semester credit hours. Analysis of business communication problems in terms of generally accepted communication principles. Practice in written messages; specifically, special goodwill letters, neutral and good-news, disappointing, persuasive and employment messages.

**3223 Organizational Communication.** Prerequisite: 50 credit hours. Communication theory and process; common and special problems associated with interpersonal and organizational communication affecting business decisions and operations. Principles and methods of basic and applied research in business and communication; practice in administrative report writing. Analysis of selected business cases.

**3333 Business Report Writing.** Prerequisite: six hours of English. Fundamentals of writing business reports, including coverage of mechanics, content, and structure of business reports. Practice in writing business reports as well as oral presentations of reports.

**5113 Seminar in Administrative Communication.** Understanding and application of valid and relevant communication principles and theories. Designed to develop management-level personnel who can effectively and efficiently use oral and written communications as administrative tools to organizational functioning.

**5210 Business Communication Applications.** 1-3 credits, maximum 3. Application of communication techniques to the business setting. Interpersonal communication skills necessary for the manager in a business organization. Problems and applications within the modern business setting.

**Business Honors (BHON)**


**4063 Topics in Contemporary Business.** Prerequisites: junior standing, admission to the Honors Program. Topics of interest in the contemporary business and economic environment. The social role of the corporation; U.S. competitiveness and business and environmental issues.

**4073 Literature in Business.** Prerequisites: junior standing, admission to the Honors Program. Foundations of American business through selected literary masterpieces.

**4083 Applied Research Processes.** Prerequisites: junior standing, admission to the Honors Program. The relevant aspects of the philosophical, historical and ethical issues in scientific inquiry and business research methods. Preparation for completion of senior honors thesis.
Cell and Molecular Biology (CLML)

3014 Cell and Molecular Biology. Lab 3. Prerequisites: BOT 1404 or MICR 2125 or ZOOL 1604 or equivalent. The cell concept and cell morphology, cell macromolecules, organelles, enzymes, energetics, movement of water and materials across membranes, influence of external environment, cellular synthesis, growth and maintenance, control and integration of function, replication, differentiation, origin and evolution of cells.

3254 Immunology. Lab 3. Prerequisite: 2125. Verification of host's ability to defend itself against foreign intrusion. Chemistry and biology of the acquired immune response. Same course as MICR 3254.

4001 Professional Transition in Microbiology and Cell and Molecular Biology. Prerequisites: declared microbiology or cell and molecular biology major with minimum 70 hours earned and consent of instructor. Understanding major areas and employment activities in microbiology, cell biology and molecular biology fields. Evaluating and understanding scientific and professional literature, and making the transition from undergraduate education to postgraduate education or employment. Same course as MICR 4001.

4013 Laboratory Techniques in Molecular Genetics. Lab 3. Corequisites: CHEM 1314 and 1515. Structure and function of living cells; the dynamics of these structures and the functions which they perform.

4264* Cell Physiology. Lab 3. Prerequisite: 3014 or BIOL 3653. Cellular activities and fundamental physiological processes. Same course as ZOOL 4264.

4273* Developmental Biology. Corequisite: 3014 or one course in Biochemistry and prerequisite BIOL 3024. The molecular biology and molecular genetics of developmental processes such as cell division, differentiation, migration, cell-cell communication, and gene expression in a wide variety of organisms.

4322* Bioenergetics. Prerequisite: 3014 or BIOL 3653. Bioenergetic reactions and mechanisms involved in energy production in plants, animals and microbial systems. Same course as MICR 4322.

4990 Special Problems. 2-4 credits, maximum 8. Prerequisite: consent of instructor. Minor investigations in the field of cell and molecular biology.

4993 Senior Honors Project. Prerequisites: departmental invitation, senior standing, Honors Program participation. A research project under the direction of a faculty member resulting in a written report to be judged by a second faculty member. Required for graduation with departmental honors in CLML.

5203* Bioinformatics. Lab 2. Prerequisite: graduate standing or consent of instructor. BASIC programs and public domain software to model and analyze simple biological processes. Models to evaluate more complex biological processes. No prior experience with computers or programming necessary, but recommended.

Chemical Engineering (CHE)

2033 Introduction to Chemical Process Engineering. Prerequisites: CHEM 1515, ENSC 2213. Corequisites: MATH 2233 or 3263. Application of mathematics and scientific principles to solving chemical engineering problems. Simple material and energy balances applied to process design. The nature and application of unit operations and unit processes to the development of chemical processes.

3013 Rate Operations I. Prerequisite: admission to CHE Professional School. Development and application of phenomenological and empirical models to the design and analysis of fluid processing and heat transfer unit operations.

3113 Rate Operations II. Prerequisites: 3013, 3333, 3473. Admission to CHE Professional School. Development and application of phenomenological and empirical models to the design and analysis of mass transfer and separations unit operations.

3123* Chemical Reaction Engineering. Prerequisites: 3333, 3473, and admission to CHE Professional School. Principles of chemical kinetics and reaction rate concepts and data reduction. Elements of reactor design principles for homogeneous systems; introduction to heterogeneous systems.


3473 Chemical Engineering Thermodynamics. Prerequisite: admission to CHE Professional School. Application of thermodynamics to chemical process calculations. Behavior of fluids, including estimation of properties by generalized methods. Study of chemical thermodynamics, including heats of reaction, chemical reaction and phase equilibria.

4002* Chemical Engineering Laboratory I. Lab 6. Prerequisites: 3013, 3333, 3473, admission to CHE Professional School. Application of CHE fundamentals and unit operation principles to the analysis of bench and pilot-scale equipment. Primarily fluid processing and heat exchange. Design of experiments on non-ideal units to generate credible data useful for validation of principles and for engineering decision making. Interpretation of experimental data and presentation of results.

4112* Chemical Engineering Laboratory II. Lab 6. Prerequisites: 4002, 3113, 3123, admission to CHE Professional School. A continuation of 4002. Primarily reaction and mass transfer processes.

4124* Chemical Engineering Design I. Lab 2. Prerequisites: 4002, 3113, 3123, admission to CHE Professional School. Economic analysis of process plants and systems of equipment; methods for estimating plant investment requirements and operating costs; economic evaluation and optimal design of chemical process systems; basic equipment and process design calculations.

4224* Chemical Engineering Design II. Lab 2. Prerequisite: 4124, and admission to CHE Professional School. A continuation of CHE 4124. Economic analysis of process plants and equipment. Design of chemical processing equipment, and chemical plant layout. Application of computer techniques to chemical engineering design.

4283* Bioprocess Engineering. Prerequisite: admission to CHE Professional School. Application of fundamental engineering principles to biochemical and biological processes. Introduction to cellular processes, fermentation technology, biological mass transfer and kinetics, bioreactor design and scale-up, and downstream processing. Same course as BAE 4283.

4293 Biomedical Engineering. Prerequisites: ENSC 2213, 3233, MATH 2155. Introduction to engineering principles applied to biomedical applications. Biomaterials, drug delivery, artificial organs, transport in biological systems, tissue engineering, and modeling of biological systems.

4343 Environmental Engineering. Prerequisites: 3333, 3473. Application of science and engineering principles to minimize the adverse effects of human activities on the environment. National and state environmental regulations; predictive movement and fate of chemicals in the geospheres; multi-media pollution assessment, analysis and control.

Chemical Engineering 231
4581* Chemical Engineering Seminar. Prerequisite: senior standing in the department. Through guest lectures and home assignments, provision of an awareness of aspects of career and personal success that are not normally covered in the technical curriculum.


4990 Special Problems. 1-5 credits, maximum 5. Lab 3-15. Prerequisite: senior standing. Training in independent work, study of relevant literature and experimental investigation of an assigned problem.

5000* Master’s Thesis. 1-6 credits, maximum 6. Prerequisite: approval of major professor. Methods used in research and thesis writing.

5030* Professional Practice. 2-6 credits, maximum 8. Prerequisites: senior standing and consent of instructor. Application of chemical engineering principles to the solution of real-life engineering problems in an actual or simulated industrial environment. Includes application of design and testing procedures, economic evaluation and reporting on one or more assigned projects.

5110* Special Topics In Chemical Engineering. 2-3 credits, maximum 9. Lab 2-6. Prerequisite: consent of instructor. Small group and individual projects in unit operations concepts and chemical kinetics, computer applications, process modeling, or any of a wide range of chemical engineering topics. May be repeated for credit if subject matter varies.

5123* Advanced Chemical Reaction Engineering. Prerequisite: 4473. Advanced principles and applications of chemical kinetics in catalysis, heterogeneous systems, non-ideal reactions, polymerization and biological reactions.


5233* Advanced Bioprocess Engineering. Prerequisite: consent of instructor. Application of fundamental engineering principles to biochemical and biological processes. Introduction to cellular processes, fermentation technology, biological mass transfer and kinetics, bioreactor design and scale-up, and downstream processing.

5293* Advanced Biomedical Engineering. Prerequisite: consent of instructor. Principles and engineering analysis of biomedical processes. Artificial organs, biomaterials, tissue engineering, transport in biological systems, biomedical imaging, and drug delivery systems.

5413* Fundamentals of Polymer Engineering. Fundamental principles in the engineering of macromolecules. Various aspects of polymer engineering: definitions and nomenclature, polymer physical chemistry, mass-transfer, rheological and mechanical properties, industrial production and applications.

5423* Process Heat Transfer. Application of fundamental principles of single- and two-phase fluid dynamics and heat transfer to the design and analysis of process heat transfer equipment.


5703* Optimization Applications. Prerequisite: graduate standing. A survey of various methods of unconstrained and constrained linear and nonlinear optimization. Applications of these methodologies using hand-worked examples and available software packages. Intended for engineering and science students. Same course as ECEN 5703, IEM 5502 and MAE 5703.

5733* Neural Networks. Prerequisite: graduate standing. Introduction to mathematical analysis of networks and learning rules, and on the application of neural networks to certain engineering problems image and signal processing and control systems. Same course as ECEN 5733 and MAE 5733.


5853* Advanced Chemical Process Control. Prerequisite: 4843 or equivalent. General concepts and approaches of model-based control. Studies in the application of process control. Introduction to multivariable and model-predictive control on multivariable, nonlinear, nonstationary, noisy processes.

5873* Air Pollution Control Engineering. Causes, effects, and control of atmosphere pollution. Same course as CIVE 5873.

5990* Special Problems. 2-4 credits, maximum 9. Prerequisite: consent of instructor. Individual report topics in chemical engineering involving operations, processes, equipment, experiments, literature search, theory, computer use or combinations of these.

6000* Doctoral Thesis. 2-15 credits, maximum 54. Prerequisite: consent of major professor. The doctoral candidate registers for a minimum of 2 semester credit hours to a maximum of 15 semester credit hours in each semester during which laboratory work is in process. Methods used in research and thesis writing. An original investigation of a problem in chemical engineering and its report in a dissertation.

6010* Chemical Engineering Seminar. 1-3 credits, maximum 14. Advanced research and development topics.

6223* Advanced Chemical Engineering Thermodynamics. Prerequisite: 5843. Phase equilibrium in multicomponent systems. Irreversible processes. Properties of fluids and the prediction of properties by statistical methods. Application of thermodynamics to unit operations.

6440* Advanced Topics in Chemical Engineering. 3-6 credits, maximum 9. Topics in chemical engineering unit operations. Advanced mathematical techniques in chemical engineering problems. May be repeated for credit if subject matter varies.


6703* Research Methods in Chemical Engineering. Prerequisites: M.S. or Ph.D. candidacy in chemical engineering or consent of instructor. Methods and skills required to successfully conduct chemical engineering research projects. Maintaining research records, experiment design, data validation, results presentation, and research ethics.

Chemistry (CHEM)

1014 (L,N) Chemistry in Civilization. Lab 2. Symbols, methods and contributions to society of the chemical sciences. Includes polymers, pollution, energy, consumer chemicals, drugs, nuclear science and other topics. No credit for students with credit in 1215, 1314.

1215 (L,N) General Chemistry. Lab 2. Prerequisite: MATH 0123 or high school equivalent. The beginning chemistry course recommended for students in the applied biological sciences. No credit for students with credit in 1014, 1314.

1225 (N) General Chemistry. Lab 2. Prerequisite: 1215 or advanced placement. A continuation of general chemistry, recommended for students in the applied biological sciences. No credit for students with credit in 1515.

1314 (L,N) General Chemistry. Lab 2. Prerequisite: MATH 1513 or concurrent enrollment in 1613, 1715 or a higher level math course. The beginning chemistry course recommended for students in basic biological sciences (including premedical science and pre-veterinary science), physical sciences and engineering. No credit for students with credit in 1014, 1215.

1413 (L,N) Inquiry-based Chemistry. Lab 3. Prerequisite: PHYS 1313 recommended. Directed inquiry and hands on study of chemical reactions. Recommended for elementary education majors as model course to learn and teach science.

1414 (L,N) General Chemistry for Engineers. Prerequisites: one year of high school chemistry or one semester of college chemistry and MATH 1313 or concurrent enrollment in 1613, 1715 or a higher level math course. Survey course for engineers needing only one semester of chemistry. Thermodynamics, atomic structure, solid state, materials, equilibria, acids and bases and electrochemistry. No credit for students in 1314.

1515 (L,N) General Chemistry. Lab 2. Prerequisite: 1313 or advanced placement. A continuation of general chemistry. No credit for students with credit in 1225.

2113 Principles of Analytical Chemistry. Prerequisites: 1515 and MATH 1513 or 1715. Modern theories of solutions, separation techniques and methods of analysis.
2122 Quantitative Analysis Laboratory. Lab 6. Prerequisite: 2113 or concurrent enrollment. Laboratory work related to material covered in CHEM 2113.

2990 Special Problems in Chemistry for Non-majors. 1-2 credits, maximum 2. Prerequisite: 1515 or concurrent enrollment. Independent training in chemistry at the lower-division level.

3015 The Chemistry of Organic Compounds. Lab 4. Prerequisites: 1215 and 1225 or equivalent. Terminal, one-semester non-majors course in organic chemistry covering the general principles of nomenclature, structures, bonding, methods of preparation, reactions and uses of acyclic, cyclic, and aromatic compounds. No credit for students with credit in 3053 or 3112.

3023 Organic Chemistry. Prerequisite: 1515 or equivalent. Hydrocarbons and their derivatives, including specific compounds of theoretical, biological or industrial importance. No credit for students with credit in 3015.

3112 Organic Chemistry Laboratory. Lab 6. Prerequisite: 3153 or concurrent enrollment. Laboratory exercises related to theoretical principles covered in CHEM 3053 and 3153. No credit for students with credit in 3015.

3153 Organic Chemistry. Prerequisite: 3053. A continuation of 3053.

3335 Descriptive Inorganic Chemistry. Prerequisite: 1225 or 1515. Structures and properties of the elements and their many compounds in the broadest sense which includes the modern technologically important materials, organometallics, and inorganic substances of biological significance.

3434 Physical Chemistry I. Prerequisites: 2113, MATH 2163. Introductory theoretical analysis of molecular structure, chemical bonding and macroscopic chemical systems using quantum theory, classical and statistical thermodynamics and kinetics. Students who are not chemistry majors may receive graduate credit.

3523 Physico-Chemical Measurements. Lab 6. Prerequisites: 2122, 3434. Apparatus, experimental methods and calculations employed in physico-chemical investigations.

3553 Physical Chemistry II. Prerequisite: 3434. A continuation of 3434. Students who are not chemistry majors may receive graduate credit.

4020 Modern Methods of Chemical Analysis. 1-5 credits, maximum 5. Lab 2. Prerequisites: 2122, 3434. Theoretical and laboratory study of modern techniques, reagents and instruments employed in analytical chemistry.

4011 Laboratory and Chemical Safety. Instruction on chemical safety, prudent laboratory practices, and federal, state, and OSU regulations on safety. Graded on a pass-fail basis.


5000 Thesis. 1-6 credits, maximum 6. Investigations, chiefly experimental, with necessary conferences. Familiarizes the student with methods used in research in chemistry.

5011 Graduate Seminar. Preparation and presentation of seminars, usually on subjects of current interest taken from the literature. Completion of 1 credit hour required for M.S. degree.

5103 Physical and Chemical Separations. Prerequisite: one year of physical chemistry. Principles of bulk and multi-stage separation methods: chromatography, liquid-liquid extraction and zone melting.

5113 Equilibrium and Kinetics in Analytical Chemistry. Prerequisite: one year of physical chemistry. Physical and chemical principles of equilibrium and kinetics as applied to analytical problems.

5220 Modern Topics for Teachers. 1-6 credits, maximum 6. Prerequisite: teaching experience. Designed to help elementary and secondary science teachers improve their subject matter competence in chemistry. Content varies, depending on the needs of specific groups of teachers.

5223 Chemistry of High Polymers. Prerequisites: 3153 and 3434 or equivalent. Preparation and polymerization of organic monomers; properties and uses of resulting high polymers; theories of polymerization; inorganic and natural organic polymers.

5260 Inorganic Chemistry I. 1-3 credit hours, maximum 6. Prerequisite: teaching experience. Designed to help elementary and secondary science teachers improve their subject matter competence in chemistry. Content varies, depending on the needs of specific groups of teachers.


5373 Spectrometric Identification of Organic Compounds. Lab 3. Prerequisite: 4320. Lectures on ultraviolet, circular dichroism, infrared, nuclear magnetic resonance (NMR) and mass spectrometry (MS). More advanced techniques in NMR and MS stressed. Hands-on training and use of modern spectroscopic instrumentation in laboratory.

5443 Mechanism and Structure in Organic Chemistry. Prerequisites: 3153 and 3553. Relationship of properties of organic compounds to their structure; mechanisms of organic reactions.

5563 Chemical Thermodynamics I. Prerequisite: 3553. Statistical and classical thermodynamics applied to chemical systems.

5623 Quantum Chemistry I. Prerequisite: 3553. Fundamentals of quantum mechanics, including classical mechanics, wave representation of matter, the Schroedinger equation and atomic structure.

5960 Inorganic Chemistry II. 1-3 credits, maximum 3. Prerequisite: 5260. Chemistry of main group and transition metal organometallic compounds, metal clusters, and catalysis by organometallic polymers, bioinorganic chemistry, and materials chemistry.

6000 Research. 1-12 credits, maximum 55. Prerequisite: M.S. degree in chemistry or permission of instructor. Independent investigation under the direction and supervision of a major professor.

6011 Advanced Seminar. Prerequisite: 5011 or M.S. degree. Preparation and oral presentation of critical reviews on chemical subject(s). Usually related to the student's research area. Completion of 1 credit hour required for the Ph.D. degree.

6050 Special Topics in Analytical Chemistry. 1-6 credits, maximum 6. Supervised study of topics and fields not otherwise covered.

6103 Electroanalytical Chemistry. Prerequisite: 4024. The theory, practice and instrumentation in various areas of modern electroanalytical chemistry.

6113 Analytical Spectroscopy. Prerequisite: 4024. Survey of selected topics in analytical applications of spectroscopic techniques. Fundamental concepts as well as current trends in research, including instrumentation.

6420 Special Topics in Organic Chemistry. 1-9 credits, maximum 9. Prerequisite: 3153. Deals with topics not covered in other courses.

6453 Chemical Kinetics. Prerequisite: 3553. The kinetics of chemical reactions and their theoretical interpretation.

6553 Molecular Spectroscopy. Prerequisite: 5623. Spectra and structure of molecules.

6650 Selected Topics in Advanced Physical and Inorganic Chemistry. 1-6 credits, maximum 12. Prerequisite: consent of instructor. Supervised study of selected topics and fields not otherwise covered.

6803 Photonics I: Advanced Optics. Lab 9. Prerequisite: ECEN 3813 or PHYS 3213, or consent of instructor. Advanced optics including spectral and time characteristics of detectors, characteristics of lasers, time, spectral and spatial parameters of laser emission, interferometric techniques, and nonlinear effects such as two-photon absorption and second and third harmonic generations. Ultrashort laser pulses. Same course as ECEN 6803 and PHYS 6803.
6810* Photons II: THZ Photonics and THz-TDS. Lab 1. 1 credit, maximum 4. Prerequisite: 6803. THz photonics and THz imaging, including THz-TDS (THz-TDS). Concepts and techniques of driving electronic circuitry with ultrashort laser pulses to generate and detect freely propagating pulses of THz radiation and their application using several operational research systems. Same course as ECEN 6810 and PHYS 6810.

6820* Photons II: Spectroscopy II. Lab 1. 1 credit, maximum 4. Prerequisite: 6803. Operating principles and applications of laser spectroscopy of atoms, molecules, solids and complex fluids. Absorption, emission, photon correlation, coherence, time resolved Fourier transmuted Raman spectroscopy and non-linear optical. Same course as ECEN 6820 and PHYS 6820.

6830* Photons II: Spectroscopy III. Lab 1. 1 credit, maximum 4. Prerequisite: 6803. Advanced spectroscopic instruments and methods used for investigation of semi-conductors and solid state material. Stimulated emission characterized both in wavelength and in time. Time-resolved fluorescence measurements. Multiphoton excitation, Fast measuring techniques including subnanosecond detectors, picosecond streak cameras, and ultrastart four-wave mixing and correlation techniques. Time-dependent photocurrent measurements. Same course as ECEN 6830 and PHYS 6830.

6840* Photons III: Microscopy I Lab 1. 1 credit, maximum 4. Prerequisite: 3553 or consent of instructor. The structure and imaging of solid surfaces. Basics of scanning probe microscopy (SPM). Contact and noncontact atomic force microscopy (AFM). Scanning tunneling microscopy (STM) in vacuum. Characterization of materials with SPM. Nanolithography with SPM. Device manufacturing and analysis. Same course as ECEN 6840 and PHYS 6840.

6850* Photons III: Microscopy II Lab 1. 1 credit, maximum 4. Prerequisite: 3553 or consent of instructor. Advanced techniques of scanning probe microscopy (SPM). Magnetic force microscopy, Kelvin force microscopy, scanning tunneling microscopy (STM) in vacuum. Characterization of materials with SPM. Nanolithography with SPM. Device manufacturing and analysis. Same course as ECEN 6850 and PHYS 6850.

6860* Photons III: Microscopy III and Image Processing. Lab 1. 1 credit, maximum 4. Prerequisite: ECEN 5793. Digital image processing, including projects. Image acquisition and display, image enhancement, geometric operations, linear and nonlinear filtering, image restoration, edge detection, image analysis, morphology, segmentation, recognition, and coding/compression. Same course as ECEN 6860 and PHYS 6860.


6880* Photons IV: Semiconductor Devices, Testing and Characterization. Lab 1. 1 credit, maximum 4. Prerequisite: 6803. Test and characterization of semiconductor and optoelectronic devices. Hall effect, four point probe, CV and IV measurements, optical pump-probe, photoluminescence, and electro-optics sampling. Same course as ECEN 6880 and PHYS 6880.

6890* Photons IV: Semiconductor Synthesis and Devices III. Lab 1. 1 credit, maximum 4. Prerequisite: 6803. Processing, fabrication and characterization of semiconductor optoelectronic devices in class 100/10000 cleanrooms. Cleanroom operation including general procedures, material processing and device fabrication. Device processing using a variety of processing such as mask aligner, vacuum evaporators and rapid thermal annealer. Testing using optical and electrical testing apparatus such as I-V, C-V, Hall, and optical spectral measurement systems. Same course as ECEN 6890 and PHYS 6890.

Civil Engineering (CIVE)


3413 Structural Analysis. Lab 3. Prerequisite: ENSE 2143. Analysis of internal forces and deflections of structures subjected to static loading. Beams, trusses, and framed structures analyzed by appropriate classical methods. Classical methods and modern computer procedures for the analysis of statically indeterminate structures.

3513 Structural Steel Design. Lab 3. Prerequisite: 3413. Introduction to the design of structural steel members and connections in accordance with AISC specifications.

3623 Reinforced Concrete Design. Lab 3. Prerequisite: 3413. Introduction to the design of reinforced concrete elements in accordance with the strength design requirements of the ACI Building Code.

3614 Engineering Surveying. Lab 3. Prerequisite: MATH 1613 or MATH 1715. Principles and techniques of vertical and horizontal measurements related to engineering and construction projects. Linear and angular measurements, differential leveling, traverses, topographic surveys, construction surveying, horizontal and vertical curves, earthwork quantities, and design of route systems.

3623 Engineering Materials Laboratory. Lab 3. Basic construction materials including Portland cement concrete, asphalt concrete, aggregates, and composite materials. Behavioral characteristics, use, and quality control of these materials. Basic statistical procedures used for material specifications. Laboratory sessions provide "hands-on" experience in performing standard tests.

3633 Transportation Engineering. Prerequisite: 3614 or consent of instructor. Planning, design and operation of transportation systems. Vehicle characteristics and human factors in design. Traffic stream variables and their measurement techniques. Basic traffic flow models. Highway and street intersection capacity and level of service. Traffic control concepts. Transportation systems management. Application of statistical analysis and operations research to analyze transportation problems.

3713 Geotechnical Engineering. Prerequisite: ENSC 2143. Physical and mechanical properties of soils, properties of soils, distribution, plasticity, permeability, consolidation, and shear strength. Use of physical and mechanical properties to calculate stresses in a soil mass, lateral earth pressures, subsurface water, and slope stability. Application of physical and mechanical properties to design of foundations, retaining structures and slopes.

3811 Environmental Engineering Science. Prerequisites: CHEM 1314 or 1515, MATH 2155. Engineering aspects of the life support system; the carbon-oxygen cycle; cycling of nitrogen, sulfur, and phosphorus; and the hydrologic cycle. Concepts of environmental pollution and degradation. Techniques for mitigation; water and wastewater treatment, solid and hazardous waste management, and air pollution abatement. Calculation of pollution potential and treatment system parameters.

3833 Applied Hydraulics. Prerequisites: CHEM 1314 or 1515, ENSC 3233, PHYS 2143. Basic hydraulics principles and their application in civil engineering problems. Analyses of water distribution networks, open channels, storm-water management and wastewater collection systems, water pumping, and hydraulic structures, treatment plant hydraulics, and hydraulic structures.

3843 Hydrology I. Prerequisites: CHEM 1315, ENSC 3233, PHYS 2143. Basic principles of surface ground water and hydrology and their application in engineering problems. The hydrologic cycle, weather and hydrology, precipitation, evaporation, transpiration, subsurface waters, stream flow, hydrographs, hydraulic and hydrologic stream routing, probability of hydrologic events, application of hydrologic models.

3853 Environmental Engineering Laboratory. Lab 3. Prerequisite: 3811. Performance of experiments with bench-scale environmental engineering unit operations, review of chemical principles and analyses important to the evaluation of these and other environmental engineering applications. Emphasis on the development of experimental results that can be used in the design of full-scale units.

3863 Civil Engineering Research. 1-4 credits, maximum 12. Prerequisite: senior standing or consent of instructor. Research and investigation of civil engineering problems.

4042 Senior Seminar. Prerequisite: senior standing or consent of instructor. Topics relevant to the professional practice of civil and environmental engineering. Written communications skills are stressed. Resumes, letters of introduction and job interviews are discussed in detail. Management principles and project management are introduced. The advantages of professional registration and professional and technical society membership are covered. Laws impacting the practice of engineering such as OSHA and ADA are introduced. Other topics include professional ethics, income taxes and investments are discussed.

4043 Senior Design. Prerequisites: 3513, 3523, 3713, senior standing. Major comprehensive design experience using the team approach. Industry practitioners provide design projects and analyze and critique results. Extends the undergraduate experience and provides the student with opportunities to analyze and design complex structures.
Environmental Engineering Design. Prerequisites: 3833, 3853, 4833. Factors involved in the design of engineered environmental systems. Solving “real world” environmental engineering problems. Design experience using decision making techniques, integrating and expanding upon current knowledge, and defending engineering decisions made. Economic, environmental, social and regulatory aspects of environmental engineering design.

Construction Engineering and Project Management. Lab 3. Prerequisites: senior standing and consent of instructor. Principles and practice of construction engineering and project management. Project planning, development of cost estimates and project schedules, construction methods and fundamental terminology used in the engineering and construction industry.

Basic Soils Testing Laboratory. Lab 3. Prerequisite: 3713. Laboratory measurement of the physical and mechanical properties of soils: specific gravity, grain size distribution, plasticity, compaction, compressibility, and shear strength.

Human Impact on the Environment. The activities of humans and how they affect the aqueous, terrestrial and atmospheric environment.

Unit Operations in Environmental Engineering. Prerequisites: 3813, ENSC 3233. Fundamental principles of water and wastewater treatment, including basic theory and development of design parameters. Application of these to the design of unit operations and processes in various treatment plants.

Master’s Thesis or Report. 1-6 credits, maximum 6. Prerequisite: graduate standing. A student studying for a master’s degree will enroll in this course for 2 credit hours if a report is to be written; 6 credits if a thesis is to be written.

Civil Engineering Seminar. 1-3 credits, maximum 6. Prerequisites: graduate standing and approval of major professor. Review of literature of major fields of civil engineering.

Aquatic Chemistry. Prerequisites: 5813 or concurrent enrollment, CHEM 1515 or equivalent. Application of chemical principles to environmental problems. Chemical kinetics, chemical equilibria, acid-base chemistry, and development of pH diagrams and coordination chemistry. Precipitation and dissolution reactions and oxidation-reduction reactions.

Civil Engineering Research. 1-6 credits, maximum 6. Prerequisites: graduate standing and approval of major professor. Research and investigations other than thesis studies.

Engineering Practice. 1-6 credits, maximum 9. Prerequisite: approval of adviser. Professional supervised civil engineering practice involving authentic projects for which the student assumes a degree of professional responsibility. Activities must be approved in advance by the student’s adviser and may consist of engineering experience on-campus or off-campus, or both. Periodic reports both oral and written are required as specified by the adviser.

Engineering Problems. 1-3 credits, maximum 6. Prerequisite: graduate standing. Problems of particular interest to graduate students in the field of applied science.

Engineering and Construction Materials and Methods. Lab 3. Prerequisite: graduate standing or consent of instructor. Analysis of engineering materials for construction and project operations. Examination and analysis of construction methods for civil engineering projects. Management of engineered materials, development of site operations and analysis of construction methods and materials.

Project Planning, Scheduling and Control. Lab 2. Prerequisite: graduate standing or consent of instructor. Project planning course in the principles and practice of scheduling and control management. Pre-project planning, development of critical path methods, and project schedules, fundamental cost and schedule analysis, and earned value concepts used in the engineering and construction industry.

The Legal and Regulatory Environment of Engineering. Prerequisite: junior, senior or graduate standing. The U.S. and Oklahoma court systems. Tort law and labor law having an impact on engineering and construction. Union organization and activities. Government contracting and the laws governing it. Discussions of the Occupational Safety and Health Act and Americans with Disabilities Act. In-Depth look at environmental policy, laws, and regulations affecting engineering including NEPA, CWA, SDWA, RCRA, CERCLA, and CAA. Water law.


Project Engineering and Management. Prerequisite: graduate standing or consent of instructor. Management of the design and construction of civil engineering projects. Topics include owner’s study, formation of project teams, design coordination, construction, and project closeout.

Contract Administration. Prerequisite: graduate standing or consent of instructor. Methods and techniques of tracking and control of construction projects. Evaluation of current research findings to contract implementation.

Construction Equipment Management. Prerequisite: graduate standing or consent of instructor. Analysis of construction equipment. Performance under various conditions. Application of engineering fundamentals to construction methods. Selection and costs of equipment, prediction of equipment production rates, and unit costs of work in place.

Concrete Formwork Design. Prerequisite: graduate standing or consent of instructor. Design of formwork for concrete structures. Analysis of load and stress of forming systems. Evaluation of economics of formwork designs.

Construction Estimating. Lab 2. Prerequisite: graduate standing or consent of instructor. The construction industry, its makeup, operation, estimating and bidding procedures. Theory and practice of estimating materials, labor, equipment and overhead costs for various types of construction. Estimate of material costs during the conceptual design phase of a construction project.

Environmental Geotechnology. Prerequisites: background in soil mechanics and basic chemistry. A study of the ability of soil to retain pollutants, effect of pollutants on chemical, physical and geotechnical properties of soil. Description of soil remediation technologies.

Geotechnical Engineering Investigations. Prerequisites: 3713, 4711, and basic geology course. Description of methods of subsurface exploration, sampling, and in situ testing. Discussion includes a review of engineering geophysical methods, equipment and methods for boring and sampling of soil and rock, measurement of ground water conditions, and in situ testing equipment and methods such as cone penetration test, pressure meter test and others.

Use and Design of Geosynthetics. Prerequisite: 4833. Description of types of geosynthetics available for engineering uses. Pertinent engineering properties required to design for various functions, basic design methodology for geosynthetics for various functions, and construction and performance considerations.

Terrain Analysis. Prerequisites: Basic courses in soil mechanics and geology. Prediction of geotechnical engineering characteristics of geological landforms from remote sensing imagery. Emphasis on photographic stereo interpretation. Training and practice of this media in land use applications and environmental problems.

Systems Analysis for Civil Engineers. Prerequisite: senior or graduate standing. Synthesis of systems modeling and simulation techniques, mathematical optimization procedures, and evaluation tools of multi-attributed systems including utility theory and decision analysis. Mathematical optimization techniques in the areas of resource allocation, transportation and water resources systems planning, structural design, construction management, and environmental and ecological problems.

Highway Traffic Operations. Prerequisite: 3633. Level of service, capacity and service volume concepts. Operational characteristics of uninterrupted-flow and interrupted-flow traffic facilities. The 1985 HCM procedures for analyzing the capacity of free-way, multilane and two-lane rural highways, urban arterials, signalized and unsignalized street intersections, and transit and pedestrian facilities. Administrative and planning actions for congestion management. Design alternatives and improvement strategies for effective use of urban arterial street width.


5373* Design of Traffic Control Systems. Prerequisite: 3633. Traffic control systems design, available technological options and range of agency needs. Design of vehicle detectors, control signals, communication links, signal display hardware and wiring. Development of timing plans using computer simulation models. Freeway surveillance and control; ramp metering, incident detection and motorist information systems. Preparation of contractual documents and construction supervision.


5403* Advanced Strength of Materials. Prerequisite: 3413. General states of stress and strain, theories of failure, energy principles, beam bending, shear center, torsion of prismatic shafts, beams on elastic foundations, plates and shells, elasticity stability.

5413* Classical Methods of Structural Analysis. Prerequisite: 3413. Advanced analysis of indeterminate frames, trusses and arches, classical, numerical, and energy methods with emphasis on methods for hand computations.


5433* Energy Methods in Applied Mechanics. Prerequisites: 3413, MATH 2233 or MAE 3323. Advanced structural mechanics from the standpoint of virtual work; energy principles and variational calculus applied to the analysis of structures, mechanisms, dynamics, and vibrations.

5443* Theory of Elastic Stability. Prerequisite: 5403. General theory of structural stability; buckling of columns; analysis of beam-columns; stability analysis of structural frames, thin-walled beams of open cross-section, and plate structures.

5453* Engineering Analysis. Prerequisite: senior standing and consent of instructor. Advanced, classical mathematical skills for engineers. Dimensional analysis, general tensor analysis, curvilinear coordinates, partial differential equations, perturbation theory, integral equations, special functions, eigen function analysis, integral transform methods, variational methods.


5503* Computer-aided Structural Analysis and Design. Prerequisites: 3413; 3513 and 3523 (computer enrollment); senior or graduate standing. Major comprehensive design experiences and finite element methods. Civil engineering problems where interaction effects are considered.

5513* Advanced Reinforced Concrete Design. Prerequisite: 3523. Advanced topics in reinforced concrete design with emphasis on beams, slabs, and earthquake-resistant structures.

5523* Advanced Steel Structure Design. Prerequisite: 3513. Advanced topics in steel design such as plastic design, plate girders, composite design, fatigue and fracture, stability, and bracing design.


5653* Asphalt Materials and Mix Design. Lab 1.5. Prerequisite: 3633 or consent of instructor. Principles of asphalt concrete mix design including material characteristics and performance. Evaluation of Hveem and Marshall mix design methods. Asphalt cements, rubberized asphalt polymer asphalts, emulsions, cutbacks, and other asphalt aging procedures. Laboratory sessions focused on the engineering properties of the materials discussed.

5673* Concrete Materials and Mix Design. Lab 1.5. Prerequisite: senior or graduate standing. Principles of concrete mix design including material characteristics, strength and durability requirements, environmental effects and forensic analysis. ACI and PCA mix design. Laboratory on theoretical and practical aspects of concrete technology.

5693* Pavement Design and Analysis. Prerequisite: 3633 or consent of instructor. Principles of pavement design including stress analyses, load and environmental effects and material characteristics. AASHTO, PCA and AI methods of pavement design. Computer methods. Practical aspects of life cycle cost analyses and construction methods.

5703* Soils in Construction. Prerequisites: 3713, 4711 or consent of instructor. Soils types and geotechnical behavior during construction. Construction requirements and specific considerations for embankments, pavements, buildings and retaining structures; groundwater control during construction; soil stabilization; and construction considerations for geosynthetics. Basic design considerations, including selection of placement conditions for compaction; determination of settlement and foundation design; and problems in the construction of foundations for dams, levees, embankments, and gravity retaining structures.

5713* Soil Mechanics. Prerequisites: 3713 and 4711. Application of soil mechanics principles and concepts in geotechnical areas of permeability and seepage, settlement analysis, bearing capacity, lateral earth pressures and retaining walls, slope stability, and metastable soils.

5723* Foundation Engineering. Prerequisites: 3713 and 4711. Types of structural foundations including footings, mats, rafts, piles and drilled shafts, their characteristics, exploration programs, field data, construction materials and methods as basis for selection of type of foundation and design. Geotechnical design procedures and considerations.


5743* Soil-Structure Interaction. Prerequisites: 3713 and senior or graduate standing in civil engineering. The mechanical interaction effects between soils and structures using suitable engineering procedures such as finite differences and finite element methods. Civil engineering problems where interaction effects are most prominent including grade beams (beams on elastic foundation), axially- and laterally-loaded piles, cantilever and anchored sheet pile walls.

5753* Engineering Soil Stabilization. Prerequisites: 3713 and 4711. Theoretical and practical aspects of engineering soil stabilization as a method for improving and upgrading low quality and unstable soils for engineering purposes. Use of lime, fly ash, portland cement, asphalt, and other physical and chemical admixtures. Application of deep foundation stabilization methods such as preloading, deep compaction, injection, and reinforcement.


5803* Essentials of Environmental Engineering. Prerequisite: CHEM 1314 or 1515; MATH 2155. Engineering aspects of the life support system; the carbon-oxygen cycle; cycling of nitrogen, sulfur and phosphorus; and the hydrologic cycle. Concepts of environmental pollution and degradation. Techniques for mitigation; water and wastewater treatment, solid and hazardous waste management, and air pollution abatement. Calculation of pollution potential and treatment system parameters.
5813* Environmental Laboratory Analysis. Lab 3. Prerequisite: 4833 or concurrent enrollment. Analytical procedures for water and wastewater contaminants. Emphasis on the chemical theory of procedures, analytical work and an understanding of the significance or need for such laboratory samples for surface and ground water management and water and wastewater treatment processes and design.

5823* Environmental Risk Assessment and Management. Prerequisites: an introductory class in statistics and background in engineering, management or science. Environmental risk assessment and management. Applies elements of statistics, probability and environmental simulation to determine the public health and ecological risks from activities of humans.


5853* Bioremediation. Prerequisite: 3813 or equivalent science background. Process selection and design of bioremediation systems for remediation of contaminated hazardous and industrial waste sites, soils, sludges. Site analysis emphasizing contaminant and environmental characteristics. Engineering factors to promote successful bioremediation. Design project required.

5863* Advanced Unit Operations in Environmental Engineering. Prerequisite: 4833. Theory and design of advanced physical-chemical water and wastewater treatment processes applied to municipal, industrial, and hazardous waste situations.

5873* Air Pollution Control Engineering. Causes, effects and control of atmospheric pollution.

5883* Residuals and Solid Waste Management. Theory, design and operation of systems for handling, treatment, and disposal of process sludges (water treatment, wastewater treatment, industrial) and solid wastes. Potential material reclamation options.


5923* Water Resources Planning and Management. Application of engineering economics and microeconomic theory to the planning and management of water resources projects including flood control, hydroelectric, water supply, and water treatment. Systems analysis approaches, primarily linear and dynamic programming, and their application in water resources.

5933* Water Treatment. Prerequisite: 4833. Theory, design and operation of water treatment plants. Sizing of various unit processes. Water treatment plant control procedures.

5943* Unit Operations and Processes Laboratory. Lab 3. Prerequisite: 4833, 5813 or equivalent. Bench and pilot-scale experiments as physical models of water and wastewater treatments. Techniques of data collection and analysis applied to design of physical, chemical and biological processes.

5953* Biological Waste Treatment. Lab 3. Prerequisite: 4833 or equivalent. Fundamentals of microbial systems applied to waste treatment processes. Standard suspended-growth and fixed film wastewater and sludge suspensions and treatment system design calculations.

5963* Open Channel Flow. Prerequisite: 3833. Open channel hydraulics, energy and momentum concepts, resistance, channel controls and transitions, flow routing, and sediment transport.

5983* Groundwater Pollution Control. Theory, design and operation of groundwater pollution control systems. Includes examples from site specific applications as well as regional or national focus.


6000* Ph.D. Research and Thesis. 1-16 credits, maximum 30. Independent research under the direction of a member of the graduate faculty by students working beyond the level of Master of Science degree.

6010* Seminar. 1-6 credits, maximum 12. Prerequisites: consent of instructor and approval of the student’s advisory committee. Analytical studies with suitable reports on problems in one or more of the subfields in civil engineering by students working beyond the level of Master of Science degree.


6413* Plate and Shell Structures. Prerequisite: 5403. Bending of thin plate structures to include rectangles and circular plates. Analysis of orthotropic plates by classical and numerical methods. Introduction to shell bending theory.


6723* Advanced Geotechnical Engineering. Prerequisite: 3713 and GEOL 1114 or 3023. Geologic occurrence and engineering significance of ground failure hazards such as slope movements, streambank erosion, subsidence, metastable soils and earthquakes. Emphasis on qualitative identification of ground failure hazards with quantitative assessive and remedial actions.

6843* Stochastic Methods in Hydrology. Prerequisites: 5843, STAT 4033. Stochastic and statistical hydrologic analyses of surface water and ground water systems. Analyses of urban and rural drainage, and detention systems. Same as BAE 6313.


6913* Advanced Environmental Laboratory Analysis. Prerequisite: 5813. Instrumental analysis of environmental contaminants. Process samples, effluents, residuals, and environmental samples. Use of gas and liquid (ion) chromatography, atomic absorption and other analytical methods.

6923* Industrial Wastes Engineering. Prerequisite: graduate standing. Theory and methods of waste minimization, waste product reduction or reuse, process changes and treatment of residuals to reduce volume and toxicity of industrial wastes.


Communication Sciences and Disorders (CDIS)

2033 Sign Languages. Prerequisite: sophomore standing. Introduction to methods of sign language currently used among the U.S. deaf community, socially and educationally including traditional American Sign Language (ASL), Manually Coded English (MCE, SEE) and fingerspelling. Linguistic components of sign and various sociological, psychological, and adaptive communication issues having an impact on the deaf community. Two hours per week, devoted to lecture and theory; one hour involved in a variety of interactive sign language skill work in smaller groups.

2213 Phonetics. Prerequisite: sophomore standing. The analysis and description of speech at the segmental and suprasegmental levels. Development of students’ perceptual and analytic skills in speech sound production. Practice using the International Phonetic Alphabet for broad and narrow transcription. Overview of the speech production mechanism and process.

3123 Audiology and Audiometry. Prerequisites: 2213, 3213 and acceptance into CDIS program, previous or concurrent enrollment in 3224. Anatomy and physiology of the hearing mechanism and related physics of sound. Common etiologies of hearing disorders. Establishing hearing screening programs. Practical experience in pure tone audiometry and impedance screening.
3213 Survey of Communication Disorders. Prerequisite: sophomore standing. The normal development of speech, language and hearing. The characteristics, diagnosis and treatment of speech, language and hearing disorders among all age groups. Suggestions for related professions involved with people with communication disorders.


4010 Clinic Practicum. 1-3 credits, maximum 3. Lab 2-6. Prerequisites: 4022, 4031, 4323 or 4413, senior standing, 3.25 GPA in the major and consent of advisor. Supervised clinical practice in speech-language pathology and audiology.

4022 Clinical Methods and Issues. Prerequisites: 4213, 5243, concurrent or subsequent to 4022. Observation and critiquing of speech and language pathology and audiology clinical activities.

413* Aural Rehabilitation for the Acoustically Handicapped. Prerequisites: 2213, 3213, 3224; declared communication sciences and disorders major. Partial or comprehensive orientation to the professional program via Declaration of Intent in CDIS. Fundamental process and procedures of clinical practicum, report writing, goal selection, production, assessment and recording of speech and language behaviors; development of interpersonal skills with clients, families, and other professionals; problem-solving skills; professional organization and credentialing requirements.

4031 Clinical Observations. Lab 2. Prerequisites: 2213, 3213, 3224; declared communication sciences and disorders and majors; must be concurrent with or subsequent to 4022. Observation and critiquing of speech and language pathology and audiology clinical activities.

413* Language Assessment and Intervention. Prerequisite: 4214. Scien
tific bases of the acoustic parameters, the perceptual processing and application of pure tone and speech audiometric tests and impediment screening. Clinical application of pure tone and speech audiometric tests and impedance screening. Clinical application of pure tone and speech audiometric tests and impediment screening. Clinical application of pure tone and speech audiometric tests and impediment screening. Clinical application of pure tone and speech audiometric tests and impediment screening.
Computer Science (CS)

1003
Computer Literacy. Lab 2. For students with little or no personal computer skills. Use of Internet and productivity software such as word processing, spreadsheets, databases, and presentation software.

1103

1113
A) Computer Science I. Prerequisite: MATH 1513 or equivalent. Introduction to computer science using a block-structured high-level computer language, including subprograms, arrays, recursion, records and abstract data types. Principles of problem solving, debugging, documentation and good programming practice. Elementary methods of sorting and searching. Use of operating system commands and utilities.

2133

2301
FORTRAN 77 Programming. Prerequisite: another programming language. FORTRAN 77 control structures, arrays, subroutines, functions, input/output.

2313
SAS Programming. Prerequisite: a different programming language or consent of instructor. SAS as a general purpose programming language. Data representation, input/output, use of built-in procedures, report generation.

2351
UNIX Programming. Lab 2. Prerequisite: 1113. The UNIX programming system. The programming environment. The UNIX file system and the shell. Use of pipes and filters.

2432
The C Programming Language. Prerequisite: 1113. C programming language types, operators, expressions, control flow, functions, structures, pointers, arrays, UNIX interface.

2570
Special Problems in Computer Science. 1-3 credits, maximum 6. Prerequisite: consent of instructor and freshman or sophomore standing. Current topics and applications of computer science. Existing and new topics to computer science. Allows lower-division students to study topics not presented in existing classes. Can be individual study or a class with a new subject.

3030
Industrial Practice in Computer Science. 1-6 credits, maximum 12. Prerequisites: 3443, MATH 2144, junior standing, consent of departmental adviser. Applied computing in industry. Topics vary with cooperating employers. Written reports will be specified by adviser.

3302
ADA Programming. Prerequisite: 2133. ADA-R control structures, data structures, subprograms, types, parallel processing, exception conditions.

3363
Organization of Programming Languages. Prerequisites: 2133, 3443. Programming language constructs. Run time behavior of programs. Language definition structure. Control structures and data flow programming paradigms.

3373

3423
File Structures. Prerequisite: 2133. Basic physical characteristics of peripheral storage devices. File organization and processing methods for sequential, direct, indexed, tree structured and inverted files. Application of data structure concepts to logical and physical file organization. Performance analysis. Elements of advanced data base systems.

3443
Computer Systems. Prerequisite: 2133. Functional and register level description of computer systems, computer structures, addressing techniques, macros, linkage, input-output operations. Introduction to file processing operations and auxiliary storage devices. Programming assignments are implemented in assembly language.

3513
Numerical Methods for Digital Computers. Prerequisites: MATH 2144 and a knowledge of programming. Errors, floating point numbers and operations, interpolation and approximation, solution of nonlinear equations and linear systems, condition and stability, acceleration methods, numerical differentiation and integration.

3570
Special Problems in Computer Science. 1-3 credits, maximum 6. Prerequisites: junior standing and consent of instructor. Current topics and applications of computer science. Existing and new topics to computer science. Allows lower-division students to study topics not provided in existing classes. Can be individual study or a class with a new subject.

3613

3653
Discrete Mathematics for Computer Science. Prerequisite: MATH 2144. Theory and applications of discrete mathematical models fundamental to analysis of problems in computer science. Set theory, formal logic and proof techniques, relations and functions, combinatorics and probability, undirected and directed graphs, Boolean algebra, switching logic.

4003
Mathematical Logic and Computability. Prerequisite: MATH 5613 or PHIL 3000 or 3003 or consent of instructor. The basic theorems of first order logic: soundness, completeness, compactness, Lowenheim-Skolem theorem, undecidability of first order logic, Godel's incompleteness theorem. Topics include: formal languages, diagonalization, formal systems, standard and nonstandard models, Godel numberings, Turing machines, recursive functions, and evidence for Church's theses. Same course as MATH 4003 and PHIL 4003.

4113
Techniques of Computer Science for Science and Engineering. Prerequisites: one year calculus and senior or graduate standing. For graduate and advanced undergraduate students requiring a one-semester treatment of computer topics. No background in computing topics assumed. Comprehensive treatment of the FORTRAN programming language with emphasis on numerical applications. Number systems, finite arithmetic, iterative processes, program structuring, numerical methods, program libraries are covered.

4143
Computer Graphics. Prerequisite: MATH 2144. Interactive graphics programming; graphics hardware; geometrical transformation; data structures for graphic representations; viewing in three dimensions; representation of 3D shapes; hidden edge and hidden surface removal algorithms; shading models.
4154* Computer Science Migration. Lab 2. Prerequisites: MATH 2144, knowledge of a programming language and senior standing. A survey of computer science for students whose major is not computer science. Programming in high level languages. Algorithm design and analysis. Fundamental data structures.

4273* Software Engineering. Prerequisites: 2133, 3443 or ECEN 3213, 3653. Fundamental characteristics of the software life cycle. Tools, techniques, and management controls for development and maintenance of large software systems. Software metrics and models. Human factors and experimental design. Same course as ECEN 4273.

4283* Computer Networks. Prerequisites: 2133, 3443 or ECEN 3653; UNIX knowledge. Computer network, distributed systems and their systematic design. Introduction to the use, structure, and architectural models. Networking experiments to describe network topology. ISO reference model. Same course as ECEN 4283.


4343* Data Structures and Algorithm Analysis I. Prerequisites: 2133, 3653. Storage, structures, data and information structures, list processing, trees and tree processing, graphs and graph processing, searching, sorting.

4443* Compiler Writing I. Prerequisites: 2133, 3443. Syntax and semantics of procedure-oriented languages and theory of translation techniques used in their compilation. Study of languages for particular application areas, including nonalgebraic languages.


4703 Special Topics in Computing. 1-3 credits, maximum 5. Advanced topics and applications of computer science. Typical topics include operating systems, multiprocessor systems, programming systems or various mathematical and statistical packages. Designed to allow students to study topics not provided in existing courses.

4793 Artificial Intelligence I. Prerequisites: 2133, 3653. Broad coverage of core artificial intelligence (AI) topics, including search-oriented problem solving, knowledge representation, logical inference, AI languages, history and philosophy of AI.

4883 (S) Social Issues in Computing Sciences. Prerequisite: senior standing. Social implications of computer use or misuse with emphasis on the effects on the individual, society and other human institutions. Social responsibilities of people involved in using or applying computers.

4993 Senior Honors Project. Prerequisites: departmental invitation, senior standing, Honors Program advisor and 1 credit for research program ending with an honors project under the direction of a faculty member, with a second faculty reader and an oral examination. Recognition for grades and honors in computing and information science.

5000* Research and Thesis. 1-6 credits, maximum 6. Prerequisite: consent of major professor. A student studying for a master’s degree who elects to write a thesis or a report must enroll in this course.

5013* Linear Programming. Prerequisites: MATH 3013 or IEM 4014; FORTRAN. Simplex algorithm to solve deterministic linear optimization problems considering maximization and minimization objectives; degeneracy, alternative optimal and no feasible solutions. Revised simplex procedures. Duality theory, economic interpretation, dual simplex and complementary pivoting. Sensitivity analysis and parametric programming. Special cases of linear optimization problems and underlying mathematical formulations. Large-scale models including computational considerations.

5030* Professional Practice. 1-9 credits, maximum 9. Prerequisites: graduate standing in computer science, consent of the department head. Experience in the application of computer science principles to problems encountered in industry and government. Participation in problem solving in the role of junior computer scientist, junior software engineer, or computer science intern. All problem solutions documented. Required written report to the major professor.

5070* Seminar and Special Problems. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Designed to allow students to study advanced topics not provided in existing courses.

5113* Computer Organization and Architecture. Prerequisite: 3443. Computer architecture, computer control, microprogrammed control, addressing structures, instruction set, organization, and implementation of basic instruction components. Study of instruction format, machine organization, memory structure, microprogramming, memory organization alternatives; input/output interfaces. Same course as ECEN 5253.

5273* Advanced Software Engineering. Prerequisite: 4273. Continuation of 4273. Advanced theory and practice of software design methodology. Large-scale design and implementation problems. Experimental design for software engineering. Same course as ECEN 5273.

5283* Computer Network Programming. Prerequisite: 4283. Detailed technical concepts related to computer and telecommunications software development. Client-server programming using various network interfaces, including STREAMS, the Transport Layer Interface (TLI), and Berkeley Sockets. Application development using TCP/IP protocols.


5323* Design and Implementation of Operating Systems II. Prerequisite: 4323. Task systems and concurrent programming, synchronization and inter process communication. Theoretical investigation of resource sharing and deadlock, memory management, strategies, and scheduling algorithms, queuing theory, distributed operating systems. System accounting, user services and utilities.

5333* Compiler Writing II. Prerequisite: 4443. Continuation of 4443. Theory and practice of compiler writing techniques. Compiler writing systems. A formal approach to computer languages.


5413* Data Structures and Algorithm Analysis II. Prerequisite: 4154 or 4434. Data structures and their application in recursive and iterative algorithms. Static and dynamic data structure representations and processing algorithms. Dynamic and virtual storage management.

5423* Principles of Database Systems. Prerequisites: 3423, 4343 or equivalents. An overview of database management systems, entity-relationship model, relational database design with normalization theorems, data base integrity constraints, database systems with the Internet.

5443* Distributed Database Systems. Prerequisites: 5423, 4283 or 5283. Overview of relational database management systems (DBMS), distributed DBMS architecture, distributed database design, overview of query processing, introduction to transaction management, distributed concurrency control, SQL server.

5513* Numerical Analysis I. Prerequisite: 4513 or MATH 4513. Algorithms and error analysis: solution of equations, interpolation and approximation theory.

5553* Numerical Analysis for Linear Algebra. Prerequisites: MATH 3013 and CS 4513 or MATH 4513. Advanced machine computing, algorithms, analysis of rounding errors, condition, convergence, and stability applied to direct and iterative solution of linear systems of equations, linear least squares problems, including LU and QR factorization, conjugate gradients, QR algorithm, and Lanczos method. Same course as MATH 5553.
5653* Automata and Finite State Machines. Prerequisite: 5313. Finite state model, state diagrams and flow tables, equivalent states and equivalent machines. Formal grammars, context-free languages and their relation to automata. Turing machines, computability and recursive function. Same course as MATH 5653.

5663* Computability and Decidability. Prerequisite: 5313. Effectiveness, primitive recursivity, general recursivity, recursive functions, equivalence of computability, definitions, decidability, and recursive algorithms. Same course as MATH 5663.

5793* Artificial Intelligence II. Prerequisite: 4793. Advance knowledge representation and expert system building, including reasoning under uncertainty. Applications to planning, intelligent agents, natural language processing, robotics, and machine learning. Common lectures with ECEN 5293, IEM 5933 and MAE 5793.

6000 Research and Dissertation. 2-15 credits, maximum 30. Prerequisites: graduate standing and approval of advisory committee. Independent research under the direction of a member of the graduate faculty. For students working toward a Ph.D. degree.

6023* Nonlinear and Integer Optimization. Prerequisite: 5033 or equivalent. Theoretical and practical aspects of nonlinear and integer optimization. Development and application of nonlinear optimization techniques for unconstrained and constrained problems; sequential search, gradient, penalty and barrier, and projection methods. Development and application of integer and mixed integer techniques for unconstrained and constrained problems; implicit enumeration, branch and bound, and cutting planes. Same course as IEM 6023.

6240* Advanced Topics in Computer Organization. 2-6 credits, maximum 12. Prerequisites: 5113 and 5253. Structure and organization of advanced computer systems, parallel and pipeline computers, methods of computation, alignment networks, conflict-free memories, bounds on computation time.

6253* Advanced Topics in Computer Architecture. Prerequisite: 5253 or ECEN 5253. Innovations in the architecture and organization of computers, with an emphasis on parallelism. Topics may include pipelining, multiprocessors, data flow, and reduction machines. Same course as ECEN 6253.

6300* Advanced Topics in Programming Languages. 2-6 credits, maximum 12. Prerequisite: 5313. Interpreter models of programming language semantics, Vienna definition language, lambda calculus, LISP definition; Knuth semantic systems and their formulation, translational and denotational semantics. May be repeated with change of topics.

6350* Advanced Topics in Operating Systems. 2-6 credits, maximum 12. Prerequisite: 5323. Design and analysis of operating systems. Concurrent processes, server scheduling, models of auxiliary storage, memory management, virtual systems, performance algorithms. May be repeated with a change in topics.

6400* Advanced Topics in Information Systems. 2-6 credits, maximum 12. Prerequisites: 5413, 5423. Principles of distributed database systems. Overview of relational database management systems (DBMS) and computer networks, distributed DBMS architecture, distributed database design, distributed concurrency control, query processing, distributed DBMS reliability.


6600* Advanced Topics in Analysis of Algorithms. 2-6 credits, maximum 12. Prerequisite: 5413. Analysis of various algorithms. Sorting, searching, computational complexity, lower bounds for algorithms; NP-hard and NP-complete problems; parallel algorithms; proof of correctness of algorithms. May be repeated with change of topics.

6623* Algebraic Structures of Formal Grammars. Prerequisites: 5313, 5563. Context-free languages, Kleene languages, Dyck languages, context-sensitive languages; use of algebraic systems to define languages; linear bounded automata.

6700* Advanced Topics in Artificial Intelligence. 2-6 credits, maximum 12. Prerequisite: 5793 or consent of instructor. Machine learning; computer perception and robotics; logic programming; natural language understanding; intelligent agents; medical informatics. May be repeated with change of topics.

Advanced Construction Management Technology (CMT)

1214 Introduction to Construction. Lab 2. Overview of the construction industry with emphasis on construction materials, methods and systems.

2253 Construction Drawings and CAD. Lab 6. Interpretation and production of construction drawings, architectural and engineering drafting using both drafting machines and computer aided drafting.

2263 Estimating I. Prerequisites: 1214, 2253. Quantity take-off with emphasis on excavation, formwork and concrete, masonry, rough carpentry and miscellaneous specialty items.


3273 Scheduling Construction Projects. Prerequisite: 2263. Scheduling basics including bar charts and critical-path methods; manual and computer techniques using current software; emphasis on using schedules for construction project management.

3331 Construction Practicum I. Prerequisite: 1214 or 2253. Supervised field experience in construction; 400 hours minimum documented time required.

3332 Construction Practicum II. Prerequisites: 3331, 2263 and CIVE 3614. Supervised temporary, full-time employment in construction, emphasizing field and office engineering and a variety of project management functions; 400 hours minimum documented time required.

3364 Structures I. Lab 3. Prerequisites: 2343, GENT 3323. Methods of structural analysis applicable to construction; design of timber structures and forms for concrete structures.

3433 Principles of Site Development. Lab 3. Prerequisite: CIVE 3614, GENT 3323. Site layout, vertical and horizontal control, surveying instrument adjustments, site investigations, excavations, site drainage and geotechnical considerations.

3463 Environmental Building Systems. Lab 3. Prerequisite: PHYS 1214. Plumbing, heating, air-conditioning, electrical and lighting systems as applied to residences and commercial buildings.

3554 Structures II. Lab 3. Prerequisite: 3364. Analysis and design of elements in steel and reinforced concrete structures; review of shop drawings for both types of construction.

3663 Concrete Design. Lab 3. Prerequisite: MET 3323. Analysis and design of reinforced and pre-stressed concrete in accordance with the ACI building code.


4050 Advanced Construction Management Problems. 1-6 credits, maximum 6. Prerequisites: junior standing and consent of instructor. Special problems in construction management.

4263 Estimating II. Prerequisite: 2263. Extensive use of actual contract documents for quantity take-off, pricing and assembling the bid for several projects. Use of computers in estimating.


4283 Business Practices for Construction. Prerequisites: 4563, ACCT 2103. Principles of management applied to construction contracting; organizing office and field staff; bonding, liens, financial management practices; introduction to the construction manager concept; schedule of values; construction billings.
4293 Construction Manager Concepts. Prerequisites: 3332, 4273, 4283. Capstone course utilizing skills and knowledge of estimating, scheduling, bidding, construction management, CAD, TQM, partnering and safety; includes topics in leadership, motivation and the use of current project management software.

4443* Construction Safety and Loss Control. Prerequisite: senior standing. A detailed study of OSHA Part 1926 - Construction Safety and Health Compliance and related safety topics; all elements of the OSHA 30-hour training course; students completing the course are OSHA Certified Competent Persons; concepts and methods of loss control.

4563 Construction Law and Insurance. Prerequisite: 3273. Legal and insurance problems as they pertain to the construction industry.

4783 Seminar. Prerequisites: CIVE 3614. Construction scheduling; construction equipment management; advanced techniques of construction project layout and control.

Counseling Psychology (CPSY)

1112 World of Work. Assists students in exploring career options through increased understanding of self and expanded knowledge of occupational information. Includes a study of the decision-making process and a look at the present and future changing world of work.

5000* Master's Thesis. 1-6 credits, maximum 6. Prerequisite: consent of advisory committee chairperson. Report of research conducted by a student in the master's program in counseling. Credit given and grade assigned upon completion and acceptance of the thesis.

5173* Gerontological Counseling. An examination of mental health treatment modalities and approaches to counseling with older adults. An experiential component is included.

5223* Psychology of Disability. Psychological and sociological implications of physical disability and illness. Dynamics involved in adjusting to disabling conditions including issues in rehabilitation psychology, counseling, and somato-pyschology.

5320* Seminar in Counseling Psychology. 3-9 credits. Prerequisite: graduate standing. In-depth exploration of contemporary topics in counseling psychology.

5453* Vocational and Career Information. Local, state and national sources of occupational information about jobs and sociological factors related to career planning and worker effectiveness.

5473* Introduction to Counseling Practice. Prerequisite: graduate standing. Orientation to counseling practice through observation and participation. The supervised experiences permit the student and the counselor education staff to evaluate the student's strengths and weaknesses as a prospective counselor or student personnel administrator.

5483* Community Counseling and Resource Development. Prerequisite: standing. Application of educational, preventive and crisis intervention techniques in counseling and case management. Includes a study of the development and evaluation of community helping resources.

5493* Professional and Ethical Issues in Counseling. Prerequisite: admission to community counseling, elementary or secondary school counseling graduate program or consent of instructor. Principles and issues of professionalism and ethics. Seminar format with special emphasis on student's thorough preparation for, and active participation in, class discussions.

5503* Multicultural Counseling. Emphasis on effective communication skills in cross-cultural counseling or helping relationships and the integration of theoretical knowledge with experiential learning. Psycho-social factors, life styles, etc. of various cultural and ethnic groups and their influence on the helping relationship.

5513* Comprehensive School Counseling Programs. Foundation of school counseling focusing on the knowledge and skills required to develop, implement, coordinate, and manage a comprehensive, developmental school counseling program.

5523* Individual Appraisal. 3 credits, maximum 6. Methods of developing a framework for understanding individuals and techniques for data collection, assessment, and interpretation such as interviews, testing, and case study. The study of individual differences including ethnic, cultural, and gender factors.

5533* Developmental Interventions. Lab 2. Counseling theories and techniques for working with children, adolescents, and their parents in individual and group counseling and consultation. Laboratory portion translates theory to practice.

5543* Career Development Theories. Historical and contemporary viewpoints advanced by Ginsberg, Super, Holland, Roe, etc. Counselors are assisted in developing theoretical and applied bases for developing school-based career education programs and for assisting individuals in career planning.

5553* Principles of Counseling. A comprehensive foundation for effective practice and the application of contemporary theories to further knowledge of counseling as a communication process.

5563* Conceptualization and Diagnosis in Counseling. Prerequisites: 5473 and 5553 or consent of instructor. Foundation in skills necessary to conceptualize and diagnose clients presentation of problems in counseling. Intake interviewing and report writing skills, case conceptualization skills, and differential diagnostic skills using the DSM system.

5573* Elementary School Counseling and Development. Cooperation of the school counselor, teachers, principals, and parents emphasized in organizing, developing, implementing, and evaluating a counseling and development program in elementary schools.

5583* Group Process. Lab 2. Group dynamics, theory and techniques applicable to working with people of all ages in various school and non-school settings. Group member competencies are stressed during the laboratory period.

5593* Counseling Practicum. 3-12 credits, maximum 12. Prerequisites: grade of “B” or better in 5473 and 5553; admission to the counseling and student personnel program or consent of instructor. Supervised experience in human interaction processes of counseling and counseling with the major goal of facilitating positive growth processes through individual supervision. May be conducted in a variety of settings with a wide range of developmental levels.

5683* Internship in Counseling I. Prerequisites: grade of “B” or better in 5593 and admission to counseling program. Supervised experience working and studying in a counseling agency or setting.

5693* Internship in Counseling II. Prerequisites: grade of “B” or better in 5583 and admission to counseling program. Supervised experience working and studying in a counseling agency or setting.

5720 Workshop. 1-9 credits, maximum 9. Professional workshops on various topics. Designed to meet unique or special needs of professionals in various mental health fields.

6000* Doctoral Dissertation. 1-25 credits, maximum 25. Prerequisite: consent of advisory committee chairperson. Report of research conducted by a student in the doctoral program in counseling psychology. Credit given and grade assigned upon completion and acceptance of the doctoral dissertation.

6053* Ethical and Legal Issues in Professional Psychology. Prerequisite: consent of instructor. Ethical and legal standards applied to the professional practice of psychology.

6083* Principles of Counseling Psychology. Prerequisite: admission to the doctoral program in counseling psychology. Development, theoretical foundations and applications of therapeutic models of counseling and psychology.

6123* Adult Personality Assessment. Prerequisite: admission to counseling, school, or clinical psychology program. Administration and interpretation of adult personality assessment instruments such as Rorschach, TAT and DAP.

6153* Personality Theories. Prerequisite: graduate standing. An in-depth analysis of personality theories and personality disorders.

6310* Advanced Practicum and Supervision. 3-12 credits, maximum 12. Prerequisite: admission to counseling psychology program. For prospective counseling psychologists, counselor educators and supervisors, and practicing counselors. Supervised experience in development of counseling, consulting and supervising competencies.
Curriculum and Instruction Education (CIED)

0123 Improving College Reading Skills. Lab 1. Individualization and lab experiences for the improvement of college reading and learning skills, including vocabulary, reading rate, comprehension, and learning strategies. May be used to fulfill the reading improvement requirement established by State Regents policy. Graded on a satisfactory-unsatisfactory basis.

1230 Reading and Study Skills for College Students. 1-4 credits, maximum 4. Lab 1-4. Instruction and laboratory experience for the improvement of reading rate, vocabulary, comprehension and study skills. Graded on pass-fail basis.

2450 Early Lab and Clinical Experience in Elementary Education I. 1-2 credits, maximum 2. Lab 3-6. Prerequisite: declaration of intention to pursue a program in Teacher Education. The initial preprofessional clinical experience in schools, kindergarten through grade eight. Required for full admission to Teacher Education. Graded on a pass-fail basis.

3005 Foundations of Literacy. Lab 0-2. Prerequisites: ENGL 1113, 1213, 2413. Survey of evaluation, selection and utilization of literature of childhood; introduces cognitive and linguistics foundations of literacy; language conventions needed to compose and comprehend oral and written texts. Work in school setting.

3153 Teaching Mathematics at the Primary Level. Lab 2. Prerequisites: MATH 1513, 1493 or 1493 and MATH 3403 or 3603. Developmental levels in selection and organization of content and procedures for primary mathematics education.

3283 Foundations of Reading Instruction. Current theories of developmental reading instruction at the primary and intermediate grade levels.

3430 Early Lab and Clinical Experience in Elementary Education II. 1-2 credits, maximum 3. Lab 3-6. Prerequisite: full admission to Professional Education. Directed observation and participation in classrooms, kindergarten through grade eight. Concurrent seminar exploring multicultural education and integrated programs. Graded on a pass-fail basis.

3450 Field Experiences in the Schools, K-12. 1-2 credits, maximum 2. Lab 3-6. Prerequisite: consent of instructor. Seminars, directed observation and participation in the schools, K-12. Develops experience in meeting the mental, social, physical and cultural differences among children. Available in discipline-specialized sections: foreign languages. Graded on a pass-fail basis.

3622 Middle Level Education. Lab 0-2. Overview of the nature and needs of early adolescents as well as an examination of the curriculum, instruction, and organization of middle grade schools. Field-based experience in a middle school. Graded on a pass-fail basis.

3710 Field Experiences in the Secondary School. 1-3 credits, maximum 3. Lab 2. Prerequisite: consent of instructor, 2.50 GPA, and passing scores on the Oklahoma General Education Test. Seminars, directed observation and participation in a particular subject area of the secondary school. Develops experience in meeting the mental, social, physical and cultural differences among children. Graded on a pass-fail basis.

3813 Topics of Middle School Mathematics. Prerequisite: consent of instructor. Strategies for teaching the topics of the middle grades and the mathematics basic skill areas of the middle grades (grades 5-9).

4000 Field Studies in Education. 1-4 credits, maximum 4. Independent study and/or field experiences, such as spending a semester in an experimental program working with handicapped children in schools, in-depth studies in research projects, internships with school personnel. Graded on a pass-fail basis.

4003* Teaching Fundamental Concepts of Mathematics. Prerequisite: full admission to Teacher Education. Teaching of the basic skill areas. Study and comparison of contemporary basic mathematics textbooks. Recommended to be taken concurrently with public school practicum experiences.

4005 Literacy Assessment and Instruction. Lab 0-2. Prerequisite: 3005 or consent of literacy faculty. Comprehensive survey of teaching strategies, formal and informal assessment, curriculum materials, theory, and research pertaining to reading, writing, spelling, and oral language development at the primary and elementary school levels. Practical experiences required.

4012 Integration of Literacy across the Curriculum. Prerequisites: 4005; full admission to Professional Education; basic knowledge of reading, writing and oral language; integration of literacy instruction into the content areas in elementary school curriculum.

4023 Children’s Literature. Survey, evaluation, selection and utilization of materials for children; extensive reading with emphasis on books which meet the needs and interest of children through grade six.

4053* Teaching Geometry in the Secondary School. Prerequisite: full admission to Teacher Education. Overview of the present secondary geometry curriculum and future trends. Axiomatic development of Euclidean geometry, proofs and transformational geometry from the perspective of the secondary mathematics teachers. Study and comparison of contemporary basic mathematics textbooks. Recommended to be taken concurrently with 3710 and MATH 4043.

4153 Teaching Mathematics at the Intermediate Level. Lab 1. Prerequisites: 3153 and MATH 3403 and MATH 3603 and full admission to Professional Education. Selection and organization of content, procedures for instruction, and evaluation of outcomes in teaching the mathematics of the intermediate school. Some attention to instruction in upper grades of the elementary school.
Intermediate (4-6) Mathematics Education. The study of the theory and research on mathematics curriculum and instruction at the intermediate (4-6) grade levels. Problem solving, fractions, decimals, percent, and applications.


Practicum in School Mathematics. 1-3 credits, maximum 6. Lab 2-6. Diagnostic and therapeutic procedures in mathematics with students of all ages. Laboratory classes provide for clinical experiences in evaluation and instruction with children experiencing difficulty in mathematics.

Kindergarten-Primary (K-3) Mathematics Education. Theory and research on mathematics learning and teaching from the preschool level through the early elementary years. Study and analysis of children's construction of mathematics knowledge and the implications for teaching. Methods for promoting conceptual understanding and enthusiasm for the further study of mathematics.

Workshop in Science Education. 1-4 credits, maximum 4. Develops and/or implements elementary and secondary science programs.

Teaching Social Studies in the Schools. Curriculum, materials, methods and procedures related to social studies.

The Visual Arts in the Curriculum. 1-3 credits, maximum 6. Lab 2. Creative approaches to the use of two- and three-dimensional media as they relate to various aspects of education. Opportunities available for periodic group and individual evaluation in order to give direction and significance to future growth.

Literature for Children, Adolescents and Adults. Exploration of the elements and characteristics of quality literature for readers of all ages, addressing evaluation, selection and utilization. Research component requiring learners to design and conduct relevant research into literature learning and engagement with selected populations.

Literacy Instruction in Primary Grades. Analysis of growth in literacy from the preschool level through early elementary years. Examination of literacy learning processes and instructional procedures.

Reading in the Content Areas. Study of the development and use of reading and writing across the content areas.

Reading Assessment and Instruction. Prerequisite: 5423 or 5433 or consent of instructor. Development of knowledge of reading assessment and instruction for children and adults who find reading difficult. Laboratory experience for authentic assessment and tutoring in reading.

Reading and Writing Difficulties. Study of research and formal assessment tools related to reading and writing difficulties in children and adults.

Literacy and Technology Across the Curriculum. The characteristics of computer-facilitated learning and relating to broad definitions of literacy. Use of a variety of computer and literacy tools across the curriculum.

Practicum in Reading Instruction. Lab 0-2. Evaluation and instruction in reading and writing for children who experience difficulty learning to read. Collaboration among teachers, learners and resource personnel.

Effective Teaching of Mathematics in the Secondary School. Prerequisite: consent of instructor. Directed advanced practicum in secondary school mathematical education. Includes study of current research findings in mathematical education, teaching strategies, materials and evaluation procedures in the secondary school. For experienced classroom teachers, superintendents, principals and supervisors.

Multicultural and Diversity Issues in Curriculum. Understanding of the historical and contemporary perspectives toward cultural diversity. Development of an awareness of diverse cultures and language communities; understanding of critical issues of race, class, gender, and ethnicity in education; perennial issues of multiculturalism in public education and in global society; a comprehensive overview of principles and current research on bilingual and multicultural education.

Developmental Reading for College and Adult Learners. Identification of the needs, materials, curricula, and instructional strategies for college and adult readers. The study of illiteracy. Consideration of the development, organization and supervision of programs for such learners.

Integrating Teaching at the Elementary Level. Study and analysis of theories related to children's learning and implications for integrating teaching at the elementary level. Examination of teachers, own practices through reflection and research, study diverse populations, share teaching approaches and materials across the curriculum, and explore outreach to school, family, and community.

Integrating Teaching in the Secondary School. Inservice for middle to secondary teachers especially with professional development in their own school settings and in further graduate work. Examination of own practices through reflection and research, study diverse populations, sharing of teaching approaches and materials across the curriculum, and exploration of outreach to school, family, and community.

Education Workshop. 1-8 credits, maximum 8. For teachers, principals, superintendents and supervisors who need advanced curriculum and instruction coursework related to K-12 subject areas and pedagogy, in the areas of instruction and administration. Students must register for the full number of credit hours for which the workshop is scheduled for a particular term.

Seminar in Education. 1-6 credits, maximum 6. Seminar topics may differ depending upon the nature of current interests and topics in American education.

Seminar in Mathematics Education. 1-6 credits, maximum 6. Lab 0-6. Prerequisite: consent of instructor. Problems, issues and trends in mathematics education.

Educational Advocacy and Leadership. Preparation of teachers as advocates and leaders in educational policy and practice at various levels. Skills in action research, policy analysis, and coalition building leading to advocacy.

Directed Study. 1-6 credits, maximum 6. Lab maximum 6. Prerequisite: consent of instructor. Directed study for master's level students.


Contemporary Issues in Curriculum Studies. 1-6 credits, maximum 6. Examination of selected contemporary topics in curriculum studies.

Analysis of Teaching. Advanced study of multiple forms of analysis of teaching such as behavioral, phenomenological, and constructivist with emphasis on major research on teacher reflection and teacher narrative.

Curriculum Leadership. A study of curriculum leadership and implications for schooling; focus on what it means to be a curriculum leader in times of major societal change and educational reform.

Seminar in Science Education. 1-6 credits, maximum 6. Problems, issues and trends in science education. The focus at the pre-service or in-service level.

Curriculum of the Elementary School. Contemporary trends, philosophies and points of view in elementary school education.

Theory to Practice in Education. A culminating seminar demonstrating the application of theories from several disciplines to the practical problems of education: curriculum development, organization, teaching strategies and evaluations.

Current Issues in Art in the School Curriculum. Problems, issues and trends in art education programs of the elementary and secondary schools and their relationship to the total curriculum. For teachers, supervisors and administrators.

Advanced Research Strategies in Curriculum. Prerequisites: SCFD 6113. Exploration of designs and methods within qualitative and quantitative research as applied to the field of curriculum. Articulation on how to ensure that both qualitative and quantitative studies meet their respective standards of rigor.

Seminar in Literacy. Research of issues in literacy education using knowledge gained through both research and classroom practice.

Staff Development in Literacy Education. Design and delivery of research related to staff development experiences in literacy.
### Design, Housing and Merchandising (DHM)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1003</td>
<td>Design Theory and Processes for Apparel and interiors</td>
<td>Lab 4. Design elements, principles and processes applied to design and merchandising.</td>
</tr>
<tr>
<td>1103</td>
<td>Basic Apparel Assembly</td>
<td>Lab 4. Basic apparel assembly techniques. Problems including basic fit, spreading and cutting methods and equipment, and use of sewing equipment including lock, chain, and overedge.</td>
</tr>
<tr>
<td>1123</td>
<td>Graphic Design for interiors</td>
<td>Lab 6. Interior design majors only. Drafting and visual communication techniques related to interiors.</td>
</tr>
<tr>
<td>1433</td>
<td>Innovation and Marketing of Fashion Products</td>
<td>The process of fashion innovation; variables of fashion affecting production and distribution of consumer goods; development of present structure in the apparel, interiors and related industries.</td>
</tr>
<tr>
<td>2003</td>
<td>Creative Problem Solving in Design and Merchandising</td>
<td>Participatory problem solving in design and merchandising; critique of proposed solutions as a positive process of evaluation.</td>
</tr>
<tr>
<td>2203</td>
<td>Intermediate Apparel Assembly</td>
<td>Lab 4. Prerequisite: 1103 Development of skill in apparel assembly. Intermediate problems in design, cutting, and sequencing of apparel assembly operations for lined garments, plaids, other special fabrics and closures.</td>
</tr>
<tr>
<td>2303</td>
<td>Materials and Finishes for Interior Building Systems</td>
<td>Prerequisites: 1003 and 1123. Materials and procedures used in the design and production of interiors and building systems.</td>
</tr>
<tr>
<td>2573</td>
<td>(L,N) Textiles</td>
<td>Lab 2. Science principles as the basis for understanding fibers, the basic structure of yarns and fabrics. Relationships between the chemical composition of fibers and properties such as tensile strength, flammability, elasticity, moisture absorption, and dye affinity. Understanding science principles in relation to textile properties for evaluation of textile products. Recommended for education majors seeking knowledge to be used for innovative teaching of science principles in grades K-12. Required for all DHM majors.</td>
</tr>
<tr>
<td>2993</td>
<td>Communication and Presentation Techniques for Apparel and Interior Design</td>
<td>Lab 4. Prerequisites: 1003, ART 1103 and SPCH 2713. Creative communication methods and techniques including a variety of media for two- and three-dimensional presentations in apparel and interior design.</td>
</tr>
<tr>
<td>3013</td>
<td>Flat Pattern Design</td>
<td>Lab 4. Prerequisites: 2203 and MATH 1483 or 1513, pass proficiency review. Interpretation of dress design developed through the macro-pattern; introduction to pattern drafting.</td>
</tr>
<tr>
<td>3023</td>
<td>Computer-aided Flat Pattern Design</td>
<td>Lab 4. Prerequisites: 3013 and pass proficiency review. Advanced apparel design problems using flat pattern and computer-aided design (CAD) techniques.</td>
</tr>
<tr>
<td>3102</td>
<td>Fashion Sketching</td>
<td>Lab 4. Prerequisites: 1003 or 3 credit hours of art and completion of 60 credit hours. Principles and techniques of sketching in the fashion field.</td>
</tr>
<tr>
<td>3153</td>
<td>Mass Production of Apparel and Related Products</td>
<td>Lab 4. Understanding and applying mass production strategies for apparel and related products. Design for production and production operations including CAD marker making and material utilization, production simulation modeling, and costing.</td>
</tr>
<tr>
<td>3203</td>
<td>Functional Clothing Design</td>
<td>Lab 4. Prerequisites: 2573, 3013 and 4 credit hours of chemistry. Problem-solving approach to functional clothing design for specialized market segments (athletic sportswear, occupational clothing, children’s wear, clothing for the handicapped) including performance evaluation of selected materials using standard methods of textile testing.</td>
</tr>
<tr>
<td>3213</td>
<td>(H) Heritage of Dress</td>
<td>Prerequisite: 3 credit hours of history. Survey of historic modes of dress as they reflect the social, economic and cultural life of a people. Application of design principles to modern dress.</td>
</tr>
<tr>
<td>3223</td>
<td>(H) Heritage of Interiors I</td>
<td>Religious, civic, commercial, and domestic architecture and furnishing prior to and including the 18th Century with emphasis on the periods which have greatly influenced housing and interior design.</td>
</tr>
<tr>
<td>3243</td>
<td>Design of Interior Components</td>
<td>Lab 2. Prerequisite: pass proficiency review. Design factors and human performance criteria for lighting, acoustics and thermal atmospheric comfort as they relate to the practice of interior design.</td>
</tr>
<tr>
<td>3263</td>
<td>Interior Design Studio I: Residential</td>
<td>Lab 4. Prerequisites: 1003, 1123 and 2993 or consent of instructor. Studio course utilizing the design process in the analysis and planning of residential environments.</td>
</tr>
<tr>
<td>3301</td>
<td>Supervised Field Experience</td>
<td>Prerequisite: 3243 or consent of instructor. Field experience in specialized residential, commercial and institutional design with both historic and contemporary elements.</td>
</tr>
<tr>
<td>3353</td>
<td>(S) Socio-Economic Aspects of Housing</td>
<td>Family housing needs, present social and economic conditions affecting housing and building processes and the roles of business and government in housing.</td>
</tr>
<tr>
<td>3363</td>
<td>Interior Design Studio II: Small Scale Contract</td>
<td>Lab 4. Prerequisites: 3243 and 3263. Studio course utilizing the design process in the analysis and planning of hospitality, retail and other small scale commercial environments with emphasis on materials, lighting, codes and accessibility.</td>
</tr>
<tr>
<td>3373</td>
<td>Computer-aided Design for Interiors</td>
<td>Lab 4. Prerequisite: 1123. Computer-aided design and drafting for two-dimensional and three-dimensional interior systems.</td>
</tr>
<tr>
<td>3433</td>
<td>Retailing of Apparel, Interiors and Related Products</td>
<td>Prerequisites: 1433, ACCT 2103, ECON 1113. Marketing structures at retail level; job descriptions and responsibilities at management level; financial and control functions.</td>
</tr>
<tr>
<td>3533</td>
<td>Decorative Fabrics</td>
<td>Lab 4. Prerequisite: 3 credit hours in art. Historic and contemporary textile designs; creation of textile designs using personal inspirations, cultural expressions and a variety of techniques.</td>
</tr>
<tr>
<td>3553</td>
<td>Profitable Merchandising Analysis</td>
<td>Prerequisites: 3433, ACCT 2103, MATH 1513 or 1483. Relationship analysis of profit and loss statement. Retail mathematical calculations necessary to plan and control merchandising results, open-to-buy, mark-up, mark-down, turn-over, stock-sales ratio. Initial development of a six-month buying plan.</td>
</tr>
<tr>
<td>3563</td>
<td>Merchandise Acquisition and Allocation</td>
<td>In-depth study of buying and distributing merchandising.</td>
</tr>
<tr>
<td>3643</td>
<td>Apparel and Accessories for Special Markets</td>
<td>Prerequisites: 1433, PSYC 1113, SOC 1113, and completion of 60 credit hours. Analysis of the apparel and accessory needs of specialized market segments and the products designed to meet those needs, with consideration given to both product design and merchandising.</td>
</tr>
</tbody>
</table>
3823 Professional Practices for Interior Design. Prerequisites: 2903, 3243 and 3263. Specific terminology, procedures, relationships and ethics pertaining to the organization and conduct of interior design practice in the United States.

3853 Visual Merchandising and Promotions. Lab 1. Prerequisites: 1003, 1433 and completion of 60 credit hours. Study and application of principles and practices in merchandise presentation and promotions for commercial purposes.

3881 Interior Design Pre-Internship Seminar. Prerequisites: 3243, 3623, SPCH 2713. Preparation for obtaining and completing a directed practical experience in a work situation in the interior design field.

3991 Pre-internship Seminar. Prerequisites: 1003, 2003, 2573, SPCH 2713 (all students), 3433 (merchandising students), 3013 (apparel design and production students), and a 2.5 major GPA. Skills requisite to completion of a directed, practical experience in a work situation within the fashion industry.

3994 Internship. Prerequisite: 3991. Directed practical experience in an approved work situation related to the fashion industry.

4003 (S)Environmental Perspectives on Apparel and Interior Design. Prerequisites: completion of 90 credit hours. Analysis of apparel and interior design, development and use from physical, technological, economic, political, religious, social and aesthetic perspectives.

4011 Post-internship Seminar. Prerequisite: 3994. Study and comparison of student work experiences. Individual student conferences, review of merchant supervisor reactions.

4143* Design for Special Needs. Problems and alternative solutions for apparel and interiors for special groups, e.g., the aging, children, the handicapped, special markets. Includes field study or design problem.

4163* (H)Housing in Other Cultures. Housing and interior design and expressions of cultural beliefs, attitudes, family patterns and environmental influences.

4243* Draping. Lab 4. Prerequisites: 3013 and pass proficiency review. Interpretation of garment design developed through the medium of draping on dress forms.

4263* Interior Design Studio III: Large Scale Contract. Lab 4. Prerequisites: 3253, 3363 and 3283. Studio course utilizing the design process in the analysis of large scale office planning and institution design including systems and specifications.

4293* Interior Design Studio IV. Lab 4. Prerequisite: 4263. Studio course developing comprehensive interior design solutions in historic preservation or adaptive reuse and an advanced design project.

4323* Heritage of Interiors II. Prerequisite: 3233 or consent of instructor. Exploration of the architecture, interiors and furnishings of a variety of structures. Residential, commercial, governmental, institutional, and recreational buildings of different cultures of the 19th and 20th centuries.

4403* Advanced Apparel Design. Lab 4. Prerequisites: 4243 and pass proficiency review. Application and pattern-making principles and apparel assembly processes in the development of original designs.

4443* Facility Management for Contract Interiors. Philosophy and principles of facility management and the practice of coordinating the physical workplace in relation to the workforce and organizational structure of the corporate environment.

4463* Entrepreneurship and Product Development for Apparel and Interiors. Prerequisites: ECON 1113 and completion of 90 credit hours. In-depth study of entrepreneurship concepts as applied to manufacturers and retailers of apparel and interior products including product development, accounting and control, merchandising and buying, operation and management, advertising and promotion.

4523 Critical Issues in Design, Housing and Merchandising. Prerequisite: senior standing. Capstone course examining critical issues in design, housing and merchandising in the context of central theories from general education.

4810* Problems in Design, Housing and Merchandising. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Selected areas of study in design, housing and merchandising.

4824 Professional Internship. Prerequisite: 3881. A supervised internship experience that simulates the responsibilities and duties of a practicing professional in interior design.

4860* Special Unit Course in Design, Housing and Merchandising. 1-6 credits, maximum 6. In-depth study of specific areas of design, housing and merchandising.

4900 Honors Creative Component. 1-3 credits, maximum 3. Prerequisites: College of Human Environmental Sciences, Honors Program participation, senior standing. Guided creative component for students completing requirements for College Honors in the College of Human Environmental Sciences. Thesis, creative project or report under the direction of a faculty member in the major area, with second faculty reader and oral examination.

4993* (T)Textiles, Apparel, Interiors and Related Products in the International Econ-o-my. Prerequisites: 2573 (all students), 2913 (apparel students), 2303 (interior students), 3 credits of ECON, and 90 hours. Broad multi-disciplinary study of textiles, apparel, interiors and related products in the international economy.

5000 Master’s Thesis. 1-6 credits, maximum 6. Prerequisites: graduate standing and consent of major professor. Research related directly to design, housing and merchandising for the master’s thesis.

5003* Theoretical Perspectives for Design, Housing and Merchandising. A study of terminologies associated with theory. Exploration of key theories and their application to practice and research in design, housing and merchandising.

5013* Research Developments in Design, Housing and Merchandising. Current methods, development needs and pattern-making principles and apparel assembly processes in the development of original designs. Experience in identifying researchable problems, selecting appropriate methods for conducting and evaluating studies.

5113* Theories of Creative Process in Design and Merchandising. A study of the creative processes used in art, science, business and hybrid disciplines, with application to design and merchandising.

5233* Design Evaluation. Prerequisite: consent of instructor. Theoretical perspectives on evaluation of applied design; examination and evaluation of historic and contemporary designers, their philosophies and their work.

5240* Master’s Creative Component. 1-6 credits, maximum 6. Prerequisites: consent of major professor and department head. An in-depth design application of theoretical design models and philosophies. A maximum of six hours to be used by graduate students following Plan III for the master’s degree.

5273* Interpretative Theories of Material Culture. A theoretical analysis of the influences of cultural values and characteristics upon the design, acquisition and use of apparel, furnishing and building products, and the cultural diffusion of those material goods.

5343* Constructed Environment and Human Behavior. Prerequisites: 5110, 5273, PSYC 1113, SOC 1113. An exploration and evaluation of the physical attributes of the constructed environment and the interrelationships with the social and psychological aspects of human behavior.

5360* Advanced Studies in Design, Housing and Merchandising. 1-6 credits, maximum 6. Investigation into special areas in the fields of design, housing and merchandising.

5383* Design, Housing and Merchandising in Higher Education. Prerequisite: 9 credit hours in design, housing and merchandising. Development and organization of curricula and teaching methods for design, housing and merchandising.

5440* Career Internship. 1-6 credits, maximum 6. Prerequisites: consent of instructor and department head. An individualized career-oriented internship. Selected learning experiences in approved work situations in industry, government, education or research institutions related to design, housing or merchandising.

5503* Housing and Real Estate for Family Financial Planning. Overview of the role of housing and real estate in financial planning process from a theoretical perspective. Taxation, legal aspects, mortgages, and financial calculations related to home ownership and real estate investments. New and emerging issues in the context of housing and real estate. Role of ethics in financial planning including housing and real estate.

5553* Functional Apparel: Theory and Design. Lab 4. Prerequisites: 2573, 4013, 5110. A holistic approach to the study of apparel design with an emphasis on integrating knowledge of the needs and functions of the individual, the structural properties of textiles and apparel design.
Economics (ECON)

1113
(S)The Economics of Social Issues. Issues-oriented approach. Basic economic principles applied to study of important social issues: for example, inflation, unemployment, poverty, discrimination, crime, population growth and environmental quality. How do the economist's approach to social problems, and evaluates the contribution of economics to their solution. No credit for students with prior credit in 2103 or 2203. No general education credit for students also taking ECON 2103 or AGEC 1114.

2103
(S)Introduction to Microeconomics. Prerequisite: 15 credit hours. Goals, incentives and outcomes of economic behavior with applications and illustrations from current social issues: operation of markets for goods, services and factors of production; the behavior of firms and industries; income distribution; and international exchange. No general education credit for students also taking ECON 1113 or AGEC 1114.

2203
Introduction to Macroeconomics. Prerequisite: 2103 or AGEC 1114. The functioning and current problems of the aggregate economy: determination and analysis of national income, employment, inflation and stabilization; monetary and fiscal policy; and aspects of international interdependence.

3010
Special Topics in Economics. 1-3 credits, maximum 9. Prerequisites: 2203, prior approval of instructor. Analysis of a contemporary topic or specialized problem in microeconomics. Course content will vary to reflect changing social issues and trends in applied economics.

3013

3023
Managerial Economics. Prerequisite: 2203. Application of economic theory and methodology to the decision problems of private industry: non-profit institutions and government agencies; demand and cost analysis, forecasting, pricing and investment.

3113
(S)Intermediate Microeconomics. Prerequisite: 2203. How the market system organizes economic activity and an evaluation of its performance. Principles of price theory developed and applied to the interactions of consumers, producers and resource owners in markets characterized by different degrees of competition.

3123
(S)Intermediate Macroeconomics. Prerequisite: 2203. Development of a theoretical framework for studying the determinants of national income, employment and general price level. National income accounting, consumption, investment, government spending and taxation, the supply of and demand for money, monetary, fiscal and incomes policies considered with regard to unemployment, inflation and economic growth.

3213
Game Theory and Experimental Economics. Prerequisite: three credit hours in economics. The fundamentals of strategic actions presented in a game theory context and the validation of these ideas with economic experiments.

3313
Money and Banking. Prerequisite: 2203. The economics of money and banking. Operations of commercial banks and structure and competition of the banking industry. Organization and operation of the Federal Reserve System and its effects on interest rates, employment and price levels. An introduction to monetary economics and international banking concludes the course.

3423
(S)Public Finance. Prerequisite: 3 credit hours in economics. The economics of the government sector. Scope of government activity, efficiency in government expenditures, federal budget, fiscal and debt management policy. Principles of taxation, major tax sources, tax distribution, tax issues. Current public finance problems such as revenue sharing, negative income tax, urban transport systems and national health insurance.

3513
Labor Economics and Labor Problems. Prerequisite: 3 credit hours in economics. Econometric analysis of contemporary labor market problems and survey of U.S. unionism. The labor force, education and training, discrimination, inflation and unemployment theories of the labor movement, economic impact of unions and public policy toward labor.

3523
Poverty and Economic Insecurity. Prerequisite: 3 credit hours in economics. Problems, programs and proposals for dealing with poverty and economic insecurity.

3613
International Economics. Prerequisites: 3 credit hours in economics. International trade and finance; international economic organizations; the foreign economic policy of the U.S.

3713
Government and Business. Prerequisite: 3 credit hours in economics. Methods of measuring the extent of monopoly power in American industries and ways of evaluating the effects of this power on consumer welfare, U.S. antitrust laws, their enforcement and landmark court decisions under these laws.

3813
Development of Economic Thought. Prerequisite: 3 credit hours in economics. Study of the ideas of great economists with emphasis upon economic concepts and systems of thought in relation to social, ethical and political ideas under evolving historical conditions.

3823
American Economic History. Economic development and economic forces in American history; emphasis upon industrialization and its impact upon our economic society since the Civil War. Same course as HIST 4513.

3903
(S)Economics of Energy and the Environment. Prerequisite: 2103. Issues related to the development and use of energy resources, and the management of the natural environment.

4000
Economics Honors Seminar. 3-6 credits, maximum 6. Prerequisite: Honors Program participation. Topical seminar in economics for junior and senior students in the Honors Program. Special problem areas of the economy or the economics discipline. Appropriate for Honors students in any major.

4213
Econometric Methods. Prerequisites: 2203, STAT 3013 or 4013. Basic quantitative methods used in economic analysis emphasizing applications to economic problems and interpretation of empirical results. Statistical analyses, regression and forecasting techniques using computer programs.
4223* Business and Economic Forecasting. Prereq-uisites: 2203, STAT 3013 or 4013. Forecasting business and economic variables. Regression models and time series models such as expo-nential smoothing models, seasonal models, and Box-Jenkins models. Evaluation of meth-ods and forecasting accuracy. Application of methods using computer programs.

4643* (I,S)International Economic Development. Pre-requisite: 3 credit hours in economics. Prob-lems of underdeveloped economics. Regression models and time series models such as expo-nential smoothing models, seasonal models, and Box-Jenkins models. Evaluation of meth-ods and forecasting accuracy. Application of methods using computer programs.

4713* (S)Economics of Industries. Prerequisite: 2103. Industrial organization of major U.S. industries. The structure-conduct-performance paradigm is used to evaluate how costs and concentra-tion interact with pricing, marketing and R&D decisions to affect industry profitability, tech-nological progress, and the efficient allocation of resources. Case studies included.

4723* Economic Analysis of Law. Prerequisite: 3 credit hours in economics. Use of economic analysis to explain legal rules and to evaluate the effects of various alternative rules of law on economic efficiency and behavior. Emphasis on the economics of the common law areas of property, contracts, and torts. Also, products liability, crime and punishment, dis-trictive justice, and discrimination.


4913* (S)Urban and Regional Economics. Prerequi-site: 3 credit hours in economics. Urban and regional economic analysis: property rights, land use, the urban environment and rural industrial development.

4993 Economics Honors Thesis. Prerequisites: de-partmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a faculty member, with second faculty reader and oral examination. Required for graduation with departmental honors in economics.

5000* Research and Thesis. 1-6 credits, maximum 6. Workshop for the exploration and development of research topics. Research leading to the master's thesis.

5003* Research Report. Prerequisite: consent of com-mitee chairperson. Supervised research for M.S. report.

5010* Research and Independent Studies. 1-3 cred-its, maximum 10. Prerequisite: consent of de-partmental committee under a workshop ar-rangement or supervised independent studies.

5013* Contemporary Environmental Policy. Eco-nomic, social and political factors that influ-ence the formation and implementation of envi-ronmental policy. Environmental policy instrumen-tation (including pollution taxes, standards and marketable pollution permits), measure-ment of environmental damages and risk. Risk comparison, regulatory issues, health risk as-sessment, and risk communication. Political-economic considerations.

5033* Macroeconomic Analysis. Prerequisite: three hours of economics or consent of instructor. Study of the determinants of aggregate output and employment, price level, and interest rates, including international aspects. Monetary, fis-cal, and exchange rate policies and impact on the macroeconomy and business environment. No credit for Ph.D. students in economics.

5113* Managerial Economics. Economic theory ap-plied to business decision making. Concepts of microeconomics and macroeconomics related to understanding the economic system, analy-sis of policy, forecasting, and international eco-nomics. No credit for Ph.D. students in eco-nomics.

5123* Microeconomic Theory I. Prerequisites: 3113, MATH 2265 or MATH 2713. Contemporary price and allocation theory with emphasis on com-parative statics.

5133* Macroeconomic Theory I. Prerequisites: 3123, MATH 2265 or MATH 2713. National income, employment and the price level from the point of view of comparative statics.

5223* Mathematical Economics I. Prerequisites: 3113, MATH 2265 or equivalent. Mathematical con-cepts of single variable and multivariate calcu-lus, topological properties of Euclidean space, convergence, linear algebra, optimization theory and the Kuhn-Tucker Theorem with ap-plications from economic theory.

5243* Econometrics I. Prerequisite: 4213 or STAT 4043. Theory and application of econometrics to economic problems. Topics include OLS, GLS, distributed lags, serial correlation, heteroskedasticity, and simultaneous equa-tions.

5313* Monetary Economics I. Contemporary issues in monetary theory and policy. Demand for money and supply of money theory, interest rate theory and issues in monetary policy.

5413* Economics of the Public Sector I. Allocation and distribution effects as well as incidence of governemental budget policies.

5433* Economics of the Public Sector II. Fiscal policy as a means of promoting economic stabiliza-tion and growth.

5543* Labor Market Theory and Analysis. A critical evaluation of the theoretical and empirical lit-erature dealing with labor market processes; wage determination and the impact of unions on relative wages; estimation of aggregate labor supply; resource allocation and labor mo-bility; the inflation-employment tradeoff and the economics of labor market discrimination.

5613* International Finance. Open economy macro-economics and the role of devaluation, fiscal and monetary policy in the open economy, monetary approach to the balance of pay-ments, portfolio balance and asset market ap-proaches to the determination of exchange rates.

5623* Economic Development I. Characteristics and problems of less-developed countries. Criteria of growth and development with emphasis on strategies for development. The role of capital, labor, technological progress and entrepreneur-ship. Growth models.

5633* International Trade. International trade and com-mercial policy. Comparative advantage, gen-eral equilibrium and modern trade theories; welfare implications of international resource allocation models; the theory of protection and international interdependence.

5643* Economic Development II. Major problems of development policy. Inflation and mobilization of capital, investment criteria, agriculture, for-eign trade, population and manpower, plan-nning and programming methods.

5703* The Economics of Organization and Competi-tive Advantage. Prerequisite: 3113 or 5113 or consent of instructor. An analysis of organiza-tional architecture (the assignment of decision-making rights, performance evaluation, and re-ward systems within an organization). An appropriate architecture to give an organiza-tion a competitive advantage and to help an organization develop prowess in innovation and reputation, providing other sources of competi-tive advantage.

5713* Industrial Organization I Organization and opera-tion of the enterprise sector of a free enterprise economy; interrelations of market structure, conduct and performance; public policies affecting these elements.

5723* Industrial Organization II. Alternative market structures and their relationships to market per-formance; the empirical evidence concerning these. Public policies toward business, includ-ing emphasis on U.S. antitrust laws and eco-nomic analysis of their enforcement; theories of public utility regulation.

5903* Regional Economic Analysis and Policy. Se-lected topics in location theory, regional eco-nomics, and policies toward regional de-velopment in the U.S.

5913* Urban Economics. The urban area as an eco-nomic system. Problems of economic policy in urban environment.

6000* Research and Thesis. 1-12 credits, maximum 30. Prerequisite: approval of advisory commit-tee. Workshop for the exploration and develop-ment of research topics. Research leading to the Ph.D. dissertation.


6113* Seminar in Economic Theory. Microeconomics.


6133* Microeconomic Theory II. Prerequisite: 5123. Contemporary price and allocation theory with emphasis on general equilibrium analysis. Welfare economics.

6143* Macroeconomic Theory II. Prerequisite: 5133. National income, employment and the price level from the point of view of dynamics. Growth models.

6223* Mathematical Economics II. Prerequisite: 5223. A mathematical approach to general equilib-rium and welfare economics.
6243* Econometrics II. Prerequisite: 5243. Advanced econometric theory covering single and simultaneous equations models, seemingly unrelated regressions, limited dependent variable models, causality, and pooled models.

6313* Monetary Economics II. Intensive analysis of classical monetary theory and individual research on selected problems in monetary economics. The ideas of Patinkin, Wicksell, Fisher and Keynes.

6803* History of Economic Thought. Economic theories from the 18th century until the present with emphasis on the origin and improvement of analytical tools.

Education (EDUC)

1111 Orientation to Education. Lab 1. Study of the profession of education with emphasis on the skills, qualities and student support services available throughout the campus.

2000 Special Topics in Education. 1-3 credits, maximum 3. Specialized readings in education.

2510 Innovative Education Studies. 1-3 credits, maximum 6. Designed to meet unique or special needs of individuals involved in education. Topics include contemporary approaches to meeting educational challenges on the professional as well as the personal classroom experience. Graded on a pass-fail basis.

3080 International Experience. 1-18 credits, maximum 36. Prerequisite: consent of the associate dean of the college. Participation in a formal or informal educational experience outside of the USA.

3090 (I)Study Abroad. 1-18 credits, maximum 36. Prerequisites: participation in an OSU reciprocal exchange program, consent of the Study Abroad office, and associate dean of the college. Participation in a formal study abroad program in which a semester or year is spent in full-enrollment at a university outside the U.S.

3110 Honors Directed Study. 1-3 credits, maximum 3. Prerequisite: admission to the College of Education's Honor Program. Individualized directed study approved by a sponsoring professor or Honors coordinator.

4050 Honors Colloquium. 1-9 credits, maximum 9. Prerequisites: consent of instructor or honors coordinator. Study of an interdepartmental and interdisciplinary nature of various important issues and aspects as related to the field of education. Provides an intellectual challenge for the able student with a strong dedication to scholarship.

4110 Teacher Education Seminar. 1-6 credits, maximum 6. Problems, trends, and pertinent education issues. May include simulation, small-group instruction and field-based experiences. For the pre-service or in-service level.

4920 Teacher Education Practicum. 1-9 credits, maximum 9. Prerequisites: admission to Professional Education. Directed observation and supervised laboratory and clinical experiences in appropriate teacher education program areas. Appraisal and learning theory approaches employed.

5110* Contemporary Educational Issues. 1-6 credits, maximum 6. Contemporary topics and issues in the broad field of education. May include television interaction, small group discussion and outreach and field experiences. Written reports required. Graded on a pass-fail basis.

5910* Educational Field Experiences. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Guided field experience appropriate to a specific program of study. Field experience preceded and followed by appropriate on-campus seminars, readings and reports.

**Educational Leadership (EDLE)**

5000* Thesis or Report. 1-10 credits, maximum 10. Prerequisite: consent of instructor. Master's students may earn up to two hours of credit for a report or six hours of credit for a thesis. Students working on a specialist's report may earn a maximum of 10 hours of credit.

5253* The Principalship. Prerequisite: 5000-level course in school administration or equivalent. Strategies, techniques and solutions used by the principal in the administration and leadership of a public school.

5473* Supervision of Instruction. Application of modern approaches to instructional supervision through practice in recording and analyzing teacher behavior in actual classroom settings. Clinical and group methods for improving instruction.

5633* Community Education. Purpose, organization and administration of community education and its various components.

5720 Education Workshop. 1-4 credits, maximum 8. Analysis of organizational, administrative, and instructional problems by common schools and higher education personnel.


5813* Leadership and Agency. Furthering understanding about leadership and agency through exploring and examining contemporary and perennial issues from multiple perspectives in diverse educational contexts.

5880* Field Studies Internship. 1-6 credits, maximum 6. Lab 1-6. Prerequisite: consent of the advisor. Directed internship experiences designed to relate ideas and concepts to problems encountered in education by faculty and building level administrators.

5953* Introduction to Educational Leadership. Prerequisite: 5813. Provide educational leaders with opportunities to apply conceptual tools to problems of practice.

5973* Foundations of Higher Education. Overview of the historical background and philosophical foundations of American higher education.

5993* Administrative Issues in Higher Education. Overview of the organization and administration processes and analyses of social, political and legal influences on colleges and universities.


6063* Educational Ideas. Decision-making processes used in educational systems and use of modern technologies for curricular enhancement and professional development.

6143* Resources for the Study of Educational Leadership. Introduction to research traditions, tools and processes that are integral to the study of educational leadership.

6233* Critical Issues in Higher Education. Issues that have shaped and are shaping higher education in American society.

6243* Connecting Theory and Practice in Administering Schools. Application of research findings and theoretical concepts to best practice in administering educational organizations.

6263* Professional Development and Instructional Improvement. Developmental perspectives of human, conceptual and technical skills needed for continuing professional development and instructional improvement through supervisory processes.

6323* Public School Finance. Development of conceptual bases in economics of education, taxation, distribution systems, policy analysis; application to Oklahoma school finance; and introduction to budget development.


6343* Problem Solving in School Administration. Identifying and analyzing administrative problems, individually and collectively, in school settings.

6353* The Superintendent. Integration of theory and practice through examination of roles and responsibilities of the superintendent, leadership, communications and the changing nature of public education.

6393* The Human Factor in Administering Schools. Analysis and critique of current issues in school personnel administration such as recruitment, selection, promotion, morale, staff relations and teacher assessment.

6423* The Politics of Education. Activities of schools as they relate to the political environment, e.g., voter behavior, change strategies and community power structures.

6433* Special Topics in School Site Administration. Investigation of in-depth issues encountered in school site administration.

6453* Special Topics in Education Law. Analysis and critique of selected topics in school law relating to public school administration.
5663* Creativity for Teachers. Theoretical origins of creativity and their concomitant applications in the learning environment. Blocks to creative thinking, imagination, imagery, creativity testing, developing ideas and innovations, creative problem solving and teaching techniques and methods to maximize creative potential in all kinds and types of students.

5713* Transpersonal Human Development. Human development in terms of individual consciousness, focusing on the implications of such extraordinary states of consciousness as those associated with hallucinogenic drugs and mystical religious experience. Integration of psychological and religious interpretations of development. Applications to practical problems in education and psychology.

5720* Educational and School Psychology Workshop. 1-9 credits, maximum 9. Workshop on various issues related to educational and school psychology.

5735* Psychoeducational Assessment of Preschoolers. Relevant issues and challenges associated with the Stanford-Binet, WPPSI-R, WISC-R, and other pre-school assessment of preschool children, from the vantage point of recent research, discourse and policy initiatives. The link between assessment and intervention.

5763* Teaching Methods and Techniques for the Gifted and Talented. Subject and skill-related learning facilitation that is process-oriented and doing-centered. The role of the teacher as facilitator, counselor and non-directive change agent. Individualized educational plans, involving independent study, tutoring, correspondence, clustering, mentors, learning centers, resource centers.

5783* Psycho-educational Testing of Exceptional Individuals. Intensive practice in the selection, administration and interpretation of individual tests, appropriate for exceptional individuals.


5803* Advanced Intellectual Assessment, Contemporary Theories and Assessment of Intelligence and Cognitive Abilities. Prerequisites: 5783 or equivalent; good standing in school, counseling, or clinical psychology program, or consent of instructor. Examination of contemporary theories of intelligence and cognitive abilities and intelligence to new assessment technology. Appropriate for school counseling, or clinical psychology students who are already familiar with tests such as the Wechsler Series and the Stanford Binet IV.

5863* Developing Programs for the Gifted and Talented. Programs based on various philosophies and structural concepts of gifted and talented education, e.g., mainstreaming, self-contained, pull-out, magnet schools, time blocking, acceleration and enrichment. Programs designed for general and specific academic ability; however, exposure will be provided to creative and productive thinking programs, leadership programs, and visual and performing arts programs. Specific models included.

5933* Altered States of Consciousness in Human Development. Theory and research concerning the role of altered states of consciousness in human development. Practical techniques for facilitating healthy human development which might be of use to counselors, teachers, and other human services workers. Techniques include guided imagery, progressive relaxation and, especially, meditation.

5962* Developing Support Resources for Gifted and Talented Programs. Development, management, and evaluation of volunteer programs in intra- and extra-class settings. Program types include parent-aid, volunteer-aid, mentors, tutors, group sponsors. Developing community interest, finding external resources, external funding and resource information sources.

5993* Identification and Behavior Characteristics of the Gifted and Talented. Cognitive, affective, and behavioral characteristics of the gifted and talented. Selection of tests and interest inventories. Selection and/or developing of nomination/recommendation forms/models, inventories, checklists, rating scales, sociograms as well as data abstraction from cumulative and anecdotal records. Functions of gifted/talented identification committees.

6000* Doctoral Dissertation. 1-25 credits, maximum 25. Prerequisite: consent of advisory committee chairperson. Report of research conducted by a student in the doctoral program in educational school psychology. Credit given and grade assigned upon completion and acceptance of the doctoral thesis.

6030* Doctoral Seminar in School Psychology. 3-6 credits, maximum 6. Prerequisite: admission to school psychology doctoral program. Research in school psychology in areas such as philosophy of science, major areas of emphasis, research design, ethical concerns, solving problems in schools, and publication. Scientific and professional ethics and standards of psychologists.

6033* Introduction to Psychotherapy with Children and Adolescents. 3 credits. Prerequisite: 5113. Development of individual and group skills in therapy with children and adolescents. Applications of theories of psychotherapy to a variety of disorders and specific intervention and adaptive social skills training.

6043* Adult Development. Theory and research concerning human development during the adult years. Practical applications for serving adult populations in education and education-related settings.

6110* Seminar in School Psychology. 1-3 credits, maximum 6. An assessment of psychological techniques applied to problems encountered in the internship.

6113* Child Personality Assessment. Prerequisite: admission to school psychology or counseling psychology program, or consent of instructor. The personal and social assessment of children using objective and projective techniques.

6133* History and Systems of Psychology. History and systems of psychology related to contemporary applied psychology.
6143* Introduction to Developmental Psychopharmacology. Prerequisites: graduate student in School Psychology or Educational Psychology, or psychology, or 5103, or equivalent, or consent of instructor. Introduction to biological basis of behavior and behavior disorders. Review of the biological systems associated with psychopharmacological treatments. Major drug classes and their role in the treatment of developmental psychopathology.

6163* Emotion and Cognition. The relationship between emotion and cognition as it relates to knowing and learning. History, wisdom and the interdependence of affect and cognition, the effect of mood on memory, emotion in feminist epistemology, the role of feeling in the writing process, intuition, and narrative thought. Exploration of potential research.

6210* Internship in School Psychology. 3-6 credits, maximum 12. Prerequisites: admission to school psychology program; completion of all course work; completed readiness for internship form and approval of school psychology faculty. Supervised field experience of nondoctoral school psychologists by certified school psychologists for a maximum of 1200 hours over the course of an academic year, or half-time for two years.

6310* Doctoral Practicum in School Psychology. 1-6 credits, maximum 6. Prerequisites: 5510 and consent of instructor. Advanced practica for doctoral students in school psychology. Supervised experiences in assessment, consultation, intervention and supervision activities in a non-school setting.

6323* Psychological Consultation. Prerequisite: admission to graduate program in the SAHEP or psychology program. Models and strategies for the delivery of special services in the schools and other agencies that focus on serving the mental health needs of children, adolescents and adults. The use of consultation as a problem solving alternative to the assessment/label approach.

6333* Instructional Assessment and Consultation. Prerequisite: admission to College of Education or psychology program; or consent of instructor. Development of skills in consulting with educational and agency personnel and families regarding academic and educational functioning. Systematic curriculum-based assessment and measurement techniques as well as planning, implementing and evaluating instructional interventions. Evaluation of the instructional environment.

6343* Behavioral Assessment and Consultation. Prerequisite: 5113 or equivalent; admission to school psychology, clinical psychology or counseling psychology program; or consent of instructor. Development of psychological skills in system-level, behavioral assessment and consultation with application to school, agency and home settings. Systematic behavioral observation, data collection and intervention design, implementation and evaluation.

6460* Internship in Educational Psychology. 1-9 credits, maximum 9. Prerequisite: consent of instructor. Supervision and guidance of teaching and service in educational psychology. May be repeated for credit when work assignment varies. Required of all teaching assistants in educational psychology during the first semester of each new teaching assignment. Includes cooperative planning and evaluation.

6533* Human Motivation. A theoretically-oriented approach to the concept of motivation; essential principles to human behavior and applications to the solution of real and hypothetical problems.

6610* Doctoral Internship in School Psychology. 3-6 credits, maximum 18. Prerequisites: admission to school psychology doctoral program, completion of all course work; readiness for internship form, approved by school psychology faculty. Supervised experience of doctoral school psychologists for final preparation to enter the profession of school psychology. Designed to fulfill requirements of APA and State Board of Examiners of Psychologists.

6613 Instructional Systems Design. A practically-oriented coverage of analyzing, defining, sequencing and validating instructional systems. Developing educational objectives, course development, matching instruction to individual differences and evaluation of systems. Techniques of developing and validating instructional components.

6850* Directed Readings in Educational and School Psychology. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Directed reading for students with advanced graduate standing in educational and school psychology.

6880* Internship in Education. 1-8 credits, maximum 8. Lab 3-24. Prerequisites: admission to advanced graduate program and consent of area coordinator. Directed off-campus experiences designed to relate ideas and concepts to problems encountered in the management of the school program.

Educational Technology (EDTC)

3123 Applications of Educational Technologies. Lab 2. Introduction to the design and development of instruction using educational media and technology. Materials development, contemporary applications of computers and other electronic systems to instruction. Integration of instructional design, instructional media, and instructional computing.

4113* Multi-media Program Production. Prerequisite: 3122. Design and production of synchronized automatic sound slide programs coordinated with subject matter content. Includes photographic techniques, audio recording and sound-mixing methods, graphics, and synchronizing techniques. Individual projects required.

5000* Master’s Report or Thesis. Prerequisite: consent of instructor. Students studying for a master’s degree will write a research paper or thesis in the area of their interest. Credit given upon completion of the written report.

5113* Videotape Television for Instruction. Educational design and production of videotape using single or multiple cameras. Videotape editing and other technology. Individual and team projects.

5153* Computer-Based Instruction Development. Lab 0-2. Prerequisite: 4113. Examinations of curriculum strategies, related research issues, and techniques for developing computer-based instruction. Students will develop and evaluate computer-based instruction with case studies.

5720* Education Workshop. 1-8 credits, maximum 8. For teachers, principals, superintendents and supervisors who have definite problems in instruction or administration. Students must register for the full number of credit hours for which the workshop is scheduled for a particular term.

5753* Educational Technology Strategies. Lab 1. Principles of designing instructional units and courses incorporating integrated advanced technologies within the framework of the current educational environment. Contemporary education issues. Advanced educational technologies: information, assessment, accessibility, linkage to curricula, support, planning, and teacher empowerment. Assumes concept of teacher as designer/conductor vs. teacher as consumer.

5773* Administration and Supervision of Audiovisual Materials. Building, planning, selecting and purchasing equipment and materials, surveying existing materials, and planning and financing adequate programs. For administrators or teachers who are responsible for audiovisual programs.

5850* Directed Study. 1-3 credits, maximum 3. Prerequisite: consent of instructor. Directed study for master’s level students.

6000* Doctoral Dissertation. 1-15 credits, maximum 15. Required of all candidates to the Doctor of Education degree. Credit is given upon completion of the thesis.

6050* Directed Reading. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Directed reading for students with advanced graduate standing to enhance students’ understanding in areas where they wish additional knowledge.

6880* Internship in Education. Prerequisite: consent of instructor. Directed off-campus experiences designed to relate ideas and concepts to problems encountered in the management of the school program.

6910* Practicum. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Helps the student carry out an acceptable research problem (practicum) in a local school situation. Credit given upon completion of the written report.

Electrical and Computer Engineering (ECEN)


3113 Energy Conversion. Lab 2. Prerequisites: 3021, 3613. Physical principles of electromagnetic and electromechanical energy conversion devices and their application to conventional transformers and rotating machines. Network and phasor models; steady-state performance.

3213 Microcomputer Principles and Applications. Lab 2. Prerequisite: junior standing or above. Introduction to microcomputers. Digital logic elements and number systems, memory components and organization. Microprocessor and microcomputer system architecture, assembly language programming, software development, interfacing techniques.


3313 Electronic Devices and Applications. Prerequisites: 2011, 3713. Semiconductor electronic components including MOSFETs, BJTs, JFETs, and OpAmps. Emphasis on device models and use of solid state electronic devices to analyze, synthesize and design amplifiers and switching circuits. SPICE simulations are extensively utilized. Basic building blocks for analog and digital applications.


3613 Electromagnetic Fields. Prerequisites: ENSC 2613, MATH 2233. Time-harmonic and transient response of transmission lines. Maxwell's equations and their applications to engineering problems in electrostatics, magnetostatics, time-harmonic fields and plane wave propagation.

3713 Network Analysis. Prerequisites: ENSC 2613, MATH 2233. Laplace transform, transfer functions, magnetically coupled circuits and two-port networks.

3723 Systems I. Prerequisites: ENSC 2122, 2613, MATH 2233. Physical and mathematical modeling of electrical and mechanical dynamic systems. Transient response of first- and second-order systems. Laplace transform techniques for solving differential equations, transfer functions, frequency response and resonance. Same course as ECE 3723.


4010* Technical Problems and Engineering Design. 1-12 credits. Consent of instructor. Individual independent study projects selected in consultation with the instructor; analysis or design problems, literature searches and computer simulations may be involved.

4013 Senior Design Laboratory I. Lab 2. Prerequisites: 3013, 3313, 3413, and 3213 or 3233. Complete design cycle for several small design projects, each including establishing objectives, synthesis, analysis, construction, testing and evaluation. Use of modern lab equipment and fabrication techniques. Development of communication skills.

4023 Senior Design Laboratory II. Lab 2. Prerequisite: 4013. Continuation of ECEN 4013. Student project teams design, build, test and present results for realistic projects from university and industrial sponsors. Formulation of specifications, consideration of alternative solutions, feasibility considerations, detailed system descriptions, economic factors, safety, reliability, aesthetics, ethics and social impact.

4133* Power Electronics. Prerequisite: 3131. Power electronic devices, components, and their characteristics: DC-to-AC conversion; fundamentals of inverters and waveform shaping devices; application aspects; control aspects; characteristics and state-of-the-art of advanced power inverters and power conditioning topologies.

4153* Power System Analysis and Design. Prerequisite: 3113. Power system component models from circuit theory. Formulation and design of the load flow model and the optimum economic generator allocation problem utilizing computer methods.


4243* Computer Architecture. Prerequisites: 3213 and 3233. Functional organization and hardware design of digital computer systems with emphasis on microprocessor-based systems. CPU organization, features of microprocessors including advanced 32-bit CPUs, memory system design including cache, virtual memory, error detection and correction, I/O operations including direct memory access and peripheral interface design.

4273* Software Engineering. Prerequisites: 3213, 3653 or CS 2133, 3442. Fundamental characteristics of the software life cycle. Tools, techniques, and management controls for development and maintenance of large software systems. Software metrics and models. Human factors and experimental design. Same course as CS 4273.

4283* Computer Networks. Prerequisites: 3213 or CS 3442. Design, analysis and implementation of computer networks, distributed systems and their systematic design. Introduction to the use, structure, and architecture of computer networks. Networking experiments to describe network topology, ISO reference model. Same course as CS 4283.


4353* Communication Electronics. Prerequisite: 3313. Design of tuned voltage and power amplifiers, oscillators and mixers, modulation and detection, and parametric amplifiers.

4413* Automatic Control Systems. Prerequisites: 3723 or EMAE 3723. Properties of feedback control systems, mathematical models of basic components, state-variable models of feedback systems, time-domain analysis, stability, transform analysis, frequency domain analysis, root-locus design of simple input single output systems and simple compensation techniques. Same course as MAE 4053.


Active Filter Design. Lab 2. Prerequisites: 3413 and 3713. Introduction to passive filters; operational amplifiers as network elements; filter specifications; design of active filters. Laboratory design projects and computer simulations.


Real Time Digital Signal Processing. Prerequisite: 4763 or equivalent. DSP Processor architectures and programming. A/D, D/A, polled and interrupt-driven I/O. Realtime implementation of FIR/IIR filters, the FFT, and other DSP algorithms on special purpose DSP hardware from Microtec, Texas Instruments and others. Link between DSP theory and practical implementation.


Thesis or Report. 1-6 credits, maximum 6. Prerequisite: approval of major professor. A student studying for the master’s degree will enroll in this course for a maximum of six credit hours.

Professional Practice. 1-8 credits, maximum 8. Experience in application of electrical engineering principles to typical problems encountered in industry and government engineering design and development projects. Solutions to the problems require participation by the student in the role of junior engineer or engineer intern. Problem solutions involve economics and ecological considerations as well as technology, and must be adequately documented.

Seminar. 1-12 credits, maximum 12. Prerequisite: consent of adviser. Students investigate certain engineering problems not normally covered in existing courses.


Engineering Systems Reliability Evaluation. Techniques and concepts needed for evaluating the long-term and short-term reliability of a system. Topics include static and spinning generation capacity; transmission, composite, interconnected, and dc system reliability evaluations; and power system security. Applications to systems other than power systems included. For students with little or no background in probability or statistics.

Direct Energy Conversion. Energy conversion techniques and applications: thermoelectrics, thermionics, fuel cells, MHED and other processes involving electrical, mechanical and thermal energies. State-of-the-art developments in direct energy conversion using selected papers from journals and other publications. Gives the student a proper perspective of the possibilities and problems associated with satisfying future energy requirements.


Digital Computer Design. Prerequisite: 3233. Analysis and design of digital computers. Arithmetic algorithms and the design of the arithmetic/logic unit (ALU). Serial and parallel data processing; control and timing systems; microprogramming; memory organization alternatives; input/output interfaces. Same course as CS 5253.


Advanced Software Engineering. Lab 2. Prerequisite: 4273. Continuation of 4273. Advanced theory and practice of software design methodology. Large scale design and implementation problems. Experimental design for software engineering. Same course as CS 5273.

Computer Vision. Prerequisite: 5713 or MAE 5713. The development of machine vision and advanced image understanding techniques for robotics, automated inspection, bio-medicine. Object recognition, motion analysis, object tracking, segmentation, representation, and 3-D analysis.

Artificial Intelligence and Expert Systems. Prerequisite: graduate standing in electrical engineering. Fundamental concepts: search-oriented problem solving, knowledge representation, logical inference, building. An expert system, artificial intelligence languages, specialized machine architectures, applications to planning, natural language processing, and robotics. Development of an expert system or research report required. Common lectures with CS 5793, IEM 5933 and MAE 5793.


Introduction VLSI. Prerequisites: 3313 and PHYS 3313 or equivalent. Semiconductor crystal structure and device fabrication, carrier distribution and transport, pn junction and diode, metal-semiconductor heterojunction, MOSFET, BJT, and optoelectronic devices.

Advanced Power Electronics. Prerequisite: 4133. Characteristics of high power semiconductor devices, and their application to such devices to power conditioning, inversion, and wave shaping at high power levels.

CMOS Analog Integrated Circuit Design. Prerequisite: 4933. Advanced study of solid state CMOS linear integrated circuits. Topics include: Op Amps, comparators, multipliers, A/D and D/A converters and Op Amp building blocks. Op Amp building blocks include, differential pairs, current mirrors, gain, output stages, and references. VLSI layout and circuit simulation using SPICE.


Nonlinear System Analysis and Control. Prerequisite: 4413 or MAE 4053. Failure of superposition of effects: phase-plane analysis; limit cycles; Lyapunov stability; hyperstability and input-output stability; controllability and observability of nonlinear systems; feedback linearization; robust nonlinear control system design. Same course as MAE 5463.

5483* Digital Data Acquisition and Control. Prerequisite: undergraduate course in programming. Use of microprocessors in real-time applications to engineering systems for data acquisition and control, use of analog to digital, digital to analog, and digital input/output, synchronous and asynchronous programming. Compete in the engineering use of microcomputers through lectures and laboratory applications. Same course as MAE 5483.

5493* Software Design for Real-time Distributed Systems. Prerequisite: 5483 or MAE 5483 or consent of the instructor. Fundamental concepts associated with the design of software for implementation on distributed computer systems using real-time operating systems. Parallel computing in a real-time environment and control algorithm design. State-of-the-art boards including analog-to-digital and digital-to-analog equipment and newest computer-aided software engineering tools.

5513 Stochastic Systems. Prerequisites: 3513 and 4503 or STAT 4053. Theory and applications involving probability, random variables, functions of random variables, and stochastic processes, including Gaussian and Markov processes. Correlation, power spectral density, and nonstationary random processes. Response of linear systems to stochastic processes. State-space formulation and covariance analysis. Same course as MAE 5513.

5523* Estimation Theory. Prerequisite: 5513 or M513. Optimal estimation theory including linear and nonlinear estimation of discrete and continuous random functions. Wiener and Kalman filter theory included. Same course as MAE 5523.

5533* Modern Communication Theory. Prerequisite: 5513. Noise as a random process, analog and digital signal detection in the presence of noise, optimum receiver design using signal space concepts and introduction to information theory. Trade-offs between bandwidth, signal-to-noise ratio and the rate of information transfer. Example system designs include earth satellite, deep space and terrestrial communication systems.

5543* Data Transportation and Protection. Data and its representation; finite field matrices, pseudorandom sequences; information protection; space division networks; synchronization; and channel and error control.

5553* Telecommunications Systems. Prerequisite: graduate standing or consent of instructor. Ways and means that voice, data and video traffic is moved long distances. Data networks (Ethernet and Token Ring Local Area Networks; FDDI and SMDS Metropolitan Area Networks; Internet, Frame Relay, and ATM Wide Area Networks); the telephone system (POTs, network synchronization and switching; ISDN, SONET, cellular telephone); and video (NTSC, switching and timing, compressed video standards such as MPEG and Px64, HDTV).


5623* Antenna Theory. Prerequisite: 3613. Fundamental antenna parameters, including directivity, efficiency, radiation resistance, and pattern. Analysis of dipole, loop, aperture, broadband, and traveling wave antennas. Array theory. Introduction to numerical techniques used in modern antenna design.


5703* Optimization Applications. Prerequisite: graduate standing. A survey of various methods of unconstrained and constrained linear and nonlinear optimization. Applications of these methodologies using hand-worked examples and available software packages. This application-oriented course is intended for engineering and science students. Same course as CHE 5703, IEM 5023 and MEE 5703.

5713* Linear Systems. Prerequisite: graduate standing or consent of instructor. Introduction to the fundamental theory of finite-dimensional linear systems with emphasis on the state-space representation. Mathematical representations of systems; linear dynamic; controllability, observability, and stability; linearization and realization theory; and state feedback and state observer. Same course as MEE 5713.

5733* Neural Networks. Prerequisite: graduate standing. Introduction to mathematical analysis of networks and learning rules, and on the application of neural networks to certain engineering problems in image and signal processing and control systems. Same course as CHE 5733 and MEE 5733.

5753* Digital Processing of Speech Signals. Prerequisite: 4763 or 5763. Digital signal processing; speech production; digital modeling of speech; short time analysis and synthesis; the short time Fourier transform, linear predictive coding and solution of the normal equations; vocoder; channel spectrum calculation; speech coding; homomorphic processing; applications of speech processing. Introduction to more advanced topics as time permits.

5763* Digital Signal Processing. Introduction to discrete linear systems; frequency-domain design of digital filters; quantization effects in digital filters; digital filter hardware, discrete Fourier transforms, high-speed convolution and correlation with application to digital filtering; introduction to Walsh-Fourier theory.

5773* Intelligent Systems. Prerequisite: 5733 or MAE 5773. Introduction to the state-of-the-art intelligent control and system successfully deployed to industrial and defense applications. Emerging intelligent algorithms (e.g., NN, FS, GA, EP, DE), intelligent control architecture (e.g., bottom-up, top-down, reinforcement learning and hybrid systems); and case studies and design projects. Same course as MAE 5773.

5793* Digital Image Processing. Prerequisite: 4763 or 5763. Digital image processing including image acquisition and characterization, transforms, coding and compression, enhancement, restoration and segmentation. Use of modern image processing software on Sun and IBM work stations.

5833* Fiber-Optic Communication Systems. Prerequisite: graduate standing or consent of instructor. Five generations of fiber-optic communication systems described in detail. Technical advances and increased capability of each system. Historical framework of how technical capability at the time forced technical decisions. A systems engineering point of view emphasizing optimization of all components of the optical fiber link.

5843* Microelectronic Fabrication. Lab 1. Prerequisite: 3313. Contamination control and cleanroom, vacuum systems, wafer manufacturing. Photolithography and alternative lithographic techniques. Physical and chemical vapor deposition, oxidation, etching, doping, packaging, formation of semiconductor devices and circuits. A series of fabrication lab projects is conducted starting from bare silicon wafers to fabricate Optoelectronic circuits.

5853* Ultrafast Optoelectronics. Prerequisite: graduate standing or consent of instructor. Combining ultrafast laser pulses with electronic circuitry. Increased device performance, Optoelectronic/electrical pulses as short as 0.2 ps. High performance areas illustrating the power of advanced techniques in applications.

Research. 1-16 credits, maximum 36. Prerequisite: consent of major professor. Independent research for students continuing graduate study beyond the level of the M.S. degree.

6050* Special Topics. 1-9 credits, maximum 9. Prerequisite: consent of instructor. Content to be selected by the graduate faculty in electrical engineering to cover state-of-the-art advances. Repeat credit may be earned with different content.

6123* Special Topics in Power Systems. Prerequisite: 5113. Selected relevant current topics related to power system operation and planning.

6253* Advanced Topics in Computer Architecture. Prerequisite: 5253 or CS 5253. Innovations in the architecture and organization of computers, with an emphasis on parallel processing. Topics may include pipelining, multiprocessors, data flow, and reduction machines. Same course as CS 6253.


6890 - Photonics IV: Semiconductor Synthesis and Devices III. 1 credit, maximum 4. Lab 3. Prerequisite: 6840. Processing, fabrication and characterization of semiconductor optoelectronic devices in class 100/10000 cleanrooms. Cleanroom operation including general procedure for material processing and device fabrication. Device processing using a variety of processing such as mask aligner, vacuum evaporators and rapid thermal annealer. Testing using optical and electrical testing apparatus such as I-V, C-V, Hall, and optical spectral measurement systems. Same course as CHEM 6890 and PHYS 6890.

Electrical Engineering Technology (EET)


1104 - Fundamentals of Electricity. Lab 3. Prerequisites: MATH 1513 and consent of department. Elementary principles of electricity covering basic electric units. Ohm’s law, Kirchoff’s law, circuit solutions, network analysis, magnetism, inductance and capacitance.

1244 - Circuit Analysis I. Lab 4. Prerequisites: 1104, co-requisite MATH 1613. Analysis of AC electric circuits. The use of network theorems and phasors, coupled circuits, resonance, filters, and power.

2303 - Technical Programming. Lab 3. Prerequisites: 1104, MATH 1513 or completion of comparable engineering science courses. Introduction to machine programming using industrial standard languages, emphasis on problems from science and technology.

2544 - Pulse and Digital Techniques. Lab 3. Prerequisites: 1244 and 1225. Electronic circuits used in digital control and computation. Pulse generation, Boolean algebra and logic circuits.

2635 - Solid State Devices and Circuits. Lab 1. Prerequisites: 1244, MATH 1613, Diodes, transistors, LSI linear devices; their operation and applications in electronic circuits.

3005 - Electronics Analysis I. Prerequisites: 1104, 1244, 2544, 2635. MATH 1513, 1613. The evaluation equivalent, and corequisite MATH 2123. Extensive use of mathematics in analyzing discrete, linear device, linear systems and nonlinear circuits. Development of the analytic skills necessary for upper-division work. The use of basic calculus in circuit analysis. Must obtain a "C" or better before admission to other 3000 level EET courses. Limited to entering and returning students. Enrollment by advisor consent.
Elements of Electricity and Electronics. Lab 1. Prerequisite: MATH 1513. Essentials of electricity, controls, and electronics for non-majors. No credit for ECT majors.


3124 Project Design and Fabrication. Lab 1. Prerequisites: 1244, 2544, 2635. Methods of designing, analyzing and fabricating electronic circuits using standard software packages. Heat transfer characteristics and problem solutions are included.

3254 Microprocessors I. Lab 1. Prerequisites: 2544. An introduction to microcontrollers and their uses in embedded applications. Topics include system architecture, assembly language, structured programming, memory systems, user I/O, timers, peripherals, etc.

3264 Microprocessors II. Lab 1. Prerequisite: 3254. A continuation of EET 3254. Programming and interfacing of microcontrollers in embedded application including interrupts, EEPROM, serial programming, interfacing, power management, algorithms, stepper motor control.

3354 Advanced Circuits I. Lab 1. Prerequisites: 1244, 2635, MATH 2133, GENT 3123; Corequisite: EET 3113. Bandpass signaling principles and circuits. The Fourier transform; AM, SSB, FM, and PM signaling; binary modulated bandpass signaling (FSK and PSK); superheterodyne receiver; phase locked loop (PLL); modulation and mixing; frequency multiplexation; special purpose IC's.


3524 Advanced Logic Circuits. Lab 1. Prerequisites: 2544, 2635, 3254. Computer-based design, simulation and implementation of digital/mixed-signal systems using programmable logic, field programmable gate arrays, ASICs and system-on-chip technology.

3533 Introduction to Telecommunications. Lab 1. Prerequisites: 2544, 2635, 3254. Introductory course to the field of telecommunications. Study of the various technologies and how the application of these technologies work together to form functioning systems and networks.

4050 Advanced Electronic Problems. 1-4 credits, maximum 4. Prerequisites: junior standing and consent of head of department. Special problems in the electronic area.

4153 Data Communications. Lab 3. Prerequisites: 3263, 3363, 3354 and 3733. Data communications including point-to-point, LANs, WANs, and switched networks. Topologies, protocols, routing, error detection and correction, text compression, modulation techniques, OSI, TCP/IP, Internet, and ISDN. Laboratory focus on design, assembly, test, demonstration, oral and written presentation of the design project. Capstone course for the computer option.

4314 Elements of Control. Lab 3. Prerequisites: 3113, 3123, 3363, GENT 3123. Principles of analog and digital control, with emphasis on the analysis of feedback control systems in their various conceptual configurations. Application of feedback control theory to the analysis and design of present day circuits and systems. Use of circuit analysis software.


4654 Microwave Techniques. Lab 1. Prerequisites: 2635, 3354. Study of topics pertaining to VHF behavior of circuits and systems. Transmission line theory; wave equations, SWR, impedance calculations and transformations, and lossy lines. Extensive use of the Smith chart to solve transmission line problems. Introduction to Maxwell’s equations, with emphasis on steady state. Wave propagation in rectangular waveguides. Introduction to antennas. Modeling of transistors at VHF, UHF, and microwave frequencies. Design and analysis of transistor amplifiers at VHF using y and s parameters. Designing LC impedance matching networks.

4833 Senior Project. Lab 1. Prerequisite: 20 credit hours of upper-division electronics courses or consent of instructor. For the student’s last semester. A synthesis of all pertinent skills and knowledge developed in the curriculum. Students work as product design group developing a useful or marketable electronic product or device through design, assembly, test, and demonstration phases. Graded written and oral presentations.

Engineering (ENGR)


1322 Engineering Design with CAD. Lab 2. Introduction to engineering design using modern design methodologies and computer-aided tools. Design, construction and testing through participation in a multidisciplinary team-based design project contest.

1332 Engineering Design with CAD for MAE. Lab 2. Introduction to engineering design using modern design methodologies and computer-aided tools appropriate for mechanical and aerospace engineering. Design, construction and testing through participation in a multidisciplinary team based design project contest.

1342 Engineering Design with CAD for ECEN. Lab 2. Introduction to engineering design using modern design methodologies and computer-aided tools appropriate for electrical and computer engineering. Design, construction and testing through participation in a multidisciplinary team-based design project contest.

1352 Engineering Design with CAD for CHE. Lab 2. Introduction to engineering design using modern design methodologies and computer-aided tools appropriate for chemical engineering. Design, construction and testing through participation in a multidisciplinary team-based design project contest.


2030 Co-op Industrial Practice I. 1-6 credits, maximum 12. Prerequisites: sophomore standing and permission of Co-op coordinator. Pre-engineering industrial practice. Written reports as specified by advisor. Application of credit to meet degree requirements varies with level and department.

2100 Orientation Projects. Lab 2-6. 1-3 credits, maximum 3. Prerequisite: pre-engineering standing. Enrollment in independent study or small groups. Projects to assist students with special needs to adjust to engineering curriculum.

3030 Co-op Industrial Practice II. 1-6 credits, maximum 12. Prerequisites: junior standing and permission of Co-op coordinator. Pre-engineering industrial practice. Written reports as specified by adviser. Application of credit to meet degree requirements varies with level and department.

3061 Domestic Scholars Experience. Prerequisite: consent of the coordinator of CEAT Student Services. Participation in the domestic scholars experience.

3080 International Experience. 1-18 credits, maximum 36. Prerequisite; consent of the associate dean of the college. Participation in a formal or informal educational experience outside of the USA.

3090 (I)Study Abroad. 1-18 credits, maximum 36. Prerequisites: consent of the Study Abroad office and associate dean of the college. Participation in an OSU reciprocal exchange program.

4030 Co-op Industrial Practice III. 1-6 credits, maximum 12. Prerequisites: senior standing and permission of Co-op coordinator. Pre-engineering industrial practice. Written reports as specified by adviser. Application of credit to meet degree requirements varies with level and department.

4060 Topics in Technology and Society. 1-3 credits, maximum 6. Problems of society relating to technology and added problems stemming from their solution. Minimal reliance on mathematics; for engineering and nonengineer ing stu...
4113* Intellectual Property for Technical Professionals. Prerequisite: 4103 or consent of instructor. Law and regulations of patents and other intellectual property protection methods. Impact of statutory and common law on the practice of technical professionals and how they can exploit intellectual property in their daily work.

4123* Environmental Regulation for Technical Professionals. 4103 or consent of instructor. Environmental laws and regulations are omnipresent in the practice of engineering, science and architecture. Survey and the environmental laws and regulations affecting the practice of these professions.

Engineering Science (ENSC)

2113 Statics. Prerequisites: MATH 2144 and either PHYS 1114 or 2014. Resultants of force systems, static equilibrium of rigid bodies, statics of structures, and fluid statics. Shear and moment diagrams.

2123 Elementary Dynamics. Prerequisite: 2113. Kinematics and kinetics of particles, systems of particles, and rigid bodies from a Newtonian viewpoint using vector algebra and calculus. Work-energy and impulse-momentum principles. Planar and three-dimensional kinetics and kinematics of rigid bodies.


2213 Thermodynamics. Prerequisites: CHEM 1314, 1414 or 1515, MATH 2144, PHYS 2144. Properties of substances and principles governing changes in form of energy. First and second laws.

2613 Introduction to Electrical Science. Prerequisites: MATH 2153 and PHYS 2114. Elements of electrical engineering: AC and DC circuits, mesh and node analysis, network equations, steady-state response to sinusoids, energy, power and power factor.

3233 Fluid Mechanics. Prerequisites: 2113, MATH 2153. The study of fluid properties, statics, conservation equations, dimensional analysis and similitude, viscous flow in ducts, inviscid flow, boundary layer theory, open channel flow, turbomachinery and fluid measurement techniques.

3313 Materials Science. Prerequisite: CHEM 1314 or 1414 or 1515. Introductory level. Relationship between structure and properties of materials and engineering applications. Atomic, microscopic and macroscopic properties.

Engineering and Technology Management (ETM)

5110* Seminar. 1-6 credits, maximum 6. Prerequisites: admission to the master’s program or consent of instructor. Guided study in a topic area selected to enhance a student’s program.

5111* Introduction to Strategy, Technology, and Integration. Prerequisite: admission to the M.S. in ETM program or consent of instructor. The first part of the capstone and the third and final credit hour of the creative component requirement. The "big picture" of engineering and technology management, emphasizing the importance of strategy, technology, and integration, where timing of products and services are keys to market success.

5121* Capstone to Strategy, Technology and Integration I. Prerequisite: admission to the M.S. in ETM program or consent of instructor. The first part of the capstone and the second credit hour of the creative component requirement. Proposal for a project to be completed for the ETM 5131 course. Substantive use of ETM course material, and a notable and relevant contribution to the student's organization. Participation in formal critique and discussion of other proposals.

5131* Capstone to Strategy, Technology and Integration II. Prerequisite: admission to the M.S. in ETM program or consent of instructor. The second part of the capstone and the third and final credit hour of the creative component requirement. Presentation of student's project. Substantive use of ETM course material, and a notable and relevant contribution to the student's organization. Participation in formal critique and discussion of other projects.

5211* Enterprise Integration. Prerequisite: admission to the M.S. in ETM program or consent of instructor. Conceptualizing, designing and operating advanced manufacturing systems within an integrated enterprise-wide framework. Recent developments in computer and communication technologies and conceptual breakthroughs regarding the nature and behavior of integrated enterprises.

5221* Application and Execution of Engineering Teamwork. Prerequisite: admission to the M.S. in ETM program or consent of instructor. A values-based approach to professional performance, along with the best practices from any industry; or benchmarking as an effective approach to study and adopt methods from the success of other industries. The concepts, tools and techniques applicable to any product or process.

5231* Benchmarking. Prerequisite: admission to the M.S. in ETM program or consent of instructor. Benchmarking as an effective approach to study and adopt methods and techniques from the success of other industries. The concepts, tools and techniques applicable to any product or process.

5241* Strategic Project Management. Prerequisite: admission to the M.S. in ETM program or consent of instructor. Overview of traditional project management concepts and techniques (i.e., Gantt charts, PERT, CPT) along with several technical issues related to their effective use. Fundamental nature of the problems associated with several technical issues related to their effective use. Fundamental nature of the problems associated with effectively managing and coordination of multiple discrete projects within an overall systems integration initiative. A framework for addressing these problems.
Design and Implementing Change in Technical Management. Prerequisite: admission to the MSETM program or consent of instructor. Major issues, principles, and processes associated with successfully implementing change in technical workgroups and organizations. Case study examples of successful and not-so-successful implementation efforts highlight and demonstrate fundamental principles. Strategy and techniques to increase the probability of effective implementation and use.

New Product Introduction and Commercialization. Prerequisite: admission to the MSETM program or consent of instructor. Elements of the new product introduction (NPI) process and its impact or business strategy and planning. Organizational resources required for NPI and tools for determining commercial viability.

Engineering Economic Analysis. Prerequisite: admission to the MSETM program or consent of instructor. Quantitative evaluation of investment alternatives. Basis for comparison of alternatives, including present worth, annual worth, rate of return and payout period methods. Decision making among capital constrained and unequal-life projects. Benefit-cost and cost effectiveness analysis.

Technology Organization and Structure. Prerequisite: admission to the MSETM program or consent of instructor. The structure and processes by which an engineering or technology organization applies and integrates functional expertise to achieve business objectives. The interplay between business strategy and structure, the utilization of technical personnel and resources, and comparison of various organizational design and management structures.

Managing Technical Functions. Prerequisite: admission to the MSETM program or consent of instructor. Issues, concepts, theories, and insights of technical management. Unique characteristics of managing engineering and technical functions, the management process in technical settings, and individual- and group-level performance measurement and improvement.

**Engineering Technology**

(See specific technology programs listed alphabetically)

**English (ENGL)**

Composition for International Graduate Students. Lab 2. Review of complex sentence structure and organizational patterns, with an emphasis on documented research paper writing and oral presentation. Graded on a satisfactory-unsatisfactory basis.

Basic Composition. Intensive instruction in grammar and error avoidance (especially the differences between spoken and written English), paragraph structure, and essay writing. May be used for skills remediation or to satisfy high school curricular deficiency in English. Graded on a satisfactory-unsatisfactory basis.

Studies in English Composition. 1-2 credits, maximum 2. Special study in composition to allow transfer students to fulfill general education requirements as established by Regent’s policy.

Composition I. The fundamentals of expository writing with emphasis on structure, development and style.

International Freshman Composition I. Lab 2. Restricted to students whose native language is not English. Expository writing with emphasis on structure and development. Special attention to problems of English as a second language. This course may be substituted for 1113.

Composition II. Prerequisite: 1113 or 1123 or 1313. Expository composition with emphasis on technique and style through intensive and extensive readings.

International Freshman Composition II. Prerequisite: 1113 or 1123. Restricted to students whose native language is not English. Expository composition with emphasis on technique and style in writing research papers. May be substituted for 1213.

Critical Analysis and Writing I. Prerequisites: English ACT score of 27 and 3.50 overall high school or transfer GPA; or, consent of course director. Expository writing forms, including summary, critique, and synthesis. Writing assignments based on readings from across the curriculum. May be substituted for 1113.

Critical Analysis and Writing II. Prerequisites: 1313, an "A" in 1113, or consent of course director. Critical thinking, research, and writing skills necessary for success in courses across the curriculum. May be substituted for 1213.

Masterpieces of Literature. Readings in the great works of the most important writers of Britain and America, such as Shakespeare, Dickens, Twain, Faulkner, and others.

Language, Text and Culture. Investigation of how human language relates to culture.

Introduction to Technical Writing. Prerequisite: 1113. Does not meet any part of the six-hour composition requirement for the bachelor’s degree. Technical writing in the student’s area of specialization. Emphasis on clarity, simplicity and careful organization.

Introduction to Literature. Fiction, drama/film and poetry. Written critical exercises and discussion.

Languages of the World. A comprehensive survey of world languages. The essential structural and historical organization of languages. The process of languages as a basic human function. Same course as FLL 2443.

Introduction to Film. The principles of film form as they affect the art of watching and thinking about motion pictures.

Introduction to Creative Writing. Literary composition with emphasis on techniques and style through readings and writings in fiction, poetry and drama.

Survey of British Literature I. The beginnings through the Neo-Classical Period.
3363 *(H)Drama. Close study of representative plays of various periods (for example, Classical, Renaissance, Restoration, Modern, and others) and of the main formal categories (tragedy, comedy).

3410 *(H)Popular Fiction. 3 credits, maximum 6. Study of certain popular genres of fiction including science fiction, detective fiction, Western fiction, horror and the grotesque, the romance, American humor. Course content varies by semester. Exploration of the characteristics and evolution of the genre while developing skills in reading, writing and thinking critically.

3453 *(H)History of American Film. Lab 1.5. Introduction to the history of the American cinema, the principal eras in American film history, key directors, and the main genres. Basic approaches to film history.

3463 *(H)History of International Film. Lab 2. Introduction to the history of international cinema and the principal eras in film history, focusing on the moments when different national cinemas flourished.

3603 *(H)British Literature to 1600. Close study of various works in the context of cultural, political, and artistic developments throughout Europe, such as the Arthurian legend, the grail myth, the troubadours.

3633 *(H)British Literature 1600-1800. Thematic and historical concerns of the seventeenth and eighteenth centuries.

3643 *(H)British Literature 1800-1900. A variety of topics focusing on literary and cultural developments in the nineteenth century, I.e. scary novels, women writers, sensationalist literature.

3653 *(H)British Literature Post 1900. Various topics in the literature and culture of England and Ireland, i.e. the city, survival, Irish Renaissance.


3813 *(H)Readings in the American Experience. Life in the New World from the colonial to the postmodern era using a multiplicity of interdisciplinary texts that demonstrate the emergence and ongoing evolution of distinctive American identities.

3923 *(H)Shakespeare I: Comedies and Romances. Recurring themes in Shakespeare's comedies, and their revision in later romances. Nature of these genres in the period and Shakespeare's innovations. The structure and language of the plays, occasional examination of historical documents and contexts, modern performances, and critical essays.


4003* History of the English Language. The growth of the English language.

4013 English Grammar. The traditional terminology and concepts of English grammar leading or evolving into the several current systems of description.

4063* Descriptive Linguistics. The methodology of linguistic analysis.

4083* Applied Linguistics. The study of topics in psycholinguistics, including language and the brain, animal communication and language acquisition.

4093 Language in America. Historical development of American English. Regional, social and cultural language differences.

4223* Introduction to Old English. The basics of pronunciation, vocabulary, and grammar, enabling students to read short works in prose and poetry.

4233* Old English Poetry: Beowulf. Prerequisite: 4223. A close reading of the poem, taking into account the original Old English manuscript and recent translations.

4263 *(H)Aesthetics of Film. The form, meaning and value of American and international motion pictures.

4302* (H)British Drama 1500-1660. Medieval and Renaissance drama by Shakespeare's contemporaries.

4313* (H)British Drama 1660-1800. Restoration and Heroic Drama, and cultural controversies related to the theater.

4323* (H)British Drama Post 1800. Genre development. Major writers and their works.

4333* (H)American Drama. Genre development. Major writers and their works.


4450 Culture and the Moving Image. 3 credits, maximum 9. The study of the moving image in a social or cultural context, including genre, auteurs and authorship, film and feminism, television and other media.

4453* (H)Contemporary Literature. Genre development. Major writers in the novel, poetry, or drama and their works.

4520* Problems in English. 1-3 credits, maximum 6. Prerequisite: 12 credit hours of English. Specialized readings and independent studies.

4523* Technical Writing Internship. Prerequisite: 6 credit hours of English including 3323. Practice in writing resumes, proposals, abstracts and articles. Concentrated review of mechanics, proofreading, editing and interviewing techniques. Second eight weeks will include internship experience.

4533* Advanced Technical Writing. Prerequisite: 6 credit hours of English including 3323. Specialized writing projects growing out of areas of specialization with emphasis on practical and marketable skills.

4543* Technical Editing. Prerequisite: 9 credit hours of English. Scientific and technical editing skills; emphasis on editing project.

4553* Document Design. Prerequisite: six credit hours of English, including 3323. Design theories and practice for hard copy, computer screens and visuals. Students will learn about design standards, page layout, instructional design, desktop publishing, typography, reading theory, and current research in visual design.

4563* (H)Scientific and Technical Literature. Prerequisite: 6 credit hours of English. Scientific and technical style.

4630* Advanced Fiction Writing. Prerequisite: 3030. Intensive practice in fiction writing.

4640* Advanced Poetry Writing. Prerequisite: 3040. Intensive practice in poetry writing.

4650* Advanced Screenwriting. Discussion of professional screenplays and critiquing peers' work; completion of exercises on structure, visualization, and characterization; and writing a fictional screenplay.

4703* (H)Chaucer. Selections from The Canterbury Tales, showing the variety of Medieval life.

4713* (H)Milton. The more notable minor poems, prose selections and the major poems - Paradise Lost, Paradise Regained and Samson Agonistes-studied critically in context of the 17th century.

4723* (H)Shakespeare. Major plays and selected criticism.

4730* Single Author or Work. 3 credits, maximum 6. Study of a single author or a work, chosen at the instructor's discretion.

4773* (H)Literature by Women. The collection of literature written by women in England and America, classical and modern figures.

4803* (H)British Romantic Poetry. Works of the major writers who revolutionized literature and the idea of the poet.

4813* (H)British Victorian Poetry. Studies of poets who wrote between 1832 and 1901.

4823* (H)British Novel 1700-1800. Emergence and development of the novel as a literary form in the eighteenth century. Authors include Austen, Burney, Defoe, Fielding, Richardson, Sterne.
5163* (H)British Novel 1800-1900. Representative authors in cultural and historical contexts such as class and gender, or the Irish novel.


4901* Tutor Training. Lab 3. Training to become effective writing tutors and teachers through face-to-face conferences with writing students, weekly seminar presentations, and discussions of current writing center theory and practice.

4933* (H)Regional Literature. Literature of a nation such as Ireland or Canada, or of a region such as the American Southwest. Topic varies by semester.

4993 Senior Honors Thesis. Prerequisites: admission to Arts and Sciences Honors Program and 3.50 cumulative GPA. For Honors students in their final semester. Thesis written on a topic of student’s choice and directed by a faculty member. Final approval of thesis requires oral defense.


5013* Introduction to Graduate Studies. Principles and procedures in scholarly research.

5043* Traditions in Literary Criticism and Theory. A survey of the major documents in literary theory and criticism from Plato to 1965.

5063* Seminar in Shakespeare. Intensive study of a limited number of plays. Assignment of problems to individual students.

5093* Seminar in Milton. Poetry, major prose, and criticism.

5120* Studies in Teaching English as a Second Language. 1-3 credits, maximum 6. Selected topics in teaching English as a second language; e.g., cross-cultural communication, materials preparation, bilingual education.

5123* Social and Psychological Aspects of Language. An introduction to language acquisition, processing, and production, and their interaction with social contexts.

5130* Studies in English Grammar. 3 credits, maximum 6. Selected study of current topics in grammatical theory as it applies to the teaching of English.

5140* Seminar in Linguistics. 3 credits, maximum 6. Selective study of current topics in linguistics.

5143* Seminar in Descriptive Linguistics. An introduction to phonology, morphology, syntax and semantics.

5163* Middle English Literature. Major works in Middle English.

5210* Seminar or Directed Study. 1-6 credits, maximum 9. Specialized readings or independent studies.

5213* Teaching Freshman Composition. Materials and methods of instruction in freshman composition.


5293* Interdisciplinary Uses of English. Interdisciplinary study with emphasis on multiple uses of English: for example, literature, writing for scholarly publication, new media, and American studies.

5313* Internship, Teaching English as a Second Language. Supervised teaching of beginning through advanced English as a second language courses.

5335* Seminar in TESL: Testing. Standardized testing for teaching English as a second language.

5353* Studies in the History of Rhetoric. An exploration of selected topics and texts in the history of Western rhetoric from Plato to the present.

5410* Seminar in British Literature of the 16th Century. 3 credits, maximum 6. Selected writers and their works, themes and literary developments of the 16th century.

5420* Seminar in British Literature of the 17th Century. 3 credits, maximum 6. Selected writers and their works, themes and literary developments of the 17th century.

5440* Seminar in British Literature of the 18th Century. 3 credits, maximum 6. Selected writers and their works, themes and literary developments of the 18th century.

5460* Seminar in British Literature of the 19th Century. 3 credits, maximum 6. Selected writers and their works, themes and literary developments of the 19th century.

5463* Seminar in Film Studies. The exploration of key aesthetic issues of analysis and evaluation as they pertain to film criticism.

5480* Seminar in Modern Literature. 3 credits, maximum 6. Selected writers and their works, themes and literary developments of modern literature.

5513* Introduction to Technical Communications. Development of critical cognitive skills of analysis, synthesis, and interpretation from the perspective of “consumer of research”.

5520* Internship in Technical Writing. 1-6 credits, maximum 6. Practice in writing appropriate documents such as proposals, manuals (software, hardware, reference, training), articles, functional specifications in job-simulation situations. Review of academic materials as appropriate.

5553* Seminar in Advanced Technical Writing. Specialized writing projects growing out of student’s special interests and emphasizing the student’s career preparation. Coverage of manuals, proposals, and visual aids used to communicate technical information.

5543* Seminar in Scientific and Technical Editing. Managing technical documentation production; developing scientific and technical editing skills; special emphasis on editing project.

5553* Information Design for Professional Publication. Study of information design theories to design and integrate textual and visual information using appropriate tools.

5563* History of Scientific Rhetoric. Structural, stylistic and rhetorical analysis of selected scientific and technical works.

5573* Theories of Communication. Survey of a broad range of theories of communication and application of those theories to technical communication.

5583* Environmental Writing. Consideration of the historical, political, cultural, and ethical contexts of modern environmentalism and examination of the rhetorical strategies in several types of environmental discourse, including risk communication, environmental impact statements, scientific papers and research reports, EPA communications, and other forms of environmental writing directed toward the general public. Major writing project tailored to individual research interests and career goals with the aim of producing a publishable document.

5593* Technical Style and Editing. An intensive study of writing style and editing. Study of style from the sentence level (including diction and grammatical arrangement) up to the levels of genres of technical communication. Writing assignments on style for different audiences.

5630* Seminar in Early American Literature. 3 credits, maximum 6. Selected writers and their works, themes and literary developments of the 17th and 18th centuries.

5660* Seminar in American Literature of the 19th Century. 3 credits, maximum 6. Selected writers and their works, themes and literary developments of the 19th century.

5680* Seminar in Contemporary Literature. 3 credits, maximum 6. Selected writers and their works, themes and literary developments in contemporary literature.

5730* Seminar in Fiction Writing. 3 credits, maximum 6. Writing fiction at the professional level.

5740* Seminar in Poetry Writing. 3 credits, maximum 6. Writing poetry at the professional level.

5750* Seminar in Scriptwriting. 3 credits, maximum 6. Scriptwriting at the professional level.

5990* Special Problems. 1-3 credits, maximum 6. Investigation into a designated area of English leading to material for creative component option (M.A.). Graded on a pass-fail basis.

Entomology (ENTO)

2003
(N)Insects and Society. A course for non-majors that emphasizes the impact of insects on society. Influence of arthropods in beliefs, culture and fears and the view of insects in folklore and mythology from ancient times to present. Focus on the use of insects as model systems in biological research. Exposure to the use of insects in teaching, music, art, literature and the cinema. 

2023
Introduction to the Science of Entomology. Lab 2. Basic structure, function and classification of insects and closely related animals. Coverage of insects in ecosystems and development of control programs that reduce reliance on chemical pesticides.

3003
Livestock Entomology. Lab 2. Economic importance, biology and control of pests affecting domestic animals.

3021
Postharvest Insect Pests. Lab 2. Prerequisite: 2023 (or concurrent enrollment) or 3003. The biology and management of insect pests of bulk-stored grains, flour, feed, dried fruits and nuts, and those of quarantine significance for export of fresh fruits and vegetables within food processing plants, warehouses, wholesale and retail distribution systems.

3043
Insect Physiology. Prerequisites: 2023; one course in organic chemistry, nine credit hours of biology. Functions of the organ systems of insects. Lecture-demonstrations of selected insect physiology techniques. Same course as 5043.

3331
Insect Pests of Agronomic Crops. Lab 2. Prerequisite: 2023 or concurrent enrollment. Sampling and decision-making processes for evaluation and control of insect pest populations in agronomic crops. Coverage of identification of pests and beneficials and damage symptoms resulting from insect feeding in crops.

3421
Horticultural Insects. Prerequisite: 2023 or concurrent enrollment. Identification, biology and control of pests of cultural plants. Emphasis on pests injurious to vegetables, fruits, pecans, greenhouse plants, turf and ornamental trees and shrubs.

3461
Insects in Forest Ecosystems. Lab 2. Prerequisite: concurrent enrollment in 2023. Identification and seasonal life history of insect pests and beneficial insects on shade trees in urban settings, in commercial forests, and in forest products.

3644
Insect Morphology. Lab 4. Prerequisite: 2023. Insect development and comparative morphology. Same course as 5644.

3663
Turfgrass Integrated Pest Management. Lab 2. Prerequisite: 2023, PLP 3344. The biology, ecology, and identification of fungal, nematode, and insect turfgrass pests. Contemporary concepts and applications of integrated control practices available for managing turfgrass pests along with decision-making tools for use in turfgrass pest management programs. Same course as PLP 3663.

4223
Ecological Methodology. Lab 2. Prerequisite: one course in either ecology or general biology. Use of insects and other invertebrates for describing and evaluating interactions of individuals and populations with their environments. Coverage of behavioral and physiological ecology on consequences to individuals, population and community ecology considered in dynamics of groups of organisms in ecosystems.

4464

4800
Undergraduate Traineeship. 1-5 credits, maximum 5. Prerequisite: consent of instructor. Participation in research or extension pest management programs of departmental faculty.

4854
Medical and Veterinary Entomology. Lab 4. Prerequisite: 3553. Biology and control of insects affecting public health.

4922
Applications of Biotechnology in Arthropod and Pathogen Control. Prerequisites: introductory biology and chemistry or equivalent. Applications of biotechnology in controlling arthropod pests of plants and animals and plant pathogens. Introduction to underlying technology, products being deployed, their effectiveness and associated problems or concerns resulting from their use. Same course as PLP 4922.

5000
Master’s Research and Thesis. 1-6 credits, maximum 6. Research in entomology.

5003
Insect Biochemistry. Prerequisite: consent of instructor. Biochemical processes in insects and closely related arthropods with an emphasis on metabolic pathways unique to this group. Biochemical aspects of arthropod host interactions.

5020
Special Problems. 1-8 credits, maximum 8. Prerequisite: graduate standing. Selected studies in the area of entomology, acarology or araneology.

5043
Insect Physiology. Prerequisites: one course in organic chemistry and nine credit hours of biology. Functions of the organ systems of insects. Lecture-demonstrations of selected insect physiology techniques. Same course as 3043.

5330
Advanced Systematic Entomology. 1-5 credits, maximum 5. Prerequisite: 5464. Special problems in advanced systematic entomology.

5332
Principles of Proposal Writing and Review. Prerequisite: consent of instructor. Mechanics of proposal development and the peer review system. Effective use of scientific literature, and the development of hypotheses, objectives, and experimental design and methods through intensive writing and discussion.

5513
Biological Control. Lab 2. Prerequisite: 2023 or equivalent or consent of instructor. The ecological principles and applied practices of biological control of insects, weeds and plant pathogens. Epizootiology including the scientific basis of biological control; natural enemies and their biology; biological control methods; and biological control in integrated pest management programs.

5523
Integrated Management of Insect Pests and Pathogens. Lab 2. Prerequisites: 2023 and PLP 3344 or equivalent or consent of instructor. Modern theory and practices for management of insect pests and pathogens in plant production systems, emphasizing an ecologically-based, integrated approach. Basic concepts of pest management, decision-making, cost/benefit analysis, and risk/benefit analysis. Same course as PLP 5623.

5550
Advanced Agronomic Entomology. 1-5 credits, maximum 5. Prerequisite: 4523. Special problems in advanced agronomic entomology.

5613
Host Plant Resistance. Lab 2. Prerequisites: 2023 and PLP 3344 or equivalent or a general genetics course; or consent of instructor. Interactions of plants and the herbivorous insects and pathogenic micro-organisms that attack them. Development and deployment of multiple-pest resistant cultivars in crop management systems. Same course as PLP 5613.

5710* Advanced Medical and Veterinary Entomology. 1-5 credits, maximum 5. Prerequisite: 4854. Special problems in methods of disease transmission, animal parasite control and the relationships existing between parasite and host.

5733* Natural Chemical Mediators in Ecology. Prerequisites: BIOL 1114, CHEM 3015 or equivalent. Interactions among organisms mediated by naturally produced chemicals. An interface of ecology, behavior, physiology and chemistry with examples from animals, plants and microorganisms. Origin, function, significance and utilization of semichemicals.

5753* Insecticide Toxicology. Prerequisite: organic chemistry or 15 credit hours biology. Properties and mode of action of the major insecticidal risk materials. Assessment of their impact on the environment.

5850* Epidemiology of Arthropod-borne Diseases. 1-4 credits, maximum 4. Lab to be arranged. Prerequisite: 4854 or equivalent. The relationships existing between the hosts, arthropod vectors and causal agents of disease and the principles of disease prevention or suppression by the intelligent use of biological principles.

5870* Scientific Presentations. 1 credit, maximum 5. Prerequisite: consent of instructor. Preparation and delivery of scientific presentations including 50-minute seminars, 10-minute talks, and posters. Same course as PLP 5870.

5992* Career Skills and Professionalism for Scientists. Prerequisite: graduate standing. For graduate students majoring in science-based fields, especially those nearing graduation. Skills needed for effective job application and interviewing, career development and advancement, communication with professional colleagues and the public, and personal professional development. Same course as PLP 5992.

6000* Doctoral Research and Dissertation. 1-9 credits, maximum 36. Prerequisite: M.S. in entomology or consent of major professor. Independent investigation under the direction and supervision of a major professor.

6100* Advanced Insect Physiology. 1-5 credits, maximum 5. Prerequisite: 4043. Special problems in advanced insect physiology.

Environmental Science (ENVR)

1113 Elements of Environmental Science. Application of biology, chemistry, ecology, economics, geology, hydrology, mathematics, physics, and other agricultural sciences to environmental issues. Addressing environmental problems from the standpoint of ethics, risk, and scientific and social feasibility. Emphasis on agricultural systems and natural resources.

4010 Internships in Environmental Science. 1-6 hours, maximum 6. Prerequisite: junior standing in environmental science or consent of instructor. Supervised internships with business, industry, or governmental agencies in environmental assessment and remediation.

4500 Environmental Science Problems. 1-6 credits, maximum 6. Prerequisites: upper division standing, GPA of 2.50 or better, and consent of instructor. Individual or small group study of selected problems in environmental science. Course may be used twice for up to six credit hours to meet degree requirements.

4573 Ethical Issues in Agriculture and the Environment. Application of ethical concepts and economics, geology, hydrology, mathematics, physical, biological, economic, and public policy and administrative principles. Primarily for environmental science majors.

5000* Research for Thesis or Report. 1-6 credits, maximum 6. Prerequisites: approval of advisory committee and departmental steering committee. Research leading to master's thesis or report.

5103* Environmental Science and Ecology. The basics of ecology for transfer students or those needing a refresher. Component and structure, biogeochemical cycles, energy flow, properties of populations, population interactions, predation and community ecological basics. May be offered in a shortened format.

5110* Advanced Topics in Environmental Science. Prerequisite: consent of instructor. Individual library, laboratory and field projects on facets of environmental science.

5200* Special Topics in Environmental Science. 1-4 credits, maximum 10. Prerequisite: graduate standing. Topics and issues in the broad field of environmental science. Group discussions and projects not covered by existing courses such as ecological risk assessment, water chemistry and environmental law.

5300* Seminar in Environmental Science. 1-3 credits, maximum 3. Prerequisite: 3000 or 4000 level ecology course. Selected environmental problems, individual research, seminar reports and group discussion of reports.

5400* Environmental Problem Analysis. 3 credits, maximum 6. Prerequisite: 5300. Multidisciplinary team investigation of environmental problems. Problem formulation, review of applicable theory from different disciplines, data collection from field, library and laboratory, mathematical modeling and application of appropriate techniques of analysis to selected environmental problems and environmental impact assessments.

5500* Environmental Management Problem Analysis. 1-3, maximum 6. Prerequisites: must have either: 5200 or POLS 5633; and either POLS 5643 or CIVE 5823. Finding sustainable solutions to complex environmental, safety and health problems using an integrated team approach. Problem formulation and analysis integrated from different disciplines using technical, legal, economic and sociopolitical approaches. May be substituted for ENVRS 500 in plan of study. Required for environmental management specialization.

5600* Environmental Management Internship and Report. 1-6 credits, maximum 12. Prerequisites: 5500 and consent of director. Internships on environmental problem solving project(s) and submission and approval of a formal report. Course must be completed within three consecutive semesters from date of initial enrollment.

5703* Chemical Aspects of Environmental Science I. Prerequisites: CHEM 1225, MATH 2155. For non-chemists with a basic understanding of industrial environmental chemistry. For the environmental professional student in the calculations required for permitting, such as the Clean Air Act, the Clean Water Act, release reporting (CERCLA), RCRA and Industrial Hygiene. The chemical interpretation of MSDS sheets and review of basic chemistry for individuals sitting for professional examinations. Fundamental scientific basis required for dealing with any environmental area.

5713* Chemical Aspects of Environmental Science II. Prerequisite: 5703. A continuation of 5703. Applications of statistical methods for environmental monitoring, environmental sampling, chemical wastewater treatment, fugacity (air emission calculations) and environmental chemical analysis.

6000* Research for Dissertation. 1-12 credits, maximum 60. Prerequisite: approval of advisory committee and departmental steering committee. Research leading to the Ph.D. dissertation.

6201* Seminar in Environmental Problems. Multidisciplinary investigations of a current environmental problem that may be either global or local in nature.

6500* Advanced Environmental Management Practicum. 1-3 credits, maximum 6. Prerequisites: 12 hours of core courses. For doctoral students specializing in environmental management issues. Using a team approach for working with safety, health, economic, policy and administrative principles.

6600* Advanced Environmental Management Internship. 6 credits. Prerequisites: 6500 and consent of director. A minimum of 480 contact hours within an approved internship placement. Report at end of internship. Course must be concluded within three consecutive semesters from initial enrollment.

Finance (FIN)

2123 Personal Finance. A first course in the management of the individual's financial affairs. Budgeting, pricing of credit, mortgage financing, investment and estate planning.
3113 Finance. Prerequisites: ACCT 2203, ECON 2203, STAT 2023. Operational and strategic financial planning, including allocation of funds, asset management, financial information systems, financial structure, policy determination and analysis of the financial environment.

3613 General Insurance. Introduction to the theory and general principles of insurance. A broad analysis of the elements and operation of property, casualty, health and life insurance.

3623 Property and Casualty Insurance. Prerequisite: 3613. Emphasis on loss and the insurance contract from fire, marine, property damage, automobile and other liability and loss adjustment. Rate formulation, social implications, government regulations and government regulation of the insurance industry.

3633 Life and Group Insurance. Prerequisite: 3613. Principles of insurance applied to life and human values. Group plans in industry, with coverage emphasizing the managerial point of view.

3713 Real Estate Investment and Finance. Prerequisite: 3113. An introductory course in real estate investment and finance. Financing real estate, financial leverage and financial planning, the institutional structure of mortgage lending, managing risks, investment strategies and decisions.


4213* International Financial Management. Prerequisite: 3113. Financial problems of multinational corporations. Designed to develop a sound conceptual understanding of the environmental factors that affect decisions of financial managers; to extend the current developments in the theory of financial management to incorporate variables peculiar to international operations; and to formulate financial strategies under different business systems and ideologies.

4223 Investments. Prerequisite: 3113. Various approaches to selecting and timing investment opportunities, e.g., common stocks, bonds, commodities and options. Modern concepts of portfolio theory.

4333* Financial Management. Prerequisite: 3113. Theories and practice applicable to the financial administration of a firm. A variety of teaching methods used in conjunction with readings and cases to illustrate financial problems and techniques of solution.

4443* Banking Strategies and Policies. Prerequisites: 3113 and ECON 3313. Theories and practices of bank asset management; banking markets and competition.

4453 Bank Decision Simulation and Analysis. Prerequisite: 4443. Student teams assume the roles of senior bank officers, making decisions regarding bank assets, funding, product pricing, financial leverage, profit enhancement, risk management, and staffing. Decisions implemented through computer simulation, incorporating the decisions into an environment where the decisions of competing management teams and the local economy determine bank profitability and shareholder value. Evaluation of students' abilities to create shareholder value and effectively communicate planning and analysis through written and spoken reports.

4463 Applied Financial Studies. Prerequisite: completed six hours beyond 3113 or consent of the instructor. Structured internship or field project with supporting academic study.

4550* Selected Topics in Finance. 1-6 hours credit, maximum 6. Prerequisite: 3113. Advanced topics in finance. Topics are updated each semester.

4613* Risk Management. Prerequisite: 3113. Introduction to relevant analytical tools necessary for the effective management of risk.

4763* Financial Futures and Options Markets. Prerequisite: 3113. Foundation in financial futures and options markets. A balance of institutional and technical background necessary to understand the structure of these markets and the theoretical developments necessary to apply the contracts to various uses. The use of financial futures and options to manage price risk.

4813* Portfolio Management. Prerequisite: 4223. Overview of portfolio management from the point of view of a trust officer, mutual fund manager, pension fund manager, or other manager of financial assets. Emphasizes the need of financial managers for an understanding of bond and stock markets, trends, and theory of portfolio management.

4913* Advanced Risk Management. 3 credits. Prerequisites: 4223, 4613, 4763, STAT 3013. Application of risk management concepts and skills for the development of programs to manage risk exposures.

5013* International Finance. Prerequisite: graduate standing. An introduction to the major areas of business finance: the financial environment in which business decisions are made and the institutions found therein, the financial management practices of a firm securing financing and allocating resources among competing alternatives, and the valuation of financial assets available to the firm and individuals.

5053* Theory and Practice of Financial Management. Prerequisites: 5013 or equivalent and prior or concurrent enrollment in ACCT 5103 or equivalent. Concepts and theories applicable to the financial administration of a firm. Cases, problems and readings to illustrate various financial problems and techniques of solution.

5213* International Business Finance. Prerequisite: 5053. Theories and financial management practices unique to business firms which operate in or are influenced by, an increasingly global economy.

5223* Investment Theory and Strategy. Prerequisite: 5053. Selected investment topics and advanced portfolio management techniques.

5243* Financial Markets. Prerequisite: 5053. An analysis of the structure of financial markets, the determination and behavior of interest rates, the functioning of and the flow of funds.

5550* Special Topics in Finance. 1-6 credits, maximum 6. Prerequisite: 5053. Theoretical and applied aspects of specialized financial areas. Evaluation of models, current trends and problems.

5613* Corporate Financial Planning. Prerequisite: 5053. Financial planning in a systems framework. An integration of existing financial theory and practice. Financial planning systems allowing the manager to acquire an overview of the various functions of the firm; to examine alternative courses of action with speed and thoroughness; to reduce the response time in reacting to change in the environment and to improve future decisions by learning from feedback of previous decisions.


5773* Financial Engineering. Prerequisite: MATH 4513. Techniques for the design, development and implementation of innovative financial instruments and processes to the formulation of creative solutions of problems in finance.

5883* Quantitative Financial Applications. Prerequisites: 5223 and consent of the department. Application of solution techniques through directed case work in appropriate business and public sector settings. Simulation, small group instruction and field-based experiences.

6053* Advanced Corporate Finance. Prerequisite: consent of Ph.D. director. Theoretical and empirical underpinnings of modern corporate finance.

6613* Theory of Finance. Prerequisite: 5053. Development of theoretical structure of financial decisions beginning with case of certainty and moving to uncertainty models. Fundamental decisions of investment, financing, and production within the context of economic theory of choice and capital market equilibrium.

6560* Seminar in Finance. 3-6 credits, maximum 12. Prerequisite: consent of instructor. Advanced research with emphasis on theoretical problems and solutions. Selected topics covered.

Fire Protection and Safety Technology (FPST)

1213 Fire Safety Hazards Recognition. "The Fire Problem" Physical, chemical and electrical hazards and their relationship to loss of property and/or life. Safe storage, transportation and handling practices to eliminate or control the risk of fire in the home, business and industry.

1373 Fire Suppression and Detection Systems. Lab 3. The design, installation, maintenance and utilization of portable fire-extinguishing appliances and pre-engineered systems. Operational capabilities and utilization requirements of fire detection and signaling systems. Fire detection and suppression applied in practical laboratory problems.

### 2050 Studies in Loss Control
1-4 credits, maximum 6. Prerequisites: consent of instructor and advisor. Problems in applied fire protection technology, occupational safety, industrial hygiene or hazardous materials management of particular interest to the loss control specialist.

### 2153 Fire Protection Management
Applied human relations, technical knowledge and skills for achieving optimum effectiveness from a fire protection organization.

### 2243 Design and Analysis of Sprinkler Systems
Lab 3. Prerequisites: 1373, 2483, ENGR 1322 or GENT 1153. Detailed current standards for selection, design, installation, operation and maintenance of automatic fire suppression systems. Laboratory problems on applicable technological principles.

### 2344 Elements of Industrial Hygiene
Lab 3. Prerequisite: CHEM 1225. Toxic or irritating substances, physical, biological, ergonomic and other occupational stress factors causing employee illness or discomfort. Environmental pollution sources and controls.

### 2483 Fire Protection Hydraulics and Water Supply Analysis
Lab 3. Prerequisites: 1373 and MATH 1513. Fluid flow through hoses, pipes, pumps and fire protection appliances. Water supply and distribution analysis using hydraulic calculations. Testing techniques to detect anomalies in design or performance capabilities.

### 2650 Technical Problems and Projects
1-4 credits, maximum 4. Special problems or projects assigned by advisers with the approval of the department head. A comprehensive written report or equivalent creative effort.

### 3013 Industrial Safety Organization
Survey course. Recognition, evaluation and control of occupational health and safety hazards. Accident prevention, accident analysis, training techniques, worker’s compensation insurance, guarding and personal protective equipment.

### 3113 Advanced Extinguishing Systems Design and Analysis
Prerequisites: 2483, 2243. Automatic fixed fire-extinguishing systems and water supply systems. Emphasis upon computer assistance through use of existing design programs.

### 3143 Structural Designs for Fire and Life Safety
Lab 3. Prerequisites: 1213, 1373, 2243. Building construction standards and codes to assure maximum life and property safety from fires, explosions and natural disaster. Egress design specifications, occupancy and construction classifications and fire protection requirements for building construction and materials.

### 3233 Radiological Safety
Lab 2. Ionizing radiation problems; detection and measurement, shielding and exposure limiting, radiation health aspects, storage, handling and disposal.

### 3373 Fire Dynamics
Lab 3. Prerequisites: CHEM 1225, CHEM 1515 and MATH 2123 or MATH 2145. Fundamental thermodynamics of combustion, fire chemistry and fire behavior. The physical evidence left by fire for investigation. Use of computer models to study fire behavior.

### 3713 Hydraulic Design of Automatic Sprinkler Systems
Prerequisites: 1373, 2483, MATH 1513. Hydraulic calculation technique for the design and analysis of automatic sprinkler fire extinguishing systems.

### 3723 Industrial Fire Pump Installations
Prerequisites: 2483, MATH 1513. Applications, design and analysis of industrial fire pump installations. Graphical analysis of fire pump contributions to existing fire protection water supply systems emphasized.

### 3733 Sprinkler System Design for High Piled and Rack Storage
Prerequisites: 2243, MATH 1513. Specific design techniques for sprinkler system protection of commodities stored in solid piles or racks over 12 feet in height.

### 4050 Special Problems in Loss Control
1-4 credits, maximum 6. Prerequisite: consent of department head. Special technical problems in fire protection and safety.

### 4133 Industrial Hygiene Instrumentation
Lab 3. Prerequisites: 2344, CHEM 1225, PHYS 1114. Description, operation and application of quantitative instruments in general use in industrial hygiene.

### 4153 Issues in Local Government and Fire Services
Prerequisites: 2153, MGMT 3013. Issues relating to the proper operation of a fire department and the fire department’s role within the structure of local government.

### 4333 System Safety Analysis
Lab 3. Prerequisites: 2344, 3013, 3143 and STAT 2013 or 4013 or 4033. Fire and safety techniques to anticipate, recognize and control hazards. Fault Tree, HazOp, FMEA and other process safety techniques.

### 4403 Hazardous Materials Incident Management
Lab 3. Prerequisites: 3013, CHEM 1225, PHYS 1114. Description, operation and application of quantitative instruments in general use in industrial hygiene.

### 4684 Industrial Loss Prevention
Lab 3. Prerequisites: prior or concurrent enrollment in all other required FPST courses and ENGL 3323 or consent of instructor. Specific industrial processes, equipment, facilities and work practices for detecting and controlling potential hazards.

### 4993 Advanced Fire and Safety Problems
Prerequisites: prior or concurrent enrollment in all other required FPST courses. Selected problems in the fire, occupational safety, occupational health and industrial security areas. Research or state-of-the-art technologies to prevent or correct such problems.

### Foreign Languages and Literatures (FLL)

**The Department of Foreign Languages and Literatures offers courses under the prefix FLL, and in the following languages each of which has its own prefix: French, German, Greek, Japanese, Latin, Russian and Spanish. These languages are listed in alphabetical order.**

### 2000 Special Studies in Foreign Languages and Literatures
1-10 credits, maximum 10. Special studies in areas not regularly offered; basic level.

### 2000 Special Study in Foreign Languages and Literatures
Intermediate. 1-5 credits, maximum 10. Prerequisite: 10 hours or equivalent in target language (applies only to language course). Special study in areas other than those offered in regular program; intermediate level.

### 2103 (H)Masterworks of Western Culture: Ancient
Ideas and values of Western culture as revealed through literary, artistic, historical, and philosophical contexts from Greek, Roman, and Medieval periods.

### 2203 (H)Masterworks of Western Culture: Modern
Ideas and values of Western culture as revealed through literary, artistic, historical, and philosophical contexts from the Renaissance to the Modern period.

### 2443 (H)Languages of the World
A comprehensive survey of world languages, The essential structural and historical organization of languages. The process of languages as a basic human function. Same course as ENGL 2443.

### 3103 (H)Hispanic Literature in Translation
Readings of significant works from Spanish and Spanish-American literatures in English translation. Does not apply to major or minor in Spanish.

### 3500 Specialized Study in a Modern Foreign Language
1-20 credits, maximum 20. Lab 1-5. Prerequisite: consent of instructor. Instruction and/or tutorial work in a modern foreign language other than those offered in a major program.

### 4000 Specialized Studies in Foreign Languages and Literatures
1-9 credits, maximum 9. Lab 1-9. Prerequisite: junior standing or consent of instructor. Individual guided study, tutorial or seminar on specially selected topics in a foreign language or literature.

### 4993 Senior Honors Thesis
Prerequisites: departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a senior faculty member with second faculty reader, both of whom will be present at an oral defense of the thesis. Required for graduation with departmental honors in any foreign language major.

### 5210 Graduate Studies in Foreign Languages
1-6 credits, maximum 20. Prerequisite: 15 upper-division hours in the language. Graduate studies in foreign languages.

### Forensic Sciences (FRNS)

### 5000 Research and Thesis
1-6 credits, maximum 6. Lab 1-6. Prerequisite: consent of major advisor. Research in forensic sciences for M.S. degree.
Case studies ranging from complex "multi-event" computer science as regularly applied in support of chemistry, biology, physics, math and computer science as regularly applied in support of forensic engineering and technology, forensic accounting, and management techniques in forensic sciences. A review of current guidelines for knowledge, procedures, quality control/assurance, and certification/credibility from national standards boards and scientific and technical working groups.

Questioned Document Examination. Lab 2. Prerequisite: 5013 or concurrent enrollment. Functions of questioned document examiners, beyond document analysis to relating services and issues. History of questioned documents, handwriting and handwriting, process for obtaining exemplars, types of document examinations (e.g., typewriting, mechanical processes, indented writing, obliterated writing, inks, currency, erasures, physical matches, and post marks.) Collection and preservation of evidence as well as courtroom procedures. (This course does not count as a detriment experience and in no way certifies or qualifies the student to conduct questioned document analysis at the conclusion of this course.)

Genetics for the Forensic Scientist. Lab 2. Prerequisite: admission to the program. Optional introductory course to develop an understanding of the concepts of genetic marker analysis especially DNA typing, that form the core of the Identity Testing Section of FRNS 5513. Fulfills genetics course requirement for classification of technologists working in crime laboratories as "DNA analysts" as defined by the DNA Advisory Board of the FBI. (Three courses, biochemistry, genetics, molecular biology, in addition to the baccalaureate degree, are required to a technologist to be designated as an analyst capable of performing independent casework analysis in the crime lab certified by the American Society of Crime Lab Directors.)

Molecular Biology for the Forensic Scientist Lab 2. Prerequisite: admission to the program. Optional preparatory course for FRNS 5513. Development of a solid foundation of knowledge in molecular biology for understanding the concepts of genetic marker analysis, especially DNA typing, that form the core of the Identity Testing Section FRNS 5513. Fulfills molecular biology requirement needed for classification of technologists working in crime laboratories as "DNA analysts" as defined by the DNA Advisory Board of the FBI. Three courses, biochemistry, genetics, molecular biology, in addition to the baccalaureate degree, are required for a technologist to be designated as an analyst capable of performing independent casework analysis in a crime lab certified by the American Society of Crime Lab Directors.

Forensic Engineering and Technology. Lab 2. Prerequisites: 5013; college-level chemistry and biology. Concepts of toxicology and identity testing, the two areas representing the most extensive application of the fields of chemistry, biology and genetics to forensic science. History, theory, application and quality assurance concepts to the mate- rial. Working knowledge of toxic compounds affecting human physiology and how they are identified in the laboratory. Basic concepts in genetics and their application to tracing origin of biological samples in civil or criminal investigations as well as resolving disputed family relationships.

Forensic Pathology and Medicine. Prerequisite: consent of instructor. Medico-legal investiga- tion of basic causes of death, accidents and violence. Transportation injur- ies, homicides, suicides, blunt or sharp-force injur- ies, gunshot wounds, asphyxia, drowning, and thermal and electrical injuries. Paternity deaths; rape investigation; injury analysis; inter- pretive toxicology; identification by dental means; anthropologic studies for determining age, sex and race; and conducting of inde- pendent medical examinations. Demonstrations and data analysis from actual cases. Review of current guidelines for knowledge, procedures, quality control/assurance, and certification/credibility from national standards boards and scientific/technical working groups.

Forensic Bioscience. Prerequisites: 5013; college-level chemistry and biology. Concepts of toxicology and identity testing, the two areas representing the most extensive application of the fields of chemistry, biology and genetics to forensic science. History, theory, application and quality assurance concepts to the mate- rial. Working knowledge of toxic compounds affecting human physiology and how they are identified in the laboratory. Basic concepts in genetics and their application to tracing origin of biological samples in civil or criminal investigations as well as resolving disputed family relationships.

Forensic Pathology and Medicine. Prerequisite: consent of instructor. Medico-legal investiga- tion of basic causes of death, accidents and violence. Transportation injur- ies, homicides, suicides, blunt or sharp-force injur- ies, gunshot wounds, asphyxia, drowning, and thermal and electrical injuries. Paternity deaths; rape investigation; injury analysis; inter- pretive toxicology; identification by dental means; anthropologic studies for determining age, sex and race; and conducting of inde- pendent medical examinations. Demonstrations and data analysis from actual cases. Review of current guidelines for knowledge, procedures, quality control/assurance, and certification/credibility from national standards boards and scientific/technical working groups.

Forensic Accounting and Fraud Investigation. Prerequisite: 5013. Introduction of concepts and tools used in the fields of forensic accounting and fraud investigations. Cases of fraud, malfeasance, and mismanagement.

Forensic Specialization. 1-3 credits, maximum 15. Prerequisite: 5013. Preparation for advanced research study in a specialty area of forensic sciences. The study of existing research and methodologies directly related to the individual discipline via computer, literature review, classroom and laboratory experience, and applied training. Courses from OSU-COM and Stillwater campus may be used to satisfy requirements for this course with the consent of the program director.
2134 Dendrology. Lab 4. Identification, taxonomy and distribution of forest trees and shrubs of the United States; their environmental requirements and utilization.

3102 Forest Mensuration II. Lab 5. Prerequisite: 2003. Two-week segment of seven-week summer field camp. Field study focusing on stand-level mensuration and the use and care of measurement equipment. Special emphasis on the statistical and physical design of forest inventory methods.

3103 Natural Resources Use, Values and Assessment. Lab 8. Three-week segment of seven-week summer field camp. Integrated management of forests and timberlands and associated wildland natural resources including wildlife, water, soil, recreation, range, wilderness and minerals to sustain a broad array of uses and values. Visits to private and public natural resource lands and projects integrated with methods of measuring resource attributes and assessing management potential and effects. The ecology, policies, and social and ethical issues that affect management at the landscape level.

3112 Silvics and Field Silviculture. Lab 5. Prerequisites: 2134; BIOL 1404. Two-week segment of seven-week summer field camp. Field study of climatic, edaphic, biotic and topographic components of forest ecosystems and their relationship to the distribution, growth and productivity of trees and forest stands. Examination of silvicultural tools and methods for managing timber stand regeneration, composition and growth.


3213 Forest Ecology. Lab 3. Prerequisites: BIOL 1304 and 1403 or consent of instructor. Study of the forest ecosystem, its structure and function, physical environment, biotic component and change over time and its management implications. Two weekend field trips required.

3223 Silviculture. Lab 3. Prerequisite: 3213. Principles and techniques of natural and artificial regeneration, intermediate cultural treatments, and silvicultural systems applicable in various forest cover types. Two-day field trip may be required.

3643 (N)Forest Environmental Science. Overview and analysis of forests, their related environments, their associated natural resources, and their tangible and intangible values, emphasizing basic physical, environmental, biotic component and change over time and its management implications. Two weekend field trips required.

3663 Forest Biometrics. Lab 2. Prerequisites: 3003; MATH 2103. The application of statistical methods to forestry problems including stand volume estimation, stem analysis, and volume table construction. Introduction to the use and significance of forest yield tables in forest management. Applications of microcomputing to analysis of forestry data.

3883 Aerial Photogrammetry and Information Systems. Lab 3. Prerequisite: MATH 1613. Principles and techniques of aerial photogrammetry, remote sensing, aerial photo interpretation, and geographic information systems. Applications to management of natural resources utilizing photogrammetric instrumentation, and geographic information system software. Same course as RLEM 3883.

3993 Forest Economics and Finance. Prerequisites: 3223 or concurrent enrollment, 3663; AGEC 1114; MATH 2103. Economic factors and analytical methods influencing decisions in forest resource management; factors affecting the production of wood products; arithmetic of interest and investment criteria; economics of nonmarket goods.

4113 Mechanical Processes of Wood Products. Prerequisite: 3113. Lumber, veneer, plywood manufacturing and lumber grading rules. Wood as a raw material to produce pulp and paper. Dry and wet type fiber board, particle-board and structural wood composites manufacture and their physical and mechanical properties. Quality control tests of wood products. Two one-day field trips required.

4223 Timber Management. Prerequisites: 3223, 3993. Principles of forest growing stock to meet management objectives. Land and timber appraisals. Organization of the forest enterprise to meet financial objectives of management.

4333 Forest Resource Management: Planning and Decision Making. Lab 3. Prerequisite: 3223, 4223, any computer science course, senior standing or consent of instructor. Integrated problem solving, to apply biological, quantitative, economic, political, and administrative principles in solving forest resource management problems.

4443 Forest Administration and Policy. Prerequisite: senior standing. Forest policy and legislation; personnel matters, organization, supervision and financing of federal, state and private forest enterprises.

4493* International Forestry and Natural Resources. Prerequisite: consent of instructor. Forestry and natural resource management, policy, use, and historical development with an international perspective, including an examination of the role of culture, politics and economics in the linkage between people and natural resources. Ten-14 day international travel component.

4500* Forest Problems. 1-3 credits, maximum 6. Open to students working for a Master of Science degree in forest resources.

4563* Forest Ecophysiology. Prerequisite: BIOL 1403. The growth and response of trees and forests to environmental, cultural and genetic factors. Application of physiological principles in predicting the effects of cultural practices on tree growth.

4601 Controversial Issues in Forestry and Natural Resources. Prerequisite: senior standing. Exploration and discussion of current issues related to the values, use, and management of forests, natural resources, and the natural environment.

4773* Forest Genetics and Tree Improvement. Prerequisite: 3213, BIOL 3034, or consent of instructor. A review of mechanisms and principles of inheritance, study of natural variation in forest populations, variation patterns, types and uses of variation, and application of this knowledge to forest tree improvement methods and the management of forest and nursery management systems.

4811* Hydrology and Water Quality. Lab 2. Prerequisite: 4813, previous or concurrent. Techniques to monitor surface water of forest growing stock in relation to nonpoint source pollution. Water sampling strategies, chemical and physical analysis for nutrients, sediment and other constituents, biological analysis, quality control and interpretation of results. One required field trip.

4813* Water Quality Laboratory. Lab 3. Prerequisite: 4811, previous or concurrent. Techniques to monitor surface water of forest growing stock in relation to nonpoint source pollution. Water sampling strategies, chemical and physical analysis for nutrients, sediment and other constituents, biological analysis, quality control and interpretation of results. One required field trip.

5000 Research and Thesis. 1-6 credits, maximum 6. Open to students working for a Master of Science degree in forest resources.

5003* Productivity of Forest Stands. Lab 2. Prerequisites: 3223, SOIL 2124, STAT 5013 or equivalent. Integrated study of the effects of environmental factors, biotic and genetic factors controlling the productivity of forest stands. Analysis of natural, economic and social factors influencing silvicultural treatment of forest stands. Tree and stand response to silvicultural manipulation.

5010* Graduate Seminar. 1 credit, maximum 2. Presentation of current and new concepts in forest land management and research techniques for their investigation. Required for the Master of Science degree.

5030* Advanced Forestry Problems. 1-3 credits, maximum 9. Individual problems in advanced forestry subject matter appropriate to students with capability at the master's level.

5053* Quantitative Forest Management and Biometrics. Prerequisites: 3663 or equivalent: STAT 5013 concurrently or equivalent. Quantitative description of forest populations and modeling of the dynamics of forest growth, quantitative timber management including applications of linear programming and related techniques for management of forest populations.
5113* Timber Manufacturing. Mechanical wood processing of logs to lumber and panel products. Relationship between workpiece properties, ties and product quality coupled with equipment, mill design and processing efficiency of solid wood and composites manufacturing.

5629* Advanced Plant Biotechnology Methods. Lab 4. Prerequisites: BIOC 3653, BIOL 3024 or equivalent or consent of instructor. Overview of current theory and principles of biotechnology and laboratory experience with contemporary techniques and experimental methods used in plant biotechnology, including genome analysis, gene transfer, identification and isolation of genes and their products, and regulation of gene expression in plants.

6000* Research and Thesis. 1-9 credits, maximum 30. Prerequisites: admission to program and consent of major professor. Research and preparation of thesis required of candidates for the Ph.D. in crop science, environmental science, plant science or associated Ph.D. programs.

French (FREN)

1115 Elementary French I Lab 1 1/2. Main elements of grammar and pronunciation, with work on the four basic skills of listening comprehension, speaking, reading and writing.

1225 Elementary French II Lab 1 1/2. Prerequisite: 1115 or equivalent. Continuation of 1115.

2112 (I) Intermediate Reading and Conversation I Lab 1. Prerequisite: 1225 or equivalent competence. May be taken concurrently with other 2000-level French courses.

2113 (I) Intermediate French I Lab 1. Prerequisite: 1225 or equivalent competence. May be taken concurrently with other 2000-level French courses.

2232 (I) Intermediate Reading and Conversation II Lab 1. Prerequisite: 2112 or equivalent competence. May be taken concurrently with other 2000-level French courses.

2233 (I) Intermediate French II Lab 1. Prerequisite: 2113 or equivalent competence. May be taken concurrently with other 2000-level French courses.

3073 (I) French Conversation. Prerequisite: 2232 and 2233 or equivalent. Colloquial speech, with discussion of French newspapers and magazines. Practice in brief public address in French.

3203 (I) Advanced Written Expression. Prerequisite: 20 hours of French or equivalent. Practice in composition and stylistics, designed to bring students up to a high level of proficiency in writing.

3213 (I) Advanced Grammar. Conceptual framework and presentation of the finer points of French grammar.

3343 (I) Business French. Prerequisite: 2232 and 2233 or equivalent. Applied French for students in commercial and technical fields. Overview and strategies of business and economic climate in France.

4163 (H,I) History of French Literature I. Prerequisite: 2232 and 2233 or equivalent. Historical survey of French literature before 1700, with reading of representative texts.

4173 (H,I) History of French Literature II. Prerequisite: 20 credit hours of French or equivalent. Historical survey of French literature of the eighteenth century, with reading of representative texts.

4183 (H,I) History of French Literature III. Prerequisite: 20 credit hours of French or equivalent. Historical survey of French literature of the nineteenth century, with reading of representative texts.

4193 (H,I) History of French Literature IV. Prerequisite: 20 credit hours of French or equivalent. Historical survey of French literature of the twentieth century, with reading of representative texts.

4333 (H,I) Background of Modern French Civilization. Prerequisite: 20 credit hours of French or equivalent. General overview of French history, geography, and culture, with emphasis on art, music, and intellectual movements. Capstone course.

4550 (I) Directed Studies in French. 1-3 credits, maximum 9. Lab 1-2. Prerequisite: 20 credit hours of French or equivalent. Individual or group study of French language or literature.

4573 (H,I) Modern French Theater. Prerequisite: 20 credit hours of French or equivalent. Analysis of French plays from the 19th and 20th centuries.

5110* Advanced Studies in French. 1-3 credits, maximum 9. Prerequisite: 15 credit hours of upper-division French. Discussion or research in specialized topics.

5120* Advanced Grammar. Conceptual framework and presentation of the finer points of French grammar.

6000* Research and Thesis. 1-30 credits, maximum 30. Prerequisites: consent of graduate committee and approval of student’s advisory committee. Independent research under the supervision of a member of the graduate faculty for students pursuing work beyond the master’s level.

General Engineering (GENG)

4010 Senior Design Project. 2-4 credits, maximum 4. Prerequisite: senior standing in general engineering. Capstone design project through independent application of engineering principles and concepts from the disciplines covered in earlier course work.

5110* Seminar. 1-6 credits, maximum 6. Prerequisite: approval of major professor. Independent or guided study in a topic area selected to enhance a student’s program.

6000* Research and Thesis. 1-30 credits, maximum 30. Prerequisites: consent of graduate committee and approval of student’s advisory committee. Independent research under the supervision of a member of the graduate faculty for students pursuing work beyond the master’s level.

General Technology (GENT)

1153 Engineering Graphics. Lab 6. Sketching, manual drafting and CAD generation of engineering drawings to ANSI standards. Interpretation of typical industrial drawings. Students with two years high school or one year practical ANSI drafting/CAD may substitute an advanced course in mechanical engineering technology with consent of their advisers.

1223 Manufacturing Processes. Basic methods and processes of fabrication with emphasis on manufacturing operations, metrology and conventional machining.

2232 Statics. Prerequisites: MATH 1613, 2123 and PHYSC 1114. Forces acting on bodies at rest; forces, moments of force, distributed forces, reactions, free-body diagrams, friction, internal forces and moments of inertia. Applications.

2650 Technical Projects. 1-4 credits, maximum 4. Prerequisite: completion of three semesters’ work in a technical institute curriculum. Special project designed by major professor with the approval of the director. A comprehensive written report must be prepared and an oral examination may also be required.

3123 Applied Analysis for Technology. Prerequisite: MATH 2133 or equivalent. Applications of elements of matrix algebra, ordinary differential equations, and infinite series to problems in engineering technology.

3323 Strength of Materials. Prerequisites: GENT 2323 and MATH 2123. Stress and strain and their relation to loads. Axial, torsional and bending loads, beam deflection, columns and combined stresses. Applications emphasized.

3433 Basic Thermodynamics. Prerequisite: MATH 2123. Basic scientific principles of energy and the behavior of substances as related to engines and systems. Gas laws, vapors and engine cycles.

Genetics (GENE)

5102*
Molecular Genetics. Prerequisites: BIOC 3653 or 3014 and one course in genetics or consent of instructor. An introduction to molecular genetics on the graduate level.

Geography (GEOG)

1113
(I.S) Introduction to Cultural Geography. A thematic approach to the study of human groups and activities around the world, including agricultural practices, demographic trends, political behavior, religious beliefs, language patterns, folk and popular cultures, ethnicity and ethnic landscapes, urbanization, and industrialization.

1114

2253
(I.S) World Regional Geography. The world’s major culture regions, with emphasis on geographic aspects of contemporary economic, social, and political relationships with the physical environment.

2343
Introduction to Geographic Information Systems. Lab 2. Survey of a variety of resource management and socioeconomic applications using geographic information systems (GIS) technology.

3023
(N) Climatology. Characteristics and distribution of world’s climate. Patterns and associations of temperature, precipitation, pressure and winds. Regional climates of Earth. Climate change.

3033
(Meteorology. A non-quantitative introduction to weather. Physical elements that cause and influence weather. Interpretation of weather maps and satellite imagery.

3123
(S) Urban Geography. Locational aspects of urbanization; functions of and relations among cities and between cities and rural areas; internal structure of urban areas.

3133
(I.S) Political Geography. Political structures, relationships and geopolitical interpretation of location, boundaries, culture and the natural environment of nations and states. Global patterns of political behavior, political history, international law and geopolitics.

3153
(S) Conservation of Natural Resources. Problems and corrective methods of conservation of land, water, forests, wildlife, minerals and people.

3163
(S) Economic Geography. Processes significant to the spatial structure of economic systems. Production, consumption and exchange activities examined in regard to location, distribution, aerial differentiation and spatial interaction patterns. Attention given to processes of change as well as to steady states.

3173
(S) Cultural Geography. Geographic impact of human cultures. Emphasis on the concepts of social space, density, crowding, territoriality, diffusion, migration, environmental perception and cultural landscape.

3243
(S) Geography of Indian Country. Systematic analysis of geographic patterns, processes, and issues peculiar to the lands of the indigenous peoples of the United States including American Indians, Alaska Natives, and Native Hawaiians. Spatial interaction of federal policy and indigenous sovereignties.

3332
Spatial Analysis. Prerequisite: STAT 2013. The utility and application of modeling and statistics to spatial problem solving. The role of quantitative methods in geographic research.

3702
(S) Geography of Oklahoma. Geographic interpretation of physical, economic, historical and scenic features.

3713
(S) Geography of the United States and Canada. A regional analysis of the United States and Canada, including physical and cultural landscapes, population and migration trends, regional development, natural resources, US-Canada relations and global relations.

3723
(I.S) Geography of Europe. Analysis of the physical and human geography of Europe, including the distribution of physical features and natural resources, patterns of population change, and the geographic background to Europe’s major contemporary social, political, economic, and environmental problems.

3733
(I.S) Geography of Russia and its Neighbors. A regional analysis encompassing cultural, economic and physical features.

3743
(I.S) Geography of South America. Areal distribution and analysis of physical, cultural and economic features of South America.

3753
(I.S) Geography of Asia. Systematic interpretation of significant spatial patterns of man and natural environment. (Exclusive of the USSR.)

3763
(I.S) Geography of Africa. General patterns and impact of population, cultural heritage, and natural resources in Africa. Historic and contemporary relationships between Africa and Western civilization. Divergent perspectives (delineation, development, government and conflict in Africa.

3773
(I.S) Mexico, Central America and the Caribbean. A real distribution and analysis of physical, cultural, and economic features of Mexico, Central America and the Caribbean.

3783
(I.S) Geography of the Middle East and Southwest Asia. A regional analysis of the Arab, Persian and Turfian lands, including the biophysical environment, agricultural resource use, cultural patterns, urbanization, economic development, hydropolitics and conflict.

3793
(I.S) Geography of Australia and the Pacific Realm. Systematic survey of Australia, New Zealand, and the island regions of Micronesia, Melanesia, and Polynesia including a study of human and environmental relations, factors affecting the spatial distribution of human groups and the activities, cultural diversity, and the way in which external involvement, both in the past and present, has shaped this region.

3910
Applied Geographical Topics. 1-3 credits, maximum 6. Specialized physical, human, regional, or technical issues and trends in geography.

4023
(N) Geography of Arid Lands. Analysis of the physical process shaping the landscapes of deserts and areas around them, emphasizing the causes and effects of climatic change and human activities.

4053*
(N) Geography of Biotic Resources. Prerequisites: 1114 or BOT 1404, ZOOL 1604. Distribution of plants and animals and processes causing distribution. Human impact on biotic resources considered along with policy and management practices.

4103
(H) Historical Geography of the United States. Examination of the spatial dynamics of frontier encounter and settlement, regional development, and cultural landscape evolution in the United States from pre-European to modern times.

4113*
Cultural Ecology. Prerequisite: junior or senior standing or consent of instructor. A study in human-environment interaction addressing the processes and patterns of human coping behavior from prehistoric to contemporary periods. Framework for understanding the transformation of cultural and natural landscapes by systematically exploring how culture works to socially and technologically adapt to environmental opportunities and limitations in arctic, alpine, grassland, arid, and tropical environments.

4123*
Geographic Aspects of Urban Planning. Prerequisite: 3123. Spatial aspects of urban planning: development of planning theory, various planning tools, and specific problem areas such as urban renewal and urban transportation.

4143*
Geography of Travel and Tourism. A systematic and comprehensive analysis of the geographical dimensions of tourism, illustrating the relevance of a spatial perspective to tourism planning, development, and management. Economic, social, and environmental impact of both domestic and international tourism considered.

4153*
Geography of Outdoor Recreation. Analysis of patterns of outdoor recreation with an emphasis on use of planned in park and wildland areas. Demand forecasting methods, the analysis of the socioeconomic and spatial impacts of recreation facilities provision and visitor management practices.

4163
Resource Management in the National Parks. Contemporary resource management issues in U.S. National Park units. The role of human and natural processes in the management of water, air, biotic and cultural resources. No credit for students with credit in GEOG 5163.

4213
(S) Sport, Place and Society. Spatial analysis of sport; its origin and diffusion, geographical organization and regional variation. Geographical movements and interaction associated with sport. Application of geographical solutions for reorganization and reform. Focus on both U.S. and international scene.

4223
(H) Geography of Music. Geographical and historical analysis of music as a cultural trait. The cultural significance of music and how it varies from place to place as well as how it helps shape the character of a place.

4313* Field Techniques and Geodata Collection. Modern concepts and techniques for geographical research and analysis, including data acquisition, manipulation and field and secondary sources. Field trips.

4323* Computer Cartography. Lab 2. Fundamentals of map compilation and design using computers. Thematic mapping of both socioeconomic and natural resources. Discussion and application of various map input techniques involving digitizers, scanners, and global positioning system receivers. 2-D and 3-D terrain representation.

4333* Remote Sensing. Lab 2. Prerequisite: junior standing. Use of several types of sensors and imagers for geological, socioeconomic and natural resource information. Uses and limitations of data extraction techniques, manual and computer-assisted. Applications to a variety of specific problems.


4353* Geographic Information Systems: Socioeconomic Applications. Lab 2. Prerequisite: 2343. Theory and principles of geographic information systems (GIS) applied to socioeconomic problems including location-allocation, market area determination, network analysis, and analysis of demographic characteristics.

4413 History and Philosophy of Geography. Historical research questions and techniques, the structure of contemporary geography and its relations to other fields of study, and future prospects of geography.

4510 Senior Project. 1-3 credits, maximum 3. Lab 1-3. Prerequisites: senior standing and consent of instructor. Individually designed projects involving laboratory work, field work, library research, or a combination of these.

4910* Topics in Geography. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Specialized physical, social and methodological topics in geography.

4930* Readings in Geography. 1-3 credits, maximum 6. Prerequisite: consent of instructor. Directed readings on selected topics, regions or methods in geography.

4940 Undergraduate Cooperative Education Internship. 1-3 credits, maximum 3. Prerequisites: consent of departmental adviser and consent of instructor. Practical experience in applying geographical concepts to societal problems. Students work with both agency representatives and faculty members.

4993 Senior Honors Thesis. Prerequisites: departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a senior faculty member, with second faculty reader, both of whom will be present at an oral defense of the thesis. Required for graduation with honors in geography.

5000* Thesis. 1-6 credits, maximum 6. Prerequisite: consent of adviser or major professor. Open only to students working on the master’s degree in geography.

5023* Geography of Arid Lands. Analysis of the physical processes shaping the landscapes of deserts and areas around them, emphasizing the causes and effects of climatic change and human activities and including research and writing components.

5113 Landscape Ecology. Prerequisite: graduate standing and BIOL 3034 or consent of instructor. Principles of landscape ecology, including structure and function of landscape elements such as patch, corridor, boundary, and matrix. Role of geographic processes, climate, biota, disturbance, and human influences in landscape structure and function. Interaction among landscape elements and role of landscape structure in ecosystem and landscape dynamics. Applications of landscape ecology to biodiversity conservation, wildlife management, and landscape planning. Survey of quantitative methods used in landscape ecology.

5123* International Resource Management. Prerequisite: graduate standing. Spatial perspectives on the assessment and management of natural resources. The role of resources in world trade, security and international environmental concerns.

5140* Cultural and Historical Geography Seminar. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Development and critical analysis of research and theory in cultural and historical geography.

5150* Geography of Sport, Recreation and Leisure Seminar. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Spatial perspectives of topics selected in sport, recreation and leisure geography.

5163* Resource Management in the National Parks. Contemporary resource management issues in U.S. National Park units. Focus on the role of human and natural processes in the management of water, air, biotic and cultural resources. No credit for students with credit in GEOG 4163.

5243* Geography of the World’s Indigenous Peoples. Prerequisite: consent of instructor. A regional survey of indigenous assertions of cultural and political identity outside the United States. Native land claims, impact of regional development and environmental issues upon indigenous communities, and their efforts to establish geo-political autonomy.

5303* Geographical Analysis I. Prerequisite: one course in statistics. Application of models and statistics to geographic problem solving.

5343* Advanced Geographic Information Systems: Resource Management Applications. Lab 2. Prerequisite: 4343. Advanced theory and applications of geographic information systems (GIS) applied to resource management problems using both raster and vector data structures. Individual projects, presentations and group discussion sessions.

5353* Advanced Geographic Information Systems: Socioeconomic Applications. Lab 2. Prerequisite: 4353. Advanced theory and applications of geographic information systems (GIS) applied to socioeconomic problems including location allocation, market area determination, network analysis, and analysis of demographic characteristics. Individual projects, presentations and group discussion sessions.

5403* Current Geographic Research. Prerequisite: graduate standing in geography. Review of recent literature in light of current human and physical geography research themes.

5413* History and Philosophy of Geography. Prerequisite: graduate standing in geography. Identification and evaluation of major themes in geographical research and teaching.

5450* Seminar in Geography. 1-3 credits, maximum 7. Prerequisite: graduate standing in geography or consent of instructor. Specialized topics in geography.

5510* Research Problems in Geography. 1-3 credits, maximum 6. Prerequisite: consent of instructor.

5540* Graduate Cooperative Education Internship. 1-6 credits, maximum 6. Prerequisites: consent of departmental adviser and consent of instructor. Practical experience in applying geographical concepts to societal problems. Emphasis on programs in planning and geographic education.

6000* Doctoral Dissertation Research. 1-12 credits, maximum 30. Prerequisites: admission to candidacy and consent of major professor.

6013* Seminar in Quaternary Paleoclimatology. Prerequisite: graduate standing in geography or consent of instructor. Analysis and discussion of various aspects of research on the Quaternary period, emphasizing the roles played by climate, geomorphic processes, vegetation, soil, and fauna.

6110* Seminar in Cultural Ecology. 3 credits, maximum 6. Prerequisite: graduate standing in geography or consent of instructor. History, trajectory, and possibilities of human-environment interaction, including cultural adjustment to, and of environmental change with the human and environmental conditions that encourage the management and mismanagement of resources.

6120* Seminar in Urban Geography. 3 credits, maximum 6. Prerequisite: graduate standing in geography or consent of instructor. Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior. Review and analysis of student research efforts.
6130 Seminar in Political Geography. 3 credits, maximum 6. Prerequisite: graduate standing in geography or consent of instructor. Theoretical foundations of political geography from MacKinder and Hartshorne to recent writings by Smith, Anderson and other modern theorists. Nationalism, national identity, state formation and cohesion considered in a spatial context.

6210* Seminar in Historical Geography. 3 credits, maximum 6. Prerequisite: graduate standing. Current epistemological issues and archival methodologies in historical geography.

6303* Geographic Analysis II. Prerequisite: 5303. Advanced methods of spatial analysis including spatial autocorrelation, geographically weighted regression, and related spatial analysis methods.

6313* Advanced Geodata Collection. Prerequisite: graduate standing in geography or consent of instructor. Advanced field methods course emphasizing spatial and attribute capture of natural resource and socioeconomic data. Student projects and use of geographic information systems (GIS) for analysis and presentation.

6330* Special Studies in GIS Image Analysis. 1-3 credits, maximum 6. Prerequisites: 4333, and 5343 or 5353. Independent study course addressing unique applications of geographic information systems (GIS) or remote sensing technologies. Scoping and implementation for public or private sectors. Specific issues and problems pertaining to data capture, preprocessing and analysis.

Geology (GEOL)


1114 (L,N)Physical Geology. Lab 2. Composition and structure of the earth and the modification of its surface by internal and external processes. Mineral resources, sources of energy, and environmental aspects of geology. A background in precollege science and math is recommended. Field trip required.

1224 (L,N)Prehistoric Life and Development of the Continents. Lab 2. Earth formation and the development of continents and oceans through time including the origin and evolution of life. Field trips required.


2030 Geologic Field Investigation. 1-3 credits, maximum 3. Prerequisite: 1014 or 1114. One to three weeks of required field study at sites of geological interest and significance. Field trip charges apply. Does not substitute for GEOL 3546.

2254 Practical Mineralogy. Lab 2. Prerequisite: 1014 or 1114. Hand-specimen identification of minerals using physical and chemical properties. Introductory optical identification of common rock forming minerals. Society’s utilization of mineral resources. Field trips required.


2304 Earth Science for Teachers. Lab 3. Prerequisite: 1114 or equivalent. Teaching natural earth systems and their environmental impact. Use of an adaptation approach in organizing, presenting, and evaluating earth science concepts in the curriculum. Field trips required.

3014 Structural Geology. Lab 3. Prerequisites: 1224, PHYS 1114 or consent of instructor. Behavior of earth materials during various deformational processes and analysis of the resulting structural features such as folds, faults and fractures. Field trips required.

3034 Principles of Stratigraphy and Sedimentology. Lab 3. Prerequisite: 1224. Principles of stratigraphy and sedimentology. Laboratory emphasizes realistic practical problems undertaken in the field and in the laboratory. Field trips required. Nonmajors may receive graduate credit.

3043 (N)Scenic Geologic Regions. Prerequisite: 1014 or equivalent recommended. The geologic characteristics of national parks and scenic regions in North America and throughout the world.

3073 Geomorphology. Lab 2. Prerequisite: 1114 or consent of instructor. Study of land forms and the processes that form them, using topographic maps, air photos, remotely-sensed images, soils maps and field techniques. Field trips required.

3103 (N)Paleontology. Lab 3. Prerequisite: 1224 or consent of instructor. Basic principles of paleontology involving invertebrates, vertebrates and plants. Lab focused on the morphology, identification, paleoecology and biostratigraphy of marine invertebrates. Field trips required.


3503 Environmental Geology. Prerequisite: 1114 or consent of instructor. Application of geologic principles to environmental issues, including human use of the surface and subsurface of the earth and human interaction with extreme natural events such as earthquakes, floods and landslides. Field trip is required.

3546* Field Geology. Lab 12. Prerequisites: 2364, 3014, 3034, 3073. Six weeks of field methods in geology. Required of all geology majors. Transportation and room and board fees required.

4023 Petroleum Geology. Prerequisite: 3014 and 3034. Origin, migration and accumulation of petroleum, requirements for source rock, reservoir rock and traps. Structure and stratigraphy of selected oil fields. Field trips required.

4213* Plate Tectonics. Prerequisite: 1114. Principles and major concepts of plate tectonics, the unifying theory of earth sciences. Geology and plate tectonics evolution of the major mountain chains of North America; Ouachitas, Appalachians, and Cordilleras. Field trip required.

4403* Geomorphology. Prerequisite: general chemistry. Application of chemical principles to geomorphological processes. Processes affecting the composition of surface and ground waters.

4453* Hydrogeology. The water cycle and groundwater systems as well as general problems related to ground-water occurrence, quantity, quality and pollution. Field trip required.

4463* Physical Hydrogeology. Lab 2. Prerequisite: 4453 recommended but not required. Physical groundwater systems. Realistic problems to acquaint students with ground-water occurrence and movement. Geologic, geophysical, hydraulic testing and modeling techniques used to define an actual ground-water system. Ground-water regulations. Field trips required.

4563* Sedimentology. Lab 3. Prerequisites: 3546, senior standing. Sediments, sedimentary processes and environmental impacts, geometry and internal features of sediments. Field trips required.

4663* (I)Global Geologic Resources. Distribution and analysis of global mineral, energy and water resources. Economic, environmental, social and political impact of selected resources on local to global scales.

4773* Planetary Geology. Lab 2. Prerequisites: GEOL 1114: upper-division standing in the natural sciences; ASTR 1014 recommended. Geophysical and tectonics of planetary interiors; geomorphology and sedimentology of planetary surfaces; geochemistry and mineralogy of planetary materials; geologic factors that could affect life on other planets; interpretation of geologic data from planetary exploration. Field trips required.

4990* Special Problems in Earth Science. 1-8 credits, maximum 8. Prerequisites: 25 hours of geology and permission of instructor. Individually designed study projects involving assigned reading, library work, field work, laboratory work or a combination of these. Field trips may be required.

4993 Senior Honors Thesis. Prerequisites: departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a senior faculty member, with second faculty reader and oral examination. Required for graduation with departmental honors in geology.

5000* Thesis. 1-6 credits, maximum 6. Prerequisite: approval of graduate committee. Work toward master’s thesis in geology.

5050* Problems in Economic Geology. 1-3 credits, maximum 6. Prerequisite: consent of instructor. Individually-designed problems in economic geology. Field trips may be required.

5073* Fluvial Geomorphology. Prerequisite: 3073 or consent of instructor. Landforms and processes related to the action of running water in stream channels and on hillslopes. Field trips required.
5100* Problems in Hydrogeology. 1-4 credits, maximum 8. Prerequisite: 4453. Advanced problems in hydrogeology with emphasis on quantitative methods. Field trips may be required.

5150* Problems in Engineering Geophysics. 1-3 credits, maximum 3. Prerequisite: consent of instructor. Advanced problems in engineering geophysics with emphasis on problem-solving. Field trips may be required.

5183* Advanced Paleontology. Lab 3. Prerequisite: 3103 or equivalent. In depth study of selected fossil groups with emphasis on organic micropaleontology. Student projects on assigned fossil groups with presentation of results both orally and in writing. Field trips required.

5203* Structural Styles in Oil and Gas Exploration. Lab 2. Prerequisite: 3014. The theoretical, experimental, and descriptive approach to structural styles formed by different tectonic stresses (i.e., extensional, contractional) and their importance in oil and gas exploration. Field trips required.

5223* Advanced Methods in Structural Geology. Lab 3. Prerequisite: 3014. Advanced geometric techniques and analysis of complex structural terrains. Elucidation of geometry and history of geological structures by interpreting seismic reflection profiles and constructing balanced cross-sections. Field trips required.

5233* Trace Elements in Hydrogeology. Lab 2. Prerequisite: CHEM 1515. Examination of the behavior of various trace elements in the aqueous environment. Availability and mobility of selected trace elements, the characterization of geochemical environments, pH stability fields, adsorption and other parameters that affect element mobility. Introduction to thermodynamic water-equilibrium computer programs.


5283* Subsurface Geologic Methods. Lab 3. Prerequisites: 3014, 3034. Use of subsurface geologic information from cores and well logs to prepare maps and identify oil and gas prospects. Field trips required.


5353* Advanced Well Log Analysis. Lab 3. Prerequisite: 3034. The geologic interpretation of a variety of well logs, emphasized, as well as quantitative methods. Some exercises involve concurrent interpretation of well logs and core samples, or well logs and bit cuttings. Field trips required.


5383* Sequence Stratigraphy. Lab 2. Prerequisites: 5253, 5353, 5363. Principles of sequence stratigraphy including carbonate and siliciclastic dominated intracratonic basins. Integration of surface and subsurface data in projects. Field trips required.

5443* Environmental Geophysics. Lab 2. Geologic aspects of problems associated with environmental engineering, ground-water pollution and regional and urban planning. Problem assessment and field methods. Two required field projects include geophysical surveys using resistivity and seismic reflection methods. Field trips required.

5453* Advanced Hydrogeology. Lab 3. Prerequisites: 4453, CS 2113 or equivalent, MATH 2144, MATH 2153 and 2163 or equivalent. Advanced quantitative techniques and methods used to address groundwater management and pollution. Advanced field and laboratory techniques as well as management and chemical transport models applied to actual field problems and case studies. Field trips required.

5503* Advanced Environmental Geology. Prerequisite: 3503 or consent of instructor. Utilization of geologic principles to resolve environmental issues in land use, land management and development. Methods of acquiring, compiling, and applying geologic information for site assessment and environmental impact. Application of these methods to an interdisciplinary project. Field trips required.

5523* Organic Geochemistry. Lab 3. Prerequisite: introductory chemistry. Introduction to some environmental aspects of organic geochemistry. Soils and sediments as pollutant receptors, sources of pollutants and selected aspects of environmental health.


5603* Basin Analysis. Lab 1. Prerequisites: 3546, 5203, 5223, 5253, 5363. Team-taught course. Interpretations of the evolution of selected sedimentary basins. Emphasis on facies analysis, petrography, diagenesis, and structural evolution. Field trips required.

5710* Advanced Studies in Geology. 1-4 credits, maximum 8. Prerequisite: use of subsurface geologic information from cores and well logs to prepare maps and identify oil and gas prospects. Individual laboratory, library and/or field projects on facets of geology not covered by existing courses. Field trips may be required.

German (GRMN)

1115 Elementary German I Lab 1 1/2. Main elements of grammar and pronunciation, with work on the four basic skills of listening comprehension, speaking, reading and writing.

1225 Elementary German II Lab 1 1/2. Prerequisite: 1115 or equivalent. Continuation of 1115.

2112 (I)Intermediate Conversation and Composition I. Lab 1. Prerequisite: 1225 or equivalent competence. (May have been gained in high school.) Colloquial speech patterns and grammar. May be taken concurrently with other 2000-level German courses.

2113 (I)First Readings in German. Prerequisite: 1225 or equivalent competence. (May have been gained in high school.) Selections from German newspapers and other contemporary material. May be taken concurrently with other 2000-level German courses.

2222 (I)Intermediate Conversation and Composition II. Lab 1. Prerequisite: 2112 or equivalent competence. (May have been gained in high school.) Continuation of 2112, with further work in composition, conversation and grammar. May be taken concurrently with other 2000-level German courses.

2223 (I)Introduction to German Literature. Prerequisite: 1225 or equivalent competence. (May have been gained in high school.) Reading and analysis of prose, drama and poetry; literary appreciation. May be taken concurrently with other 2000-level German courses.

3013 (I)German for Reading Requirements I. Reading in the humanities and the sciences. Translation from German to English.

3023 (I)German for Reading Requirements II. Prerequisite: 3013 or equivalent. Intermediate and advanced reading in the humanities and sciences. Translation from German to English.

3333 (H,I)Modern Germany. Prerequisites: 20 credit hours of German or equivalent. The major cultural, social and political forces that have shaped the Germany of today.

3343 (I)Business German. Lab 1. Prerequisite: 2222 and 2223 or equivalent. Introduction to business practices and economic environment in Germany. Study of specialized vocabulary.

3403 (I)Advanced Diction and Phonetics. Lab 1. Prerequisite: 20 credit hours of German or equivalent. German speech sounds and intonation patterns. Practice to improve the student’s pronunciation. Required course for teacher certification.

3803 (I)Advanced Conversation. Lab 1. Prerequisite: 2222 and 2223 or equivalent. Colloquial speech forms and sentence structure. Practice in brief public address in German.

3813 (I)Advanced Grammar and Composition. Lab 1. Prerequisite: 2222 and 2223 or equivalent. Practice in original composition in German. Problematic points of German grammar and stylistics.

3902 (I)Orientation to Internship Abroad. Prerequisite: 2222 and 2223 or equivalent. Preparation for residential internship in a German-speaking country. Culture, civilization, and contemporary conditions, and communication for students accepted for international cooperative education program.
3903
(Internship Abroad. Lab TBA. Prerequisite: 2222 and 2223 or equivalent. Practicial studies in a German-speaking country. Supervised research papers and reports, and oral testing, during and following the practicum.

4153
(H,I) Survey of German Literature I. Prerequisite: 20 credit hours of German or equivalent. German literature from the 17th to 1875.

4163
(H) Survey of German Literature II. Prerequisite: 20 credit hours of German or equivalent. German literature from 1875 to the present.

4333
(H) Backgrounds of Modern German Civilization. Prerequisite: 20 credit hours of German or equivalent. Historical, cultural, political and literary trends in the formation of German civilization. Capstone course.

4513
(H) The Age of Goethe. Prerequisite: 20 credit hours of German or equivalent. Principal figures of German Classicism and Romanticism.

4523
(H) 19th Century German Literature. Prose, lyric and drama from Romanticism to Naturalism.

4543
(H) 20th Century German Literature. Prerequisite: 20 credit hours of German or equivalent. Main currents in German literature from Naturalism until present day.

4550
(I) Studies in German. 1-3 credits, maximum 9. Prerequisite: 20 credit hours of German or equivalent competence. Reading and discussion of vital subjects in German.

Graduate (GRAD)

5880*
Graduate Traveling Scholar. 1-24 credits, maximum 24. Prerequisite: graduate degree candidate. Credit will vary depending on the program of each traveling scholar. Enrollment of graduate traveling scholars in academic or research courses.

5883*
Orientation to Gerontology. Prerequisite: graduate standing. Interdisciplinary introduction to the field of gerontology with particular focus on biological, psychological and sociological theories of aging.

5990*
Graduate Research and Teaching Practicum. 1-12 credits, maximum 12. Prerequisite: graduate standing. Graduate-level instructional program in research and teaching techniques and procedures. Graded on pass-fail basis.

6010*
Research or Intern Practicum. 1-9 credits, maximum 12. Prerequisite: graduate standing. Graduate-level internship program for public administration-speaking research. Supervised research and theoretical and absolute phase of the academic with practical on-the-job experience.

Greek (GREK)

1113
Elementary Classical Greek I. Grammar and vocabulary of ancient Greek.

1223
Elementary Classical Greek II. Prerequisite: 1113 or equivalent. A continuation of 1113. Grammar and readings of classical Greek authors.

2113
Elementary Classical Greek III. Prerequisite: 1223 or equivalent. A continuation of 1223. Grammar and readings of classical Greek authors.

2213
Intermediate Readings. Prerequisite: 2113 or equivalent. An introduction to a variety of classical authors to increase reading facility and grammatical comprehension.

3330
Advanced Readings. 1-6 credits, maximum 9. Prerequisite: 2213. Authors, epic poetry, drama, Koine Greek and religious texts.

Health and Human Performance (HHP)

1713
Introduction to Athletic Training. Lab 1. An introduction to the profession of athletic training. The principles of injury prevention and care relative to athletic injuries and development, dance and activities. Analysis of skills, concepts, terms, safety issues, teaching strategies and developmental appropriateness.

1812
Pedagogy of Outdoor Activities. Prerequisite: HHP and LEIS majors and minors only. Introduction of selected motor skills, activities, methods and theories within outdoor activities. Analysis of skills, concepts, terms, safety issues, teaching strategies and developmental appropriateness.

1822
Pedagogy of Rhythm and Movement. Prerequisites: HHP and LEIS majors and minors only. Introduction of basic fundamentals and methods of movement skills for rhythms including social, creative, developmental, and multicultural dance and activities. Analysis of skills, concepts, terms, safety issues, teaching strategies and developmental appropriateness.

1832
Pedagogy of Sports Skills. Prerequisites: HHP and LEIS majors and minors only. Introduction of selected motor skills, activities, methods and theories of individual, dual and team sports. Analysis of skills, concepts, terms, safety issues, teaching strategies, and developmental appropriateness.

1842
Pedagogy of Fitness and Wellness. Prerequisite: HHP and LEIS majors and minors only. Introduction of concepts, technologies and teaching methods for strength training, aerobic conditioning, fitness assessment and stress management. Analysis of skills, concepts, terms, computer applications, safety issues, teaching strategies, and developmental appropriateness.

2052

2213
Principles in Health Education and Health Promotion. Introduction to the field of health education and health promotion focusing on health principles, theories, career opportunities and a field experience.

2222
Introduction to Health Aspects of Gerontology. An introductory course of the physical and psychological aspects of aging combined with common pathology and intervention.

2450
Clinical Experience in Health and Human Performance I. 2-4 credits, maximum 8. Directed observation in supervised beginning laboratory and clinical experiences in appropriate health and human performance areas.

2602

2603
Total Wellness. Overview of individual, interpersonal, and socio-cultural issues that have an impact on health. Behavioral decision-making, social relations, cultural diversity and environmental sensitivity.

2653
Applied Anatomy. Action and location of individual muscles and muscle groups. Anatomy as applied to a living person. Common anatomical injuries and diseases will be presented with each joint structure.

2663
Care and Prevention of Athletic Injuries. Prerequisite: 2653. Symptoms of common athletic injuries, their immediate treatment and care.

2712
Psychomotor Development. Prerequisite: HHP and LEIS majors and minors only. Fundamental aspects of motor development for infants, children, youth and adults.

3010
Health and Human Performance Workshop. 1-3 credits, maximum 6. Concentrated study of selected areas of health and human performance, including problems in instruction and administration not usually addressed in the under-graduate curriculum.

3114
Physiology of Exercise. Lab 2. Prerequisite: MATH 1513. A study of the various bodily systems, including major organs and tissues, and how they respond to acute and chronic exercise of varying intensity, duration and frequency.

3223

3430
Early Laboratory and Clinical Experiences in Physical Education. 1-2 credits, maximum 4. Prerequisites: 1753 and declaration of intention to pursue a program in Teacher Education. The initial preprofessional clinical experience for schools, kindergarten through grade twelve with primary duties including instruction in physical education. Required for full admission to Teacher Education. Graded on a pass-fail basis.

3450
Clinical Experience in Health and Human Performance II. 2-4 credits, maximum 8. Prerequisite: 2450. Directed observation in supervised intermediate laboratory and clinical experiences in appropriate health and human performance areas.

3613
Community Health. A survey of issues impacting the health of populations from a community health perspective.

3623
School Health Programs. Prerequisite: 2603. The identity and relationships of school health instruction, services and environments.
3653 Advanced Assessment of Athletic Injuries. Prerequisite: 2653. Advanced knowledge and skills related to the recognition, assessment and appropriate medical referral of athletic injuries to the spine, upper and lower extremities.

3663 Biomechanics. Prerequisite: 2653. The study of anatomical mechanical phenomena underlying human motion. Application of biomechanical concepts to a wide variety of exercise, fundamental movement, sport and physical activity.


3713 Principles of Epidemiology. Prerequisites: 2213, 2603. Survey of epidemiological principles as they relate to the planning of both community and consumer-focused health promotion and disease prevention programs.

3753 Methods in Teaching Elementary Physical Education. Prerequisites: 1753, 2712, 3430 and any two of 1812, 1822, 1832, 1842. Theory and practical experience of physical education in the elementary school. Teaching styles and activities needed to meet the needs of children from kindergarten through grade five.

3763 Health and Physical Education for Elementary Age Children. Methods of teaching health and physical education to elementary age children. Theory and practical experience of health behaviors, movement skills and physical fitness.

3773 Methods in Teaching Secondary Physical Education. Lab 2. Prerequisites: 1753, 3430 and any two of 1812, 1822, 1832, 1842. Instructional styles, implementation of behavioral goals and objectives through unit and lesson preparation, teaching methods, and classroom management.

3903 Therapeutic Modalities for Athletic Injuries. Lab 1. Prerequisite: 2663. Discussion and application of common electronic and physiologic devices used in the treatment of acute and chronic athletic injuries to the musculoskeletal systems.


4010 Directed Study. 1-3 credits, maximum 6. Prerequisite: written approval by department head. Supervised readings, research or independent study of trends and issues related to the area of health, physical education or leisure services.

4033* Alcohol and Drug Education. Prerequisites: 2603, junior standing or consent of instructor. Examination of pathological and socio-behavioral aspects of drug use, misuse and abuse across an array of populations and social contexts.

4433* Program Design in Health Promotion. Prerequisites: 2603, 3613. A survey of program design principles including theoretical foundations, planning, marketing, delivering and evaluating.

4450 Clinical Experience in Health and Human Performance III. 2-4 credits, maximum 4. Prerequisite: 3450. Directed observation and supervised advanced laboratory and clinical experiences in appropriate health and human performance areas.

4480 Internship in Health and Human Performance. 1-12 credits, maximum 12. Prerequisites: last semester senior standing with cumulative GPA of 2.50. Supervised experience in school (physical education and health), community, worksite or athletic training settings in order to qualify or prepare for appropriate teaching and professional certification. Graded on a pass-fail basis.

4503 Applied Health Behavior. Prerequisite: senior standing or consent of instructor. Health assessment and intervention strategies with focus on diet, weight management, stress, substance abuse, consumer health and other current health issues.

4533 Psychosocial Issues in Health Promotion. Prerequisites: 2213, 2603. Survey of psychosocial issues as they relate to the practice of health promotion.

4643 Methods in School and Community Health Education. Prerequisites: 3623; full admission to Teacher Education. Conceptual approach to health education through a variety of teaching methodologies.

4702 Pre-internship Seminar. Prerequisite: junior standing. Capstone course for the health promotion program. Preparation for the health internship experience.

4723 Measurement and Evaluation in Health and Physical Education. Prerequisite: full admission to teacher education. Evaluation techniques commonly used by physical educators and health professionals to measure knowledge, attitudes, sport skill proficiency, and physical fitness.

4733 Administration and Program Design in Physical Education and Athletics. Prerequisites: 3753, 3773 or concurrent enrollment; full admission to teacher education. Design and management of physical education (K-12) and athletic programs.

4773 Principles of Exercise Testing and Prescription. Prerequisite: 3114. Study of principles of exercise testing including submaximal and maximal tests, exercise and basic electrocardiography, and guidelines for recommending exercise as related to health promotion and exercise science.

4783 Health Issues in Gerontology. Prerequisite: 2603, or consent of instructor. An in-depth study of physiological aspects, special health concerns, chronic illnesses and services as applied to gerontology.

4793* Adapted Physical Education. Prerequisites: 3753, 3773, full admission to Professional Education. Cognitive and psychomotor characteristics of disabling conditions, needs and challenges of educating the exceptional learner in the regular physical education program.

4933 Administration and Organization of Athletic Training Programs. Prerequisites: 3653, 4902, 4922. The administration and organization of athletic training programs including planning and implementation, certification procedures, code of professional practice, safety standards, and resource management.

4983* Current Issues in Athletic Training. Prerequisites: 3663 and admission to athletic training program. Development of competencies set by the National Athletic Trainers Association Board of Certification. Current issues facing athletic trainers and the role in today’s health care systems.

4993* Health and Human Sexuality. Prerequisite: 2603 or consent of instructor. The study of human sexuality as it relates to the health and well-being of individuals in the community, worksite, college and school setting.

5000* Master’s Thesis. 1-6 credits, maximum 6. Independent research required of candidates for master’s degree. Credit awarded upon completion of thesis.

5010* Seminar. 1-2 credits, maximum 4. Selected topics from the profession not covered in other courses. Presentation and critique of research proposals and results.


5030* Field Problems in Health and Human Performance. 1-3 credits, maximum 6. Individual investigations of issues in the areas of health and human performance.


5073* Psychological Aspects of Sport. Psychological foundations of sport emphasizing performance enhancement by athletes through psychological training techniques.

5143* Health Promotion Program Implementation and Evaluation. Prerequisite: 4433 or consent of instructor. An intensive overview of principles of health promotion program planning, implementation, and evaluation, with special emphasis on application.

5523* Current Readings in Health. Contemporary research, literature, projections and views as applied to total health and well-being.

5553* Human Electrocardiographic Interpretation. Prerequisites: 3114 and 4773 or consent of instructor. Knowledge concerning the collection and interpretation of the electrocardiogram (EKG) and its relationship to heart anatomy, physiology and electrophysiology.
6020* Research Colloquium. 1-3 credits, maximum 3. Exploration and presentation of selected topics and research in health and human performance.

6023* Special Topics in Health and Human Performance. Prerequisite: admission to the Graduate College. Special topics related to health and human performance. Investigation, discussion and analysis of contemporary topics.

6043* Ethical Issues in Health, Leisure and Human Performance. Prerequisite: admission to the Graduate College. A survey of ethical issues with specific emphasis on health, leisure and human performance.

6053* Advanced Research in Health and Human Performance. Prerequisite: graduate elementary statistical methods course. In-depth study of selected surveys and experimental research in HHP, including questionnaire development, survey methodology and analysis of data.

6063* Statistical Computing and Proposal Writing. 1-3 credits, maximum 3. Prerequisite: consent of instructor. Instruction in the use of SPSS using a personal computer. Preparation of research proposals.

6723* Curriculum Development in Health, Leisure and Human Performance. Prerequisite: admission to the Graduate College. Identification and analysis of curriculum theories with emphasis on traditional and innovative approaches to curriculum design for programs in health, leisure and human performance.

History (HIST)

1010 Studies in American History. 1-2 credits, maximum 2. Special study in American history to allow transfer students to fulfill general education requirements as established by Regents’ policy.

1103 Survey of American History. Meaning, vitality, and uniqueness of United States history since 1492 through a thematic examination of the nation’s past. Satisfies, with POLS 1113, the State Regents requirement of six credit hours of American history and American government before graduation. No credit for students with prior credit in HIST 1483 or 1493.

1483 American History to 1865. From European background through the Civil War. Satisfies, with POLS 1113, State Regents requirement of six credit hours of American history and American government before graduation. No credit for students with credit in HIST 1103.

1493 American History Since 1865. May be taken independently of HIST 1483. Development of the United States including the growth of industry and its impact on society and foreign affairs. Satisfies, with POLS 1113, State Regents requirement of six credit hours of American history and American government before graduation. No credit for students with credit in HIST 1103.

1613 (H) Western Civilization to 1500. Lab 1. History of western civilization from ancient world to Reformation. Laboratory discussion sessions on interpretation of primary sources in translation.
3203 (H) Early Middle Ages, 325-1000. Economic, social, cultural and religious developments in Byzantium, Islam, and the Germanic West, which succeeded imperial Rome.

3233 (H) Medieval Europe, 1000-1450. High and Late Middle Ages in the West with emphasis on political, social, economic and intellectual development.

3243 (H) Renaissance, 1350-1517. The development of the Renaissance from the Italian city-states to the New World. Political development, cultural innovation, and the role of disease in history.

3253 (H) Absolutism and Enlightenment, 1648-1789. Political, economic, social, intellectual and religious transformation of Europe between the Peace of Westphalia and the French Revolution.

3263 (H) Modern Europe, 1815-1914. Impact of modernization on the character of European society, the factors that transformed the Continent into a battle ground in the 20th century.

3273 (H) Modern Europe Since 1914. Origins, character and impact of the first World War; emergence and consequences of the totalitarian state; nature of political and intellectual terrorism. Effects of worldwide economic depression; dilemmas of modern democracies; political collapse of Europe as a consequence of World War II.

3323 (H) Modern France, 1789-Present. French politics, economy, society, and culture from the defeat of Napoleon to France's post-World War II "rebirth."

3333 (I, S) History of the Second World War. Problems leading to World War II with their international implications and consideration of the war years.

3343 (H) World War I in Modern European Culture. Analysis of the war as the principal event determining the course of twentieth century European history: battles, home fronts, personal, literary, and artistic expression.

3353 (H) Mediterranean World, 1200-1600. Examination of the cultural and social encounters between East and West, Christian and Muslim. The meeting point for three world cultures and three continents explored in the following themes: pilgrimage, commerce, slavery, intellectual exchange, warfare, and minority communities.

3373 (S) Medieval England: 55 B.C.-1485 A.D. English History from Roman Britain to the beginning of the Tudor period. Development of the English constitution from the early Germanic state through feudalism to the New Monarchy.


3403 (H) East Asia to 1800. Traditional Chinese civilization and its impact on Japan, Korea and Southeast Asia.

3413 (H, I) East Asia Since 1800. Impact of the Occident on China, Japan and Southeast Asia. Problems of trade and diplomacy; political and industrial transformation of Japan; revolutionary process in China; the rise of nationalism in Southeast Asia.

3423 (H, I) Modern Japan. Modernization process in Japan since 1868.

3433 (H, I) Modern China. Response of China to the West since 1840, with stress on economic, social and intellectual currents.


3483 (H) Reformation Europe, 1517-1648. Development and impact of religious reform movements, expansion, statebuilding, the Scientific Revolution, and the Thirty Years' War on European civilization.

3503 (H) Islamic Civilization 600-1800. Rise of Islam in Arabia and subsequent spread to Africa, Asia and Europe. Nature of Islamic civilization through discussion of political, social, cultural and economic institutions established in the Middle Ages as well as diversity of Islamic traditions.

3513 (H, I) Modern Middle East Since 1800. Main political events, social institutions, cultural and economic developments, as well as various aspects of everyday life in the Middle East since 1800. Transformation of traditional society, imperialism and independence, Arab nationalism, Arab-Israeli conflict, the impact of oil, westernization, the rise of militant Islam, and the prospects of democratization.

3533 (H) Historical Archaeology. Methods and problems of historical archaeology through a review of fieldwork done in the United States and Near East.

3543 (H) Islamic Institutions. Prerequisite: 3503 is strongly recommended. Development of Islamic institutions from their origins in the seventh century until the present.

3553 (H, I) Media and Popular Culture in the Arab Middle East. Popular culture throughout the Arab-speaking world in light of the most important political and economic events of the 19th and 20th centuries.

3613 (H) American Colonial Period to 1750. Colonization of British and French North America; colonial political, social, cultural, intellectual and economic development; international rivalries; the imperial structure.

3623 (H) Era of the American Revolution. British imperial problems; the American Revolution; political, cultural, economic, social and religious change; the War for Independence; the Articles of Confederation; the critical years.

3633 (S) Early National Period, 1787-1828. Drafting and adopting the Constitution, organizing the government, Jeffersonian Republicanism, the War of 1812, territorial expansion, the new West, nationalism and sectionalism.

3643 (S) The Jacksonian Era, 1828-1850. Development of a modern political system and an entrepreneurial economy; social reform; territorial expansion; and sectionalism.

3653 (S) Civil War and Reconstruction, 1850-1877. Causes, decisive events, personalities and consequences of the disruption and reunification of the United States.

3663 (S) Robber Barons and Reformers: U.S. History, 1877-1919. The impact of industrialization upon American society and politics. America's rise to world power, the Progressive movement and World War I.

3673 (S) United States History, 1919-45. The political, economic, social and cultural changes in the United States from 1919 to 1945, the 1920s, the Depression, the New Deal, WWII, and domestic impact of the war.

3683 (H) United States History since 1945. The political, social and cultural history of the United States since World War II. The Cold War, McCarthyism, 1950s ideals of the nuclear family, the civil rights and other social movements, the Vietnam War, Watergate, the Reagan years, and globalization.

3753 (S) Trans-Mississippi West. Emergence of the modern West from Spanish and French settlement and exploration, the Rocky Mountain fur trade, the settlement of Texas, Oregon, California, and Utah, the mining, ranching and farming frontiers, the Indian Wars and transportation.

3763 (S) American Southwest. Southwestern states of Texas, Arizona, New Mexico and California from the Spanish colonial period to the present. Mining, ranching, farming frontiers, Indian wars of the Apaches, Comanche and other southwest tribes, and the emergence of the modern Southwest.

3773 (S) Old South. Social, political and industrial conditions in the South before the Civil War.

3783 (S) New South. Recent history and major current social and economic problems of the southern regions of the United States.

3793 (S) Indians in America. American Indian from Columbus to the present, emphasizing tribal reaction to European and United States cultural contract and government policy.

3913 (S) History of Medicine. Historical growth of medicine and its relationship to the society in which it develops. Scientific problems, cultural, religious, and medicine.

3963 (H) Ideas and Ideologies in Modern Europe. Prerequisite: 1623. Intellectual and ideological developments in modern Europe, including political, social, and cultural foundations and impact on modern Europe.

3983 Historians and the Study of History. Prerequisite: history major or consent of instructor. An introduction to the craft and theory of history and the development of the craft and theory of history has evolved over the centuries. Special emphasis on the controversies over purposes, methods, and meanings, especially in the 20th century.

4063 Historic Preservation. Focuses on the United States and examines the history and theory of the preservation movement, the legal basis for preservation of the built environment, and the methodology of preservation.

4273 (H)American Foreign Relations Since 1917. America’s emergence as the decisive factor in the world balance of power.

4353 (S)American Military History. Civil-war-related military actions, the political implications of American foreign policy, and the impact of technological advances on warfare since colonial times.

4463 (H)American Cultural History to 1665. American society in nonpolitical aspects: sections, classes, national culture and social structure, immigration, education, religion, reform, world influences; ends with Civil War.

4483 (H)American Cultural History since 1665. Continuation of 4463; may be taken independently. Emphasis on nonpolitical aspects of American society and thought and on world influences.

4503 (S)American Urban History. Impact of urbanization upon American communities from 1865 to the present. Evolving political and social institutions, social change, technological innovations and planning theories.

4513 (S)American Economic History. Economic development and economic forces in American history; emphasis upon industrialization and its impact upon our economic society since the Civil War. Same course as ECON 3823.

4523 (S)American Environmental History. Examination of the changing ways society (from Native American to post-industrial) has defined, interpreted, valued, and used nature.

4533 (S)Black in America. Achievements of blacks in America and their participation in the development of the United States.

4543 (H)Vietnam War. Origins of the Vietnamese struggle against colonialism, international policy, making of military strategy and diplomacy, anti-war movement, impact on the war on soldiers and civilians, reflections of the war in popular memory and culture.

4553 (H)Gender in America. Cultural, societal and political reflections of American men and women from the colonial era to the present. Examination of the women’s movements and their opponents. Exploration of changing notions of masculinity and femininity.

4563 (H)Cold War. International perspectives on the origins, conflicts and ideologies of the Cold War, the nuclear arms race, impact on daily life, cultural reflections, the collapse of communism, victors and losers in the post Cold War world.

4573 (H)Women in Western Civilization. Women in the development of Western Civilization from the earliest times to the present.

4583 History of Technology. The development of technology in Western civilization. The relationship between science and technology and the effects of technology on society.

4903 (H)Senior Seminar. Prerequisites: History major or consent of instructor. An introduction to historical research for senior history majors. Students will be required to select, research, and write a seminar paper based on primary documents and use standard footnoting and bibliographical methods.

4960* Topics in History. 1-3 credits, maximum 9. For students interested in pursuing either a research or a reading project. Open to honors students in history and to others by permission of the department head.

4990 Undergraduate Internship. 1-6 credits, maximum 6. Prerequisite: consent of instructor. History-related internship experience designed to introduce majors to career possibilities.

4992 Senior Honors Thesis. Prerequisites: departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a faculty member, with second faculty reader and oral examination. Required for graduation with departmental honors in history.

5000 Thesis. 1-6 credits, maximum 6.

5021 Teaching History at the College Level. Survey of objectives and methods in the teaching of history at the college level.

5023 Historical Methods. Methods of historical research and the writing of history.

5030* Applied History Internship. 3-6 credits, maximum 6. Prerequisite: consent of graduate committee. Supervised practical experience in applied history.

5120* Reading Seminar in American History. 3 credits, maximum 15. Historiographical and bibliographical study of special areas of American history.

5140* Reading Seminar in European and World History. 3 credits, maximum 15. Historiographical and bibliographical study of special areas of European and World history.

5220* Research Seminar in American History. 3 credits, maximum 15. Research in selected problems in American history.

5240* Research Seminar in European and World History. 3 credits, maximum 15. Research in selected problems in European and World history.

6000* Doctoral Dissertation. 1-19 credits, maximum 30. Prerequisite: admission to candidacy. Advanced research in history.

6023 Historiography. Major writers of history, historical schools and patterns of developments in historical interpretation from the earliest times to present.

6102* Special Studies in History. 1-3 credits, maximum 36. The meaning and operation of the historical processes and the development capabilities for clarity of statement, investigation, and creative, critical attitude. Areas studied vary from semester to semester.

Honors College (HONR)

1000 Introductory Honors Topics. 1-3 credits, maximum 6. Prerequisite: Honors Program participation. Introduction to topics in various disciplines by faculty from the undergraduate colleges for freshman and sophomore students in the University Honors Program.

1013 (H) The Ancient World. Prerequisite: Honors Program participation. Interdisciplinary study of art, history, philosophy and literature from ancient Greece and Rome as well as the religious ideas central to Judaism and Christianity. Team-taught by faculty from appropriate disciplines in a lecture, history, philosophy and literature format. For the Honors student. No credit for students with prior credit in HONR 2113.

1023 (H) The Middle Ages and Renaissance. Prerequisite: Honors Program participation. Interdisciplinary study of art, history, philosophy and literature from the Middle Ages to the early Renaissance. Team-taught by faculty from appropriate disciplines in a lecture and discussion format. For the Honors student. No credit for students with prior credit in HONR 2113.

1033 (H) The Early Modern World. Prerequisite: Honors Program participation. Interdisciplinary study of art, history, philosophy and literature from the late Renaissance to the mid-19th century. Team-taught by faculty from appropriate disciplines in a lecture and discussion format. For the Honors student. No credit for students with prior credit in HONR 2223.

1043 (H) The Twentieth Century. Prerequisite: Honors Program participation. Interdisciplinary study of art, history, philosophy and literature from the late 19th century to the present. Team-taught by faculty from appropriate disciplines in a lecture and discussion format. For the Honors student. No credit for students with prior credit in HONR 2223.

1093 Patterns and Symmetry in Mathematics. Prerequisite: Honors Program participation. Interdisciplinary study of art, geometry, nature and mathematics. Focuses on the relationship of pattern and in space, and the symmetries, or rigid motions, that preserve them. Illustrations from art, architecture, science, and nature. For the Honors student.

2013 (S) Honors Law and Legal Institutions. Prerequisite: Honors Program participation. An introduction to law in American society with re Pall, or economics, political science, and legal studies; perspectives in American law and legal institutions; the relationship between social, economic, psychological, and sociological dimensions; and the substantive law in selected areas. Introduction to legal reasoning and legal research techniques. For the Honors student.
Horticulture (HORT)

1003
Home Horticulture. Offered by correspondence only. An introduction to horticultural practices for the home gardener. Planning and care of home gardens, home orchards and vegetable gardens; selection, use and care of indoor plants. Non-majors only. Credit will not substitute for required courses.

1013
Principles of Horticultural Science. Lab 2. Basic physical and physiological processes responsible for plant dormancy, growth, flowering, fruiting, and senescence with respect to the science and art of production, cultivation, utilization, and/or storage of horticultural plants. Current research associated with various horticultural commodity groups.

2010
Internship in Horticulture. 1-6 credits, maximum 6. Prerequisites: 24 credit hours and consent of adviser. Supervised work experience with approved public and private employers in horticulture and related fields. Credit will not substitute for required courses. Graded on a pass-fail basis.

2112
Indoor Plants and Interior Plant Scaping. Lab 2. Identification, cultural requirements and use of ornamental foliage and flowering plants for indoor gardens.

2212
Herbaceous Ornamental Plants. Lab 2. Identification, cultural requirements and landscape value of ornamental flowering herbaceous plants. Discussions of design and installation of herbaceous beds and borders.

2313
Landscape Plant Materials I. Lab 2. Prerequisites: 1114 or 1403. Identification, adaptation, tolerance and use of deciduous trees, shrubs, vines and ground covers in the landscape.

2413
Landscape Plant Materials II. Lab 2. Prerequisites: 2313. Identification, adaptation, tolerance and use of evergreen trees, shrubs, vines and ground covers in the landscape.

2652
Basic Floral Design. Lab 2. Fundamentals of floral arrangement and design for the home and the retail shop; basic skills useful to flower shop employment and operation.

3014
Business and Practice of Arboriculture. Lab 2. Prerequisites: 2313 and 2413 or FOR 2134, and SOIL 2124. Theory and practice of selecting, planting and maintaining trees, shrubs and vines. Basics of the landscape management business, including estimates for labor, equipment and plant materials; bidding; costs and record keeping; and employee safety.

3084

3113
Greenhouse Management. Lab 3. Prerequisites: 1013, BIOL 1404, MATH 1483 or 1513 or above. Commercial greenhouse operation with emphasis on floricultural plant production aspects; environment, growing media, fertilizers and application methods, watering, pest and disease control, chemical growth regulators, production costs.

3153
Turf Management. Prerequisites: 1013, SOIL 2124 and 3153, 2-4 credit hours plant science. Selection, establishment and maintenance of grass species and other plant materials for special use areas.

3213
Fruit and Nut Production. Prerequisite: BIOL 1403. Commercial production of fruits and nuts, with emphasis on pecan, apple, peach, strawberry, blackberry and blueberry. A two-day field trip is required.

3432
Commercial Vegetable Production. Prerequisites: 1013, SOIL 2124 and BIOL 1403. Commercial production and marketing of vegetable crops.

3544
Nursery Production. Lab 2. Prerequisites: 2313, 2413, and SOIL 2124. The propagation, production, management and marketing of commercial nursery stock.

3553
Advanced Floral Design and Marketing. Lab 2. Prerequisite: 2652. Preparation, arrangement, care and marketing of floral products in the retail shop, advanced designing, pricing, wholesale purchasing and retail selling.

4313

4453

4713
Public Garden Management. Lab 4. Prerequisite: 1013. Issues and methods in public garden management including database management of collections, conservation of native species, grant writing, volunteer coordination, computerized mapping systems, master planning, and other topics pertaining to a career in public horticulture. Field trips required.

4773
Applied Landscape Planning. Lab 3. Prerequisite: 2313 or 2413. Concepts of landscape contracting, design and planning. Preparation of plans and cost estimates with an emphasis on residential landscapes and use of plant materials. No credit for students in the landscape architecture or landscape contracting programs.

4990
Horticultural Problems. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Problems related to pomology, olericulture, nursery production, landscape design, or the culture, sales and arrangement of flowers.

5000

5020
Graduate Seminar. Prerequisite: graduate standing. Proposal and results seminars for graduate programs.

5110
Advanced Horticultural Problems. 1-12 credits, maximum 20. Selected research problems in horticulture, floriculture, landscape design, nursery production, olericulture, and pomology.

5123
Advances in Horticultural Science. The latest advances in horticultural science and technology affecting the vegetable, fruit and nut, turfgrass, nursery, and floriculture commodity areas. Areas of production systems, postharvest preservation, plant responses to the environment, and sound environmental practices.

5133
Temperature Stress Physiology. Prerequisite: BIOL 3653, BOT 3463 or consent of instructor. Effects of heat, chilling and freezing stress on plants. Responses to temperature extremes at the molecular to whole plant levels, with emphasis on mechanisms of injury and resistance.

5253
Experimental Horticulture. Methods of conducting research with horticultural crops including organization and plans, field plot techniques and analysis of data.

5412
Mineral Nutrition in Horticultural Crops. Prerequisites: BOT 3463, SOIL 4234. Fertilizer use and plant response in horticultural crops.
penses and analysis financial reports, con-
ning planning and control of revenue and ex-
and practice in the hospitality industry includ-
requisite: ACCT 2103. Financial analysis theory
Hospitality Industry Financial Analysis

2283 Hospitality Industry Financial Analysis. Prerequisite: ACCT 2103. Financial analysis theory and practice in the hospitality industry including planning and control of revenue and exp-
enses and analysis financial reports, con-
cepts, examples, and case studies specific to the hospitality industry.

1103 Introduction to Hotels, Restaurants, and Tourism Around The World. Study of hotels, restaurants, tourism and the hospitality industry around the world. The scope of the industry, development and history of the hos-
pitality industry on an international basis, ethical issues, and career opportunities.

1114 Introduction to Professional Food Preparation and Sanitation. Lab 3. Techniques and theo-
ries of food preparation and sanitation includ-
ing use and selection of equipment, quality controls, presentation, and nutrient relation-
ships based on food preparation systems. The theory and practice of food safety and sanita-
tion.

1771 Hospitality Speakers Series. Seminars pre-
seated by distinguished hospitality industry pro-
essionals. Current issues and implications for the future of the hospitality and service indus-
tries.

2125 Service Management in Hospitality Operations. Lab 4. Analysis and development of service management skills for the hospitality industry, including leadership behavior, motivation; com-
munication, supervision, leadership, and professional-
ism with an emphasis on fine dining.

2353 Hospitality Information Technology. Overview of computer system components, file structure, operating systems, word processing, spreads-
heets, and databases utilized in the hospitality industry. The interaction between technol-
ogy, oral, and written communication at all levels of hospitality organizations.

2770 Hospitality Industry Speakers Colloquium. 1-3 credits, maximum 3. Seminars presented by distinguished hospitality industry professionals.

2771 Hospitality Speakers Series. Seminars pre-
seated by distinguished hospitality industry pro-
essionals. Current issues and implications for the future of the hospitality and service indus-
tries.

2850 Special Topics in Hotel and Restaurant Admin-
istration. 1-3 credits, maximum 6. Study of spe-
cific issues or topics in hotel and restaurant administration.

3193 Hospitality Training Program Development. Study of the design, delivery and evaluation of training programs for hospitality and tourism organizations. Needs assessment, performance objectives, instructional design, and a variety of presentation methods. Organizational and individual development.

3213 Hospitality Management and Organizations. Function and methods of management as re-
lated to the hospitality industry including manage-
ment principles and analysis and decision making skills as applied to hospitality manage-
ment system organizations, interpersonal rela-
tionships, and production systems.

3223 International Travel and Tourism. The study of international travel and tourism for business and pleasure. The management of travel and tourism concepts in the hospitality industry and related businesses around the world. Interna-
tional travel industry financial management, technology, economic planning and policy for-
mulation.

3330 On-campus Internship. 1-3 credits, maximum 6. Prerequisites: HRAD 2125, 2771 or consent of instructor. Supervised experience in an ap-
proved on campus work situation related to a future career in the hospitality industry. Human resource, customer service, management or supervisory experience in multiple aspects of the department.

3363 Lodging Front Office Systems. Lab 2. Prereq-
uisites: 3213, ACCT 2103. The organization, duties and administration of a hotel front office. The various jobs in the lodging front office, and procedures for registering, accounting for, and checking out guests. Additional focus on the organizing systems, word processing, spread-
ads, and administrative, hotel reservations, night audit, and uniformed services departments.

3403 Lodging Services Management. The organiza-
tion and management of guest services in lodg-
ing properties. Examination of the principles of concierge, bell staff, retail outlets, and busi-
ness services.

1133 Hospitality Law and Ethics. Examination of the laws regulating the hospitality industry. The interrelationships between law, the hospitality industry, and the public. Exploration of ethics, how legal principles apply in a global environ-
ment, and fundamental principles of tort and contract law.
4120* Special Events Management. 1-3 credits, maximum 6. Study of special event planning, implementation, and evaluation. The interaction between the staff, the customer, guests, contractors, and others necessary to implement a successful special event. Catering through hotels, restaurants or private companies.

4121* Special Events Management. Study of special event planning, implementation, and evaluation. The interaction between the staff, the customer, guests, contractors, and others necessary to implement a successful special event. Catering through hotels, restaurants or private companies.


4213* Hospitality Sales and Catering. Prerequisites: 2125, 3213, and 3363. Fundamentals of sales and catering including the sales department, publicity, advertising, policies and techniques used to sell the organization in all aspects of the hospitality industry. Includes planning for versatility, customer responsiveness, cost, timing, and follow up for events.

4221* Special Events Management. Prerequisite: 4121. Study of special event planning, implementation, and evaluation. The interaction between staff, customer, guests, contractors, and others necessary to implement a successful special event. Catering through hotels, restaurants or private companies.

4293* Hospitality Small Business Development. The theories and procedures necessary to develop a small business in the hospitality industry. Financial analysis, feasibility study, pro-forma creation, building and site construction, and brand selection.

4321* Special Events Management. Prerequisites: 4121, 4221. Study of special event planning, implementation, and evaluation. The interaction between the staff, the customer, guests, contractors, and others necessary to implement a successful special event. Catering through hotels, restaurants or private companies.

4333* Hospitality and Tourism Financing. Prerequisites: 2283, ACCT 2103. The theory and practice of operational and strategic financial policy and problems in the hospitality industry. Financial information systems, fund allocation, asset management, financial structure, and analysis of the financial environment.

4365* Food Production Management. Lab 5. Prerequisites: 2125, 3213, 3553, and a course in accounting, or consent of instructor. Organizing, purchasing, costing, recipe development, preparation, and service of food. Emphasis on the management of the process, budgeting, marketing, and food safety.

4383 Hospitality Education. An examination of the foundation, organization and operation of hospitality education; especially focused on vocational, secondary, community college, and university settings.

4413* Hospitality Information Systems. Prerequisites: 2125, 3213 and 3363. Conceptional analysis of hospitality technology systems such as food and beverage service, housekeeping, sales, property management, personnel, accounting, front office, and inter-departmental functions. The ethical implications of technology.

4421* Special Events Management. Prerequisites: 4121, 4221, 4321. Study of special event planning, implementation, and evaluation. The interaction between the staff, customer, guests, contractors, and others necessary to implement a successful special event. Catering through hotels, restaurants or private companies.

4443* Advanced Hospitality Management Internship. Prerequisites: 2125, 3213, 3363 or 3943 and 3443 or concurrent enrollment in 3443 with consent of instructor. Management experience in multiple aspect of a hospitality organization. Exploration of human resources, development of an understanding of organizational behavior, conflict resolution, negotiating and communication techniques. Application of critical thinking skills to solve problems. The interaction between the customer and the products and services provided by the organization.

4523* Integrated Capstone Seminar. Prerequisite: senior or graduate standing. Integration of previous classroom, laboratory, and practical experiences through development of a comprehensive project. Additional focus on application of critical thinking, demonstration of leadership principles, interaction with industry professionals and development of an awareness of societal and ethical issues and their application to the hospitality and tourism industries.

4553* Specifications and Advanced Purchasing. Prerequisites: 2283, 3213 and 3553. Development of specifications for food, supplies, and services used in the hospitality and service industries. The product mix and its integration with the services in hospitality operation. The developing e-commerce and other technological advances in purchasing and distribution.

4561* Hospitality Management Seminar. The issues having an impact on the hospitality industry. Exploration of the issues utilizing various strategies and a multi-disciplinary approach. Discussion and interpretation of multiple perspectives with an emphasis on critical thinking, strategic decision making, and the formulation of innovative solutions and processes to enhance the workplace.

4573* Non-commercial, Institutional and Contract Services in the Hospitality Industry. The organization and administration of non-commercial food and hospitality services. Business and industry, athletic venues, college and universities, prisons, schools, government services, hospitals, healthcare, assisted living, and other similar facilities. Additional emphasis on self operation and services provided by contract management companies. The principles associated with development of a request for proposals, analysis of proposals, services evaluation, contract liaison activities and communication.

4593* Manufacturing and Distribution of Goods and Services in the Hospitality Industry. Prerequisite: 4553. Examination of product and service distribution channels. The characteristics and management of the sequence necessary to bring goods and services from manufacture to market. Additional focus on the marketing concepts associated with the distribution process.

4633* Labor Relations In The Hospitality Industry. Prerequisites: 3213 and 3783. Examination of the concepts related to labor relations in the hospitality and service industries. Emphasis on collective bargaining and applicable law. Training and development programs for the hospitality and service labor force.

4683* Culinary Techniques and Catering. The history of cuisine, its origin, use and impact on the culinary arts. Examination of a wide variety of foods, production techniques, presentation skills, and service styles. Upscale catering including planning and producing an event.

4723 International Beverage Education. Prerequisite: proof of minimum age 21. Emphasis on the international and domestic dimensions of the classification, production techniques, distribution, and quality factors of beverages such as wines, distilled spirits, beers, and non-alcoholic beverages. Emphasis on responsible alcohol beverage service and management techniques.


4783* Critical Issues In the Hospitality and Tourism Industry. Prerequisite: senior or graduate standing. Breadth of vision and broad perspective of contemporary issues in the management of hospitality and tourism industry organizations. Awareness of the link among cultural, and international issues and their impact on hospitality and tourism organizations.

4850* Special Unit Course in Hotel and Restaurant Administration. 1-6 credits, maximum 6. Prerequisite: Consent of instructor. Special unit of study related to specific problems in the hospitality industry.

4883* Multi-Level Organizational Behavior. Prerequisite: senior or graduate standing. Study of the structure and management of multi-level and multi-national organizations in the hospitality industry. Organizational behavior, policy and procedures, multi-site management, and decision making in complex organizations in domestic and multi-national hospitality organizations.

4900 Honors Creative Component. 1-3 credits, maximum 3. Prerequisite: College of Human Environmental Sciences Honors Program participation, senior standing. Guided creative component for students completing requirements for College Honors in College of Human Environmental Sciences. Thesis, creative project or report under the direction of a faculty member in the major area, with second faculty reader and oral examination.
3123 (S)Parenting. Prerequisite: 2113. Examination of the fundamental issues and special topics in parent-child relationships across the life span. Current theory and empirical research in multiple contexts of family, school and community.

3213 Literacy Development in Early Childhood Education. Prerequisites: concurrent enrollment in 3224 and full admission to Professional Education. Theoretical and research based rationale for an integrated language arts and an interdisciplinary approach to literacy development as it addresses writing, reading and oral language for infants through age eight. Use of children’s literature.

3224 Integrated Curriculum in Early Childhood. Prerequisites: concurrent enrollment in 3213, and full admission to Professional Education. Application of theories of cognitive development to developmentally appropriate curriculum in mathematics, social studies, physical and natural sciences.

3233 Guidance and Discipline in Programs for Young Children. Prerequisites: concurrent enrollment in 3243 and 3246, and full admission to Professional Education. Child-centered approach to the guidance and discipline of young children. Relevant theories, influential research and developmentally appropriate guidance techniques that facilitate the development of pro-social, cooperative and helping behaviors.

3243 Preparation for Field Experience in Pre-kindergarten-Kindergarten Education. Prerequisites: concurrent enrollment in 3233 and 3246, and full admission to Professional Education. Program planning, implementation and evaluation of developmentally appropriate programs for pre-kindergarten-kindergarten settings.

3246 Internship in Early Childhood Education in Pre-kindergarten-Kindergarten. Prerequisites: concurrent enrollment in 3233 and 3243, full admission to Professional Education. Program planning, implementation and evaluation of developmentally appropriate programs for pre-kindergarten-kindergarten settings.

3413 Infant and Child Development. Examination of continuity and change in physical, cognitive, language, and socioemotional development from the prenatal period through early middle childhood (age nine). Diverse contexts, directed observation of infants and children.

3423 (S)Adolescent Development in Family Contexts. Development of the adolescent physically, socially, intellectually and emotionally with emphasis on the search for identity, sexuality, vocational choice and interpersonal relations. Observation of adolescents.

3433 (S)Relationship Development and Marriage. Theory and research on the formation and development of interpersonal relationships from dating through courtship and marriage.

3443 (S)Family Dynamics. Applying family theories and current research to the examination of dynamics of diverse families across the life course and within the social context.

3453 Management of Human Service Programs. Prerequisites: 1112, 2113, 3433, 3434. Designing and managing human service programs: planning, needs assessment, program hypothesis, developing human resources, budget management, monitoring and evaluation. Emphasis on accountability.

3513 (S)Introduction to Research Methods. Prerequisite: STAT 2013 or equivalent. Examination of fundamentals of scientific method as applied to research in human development and family sciences. Research design, sampling, and measurement. Analytical, evaluative, and interpretive skills needed to understand the professional research literature. Introduction to how computers are used in research.

3523 Professional Skills in Human Services. Prerequisites: 1112, 2113, 3433, 3513. Development of professional skills for the human services. Intakes, interviewing, reporting, program marketing, case management, advocacy, facilitating change, community collaboration, and using data bases.

3533 Observation and Assessment. Prerequisite: 3513. Examination of individual and family interaction through observation and assessment techniques in multiple contexts.

3613 Professional Services for Children and Families. Study of current major issues and selected services for children and families.

4000 Senior Thesis. 1-6 credits. Maximum 6. Prerequisite: 4743, STAT 2013, senior standing, consent of instructor. Supervised research for the bachelor’s degree.

4223 Field Experience Preparation in Primary. Prerequisites: concurrent enrollment in 4226 and 4333, and full admission to Professional Education. Decision-making, priority-setting, self-assessment, classroom organization and management, selection of appropriate content, and teaching strategies in public schools and state accredited programs.

4226 Internship in Early Childhood Education in Primary. Prerequisites: concurrent enrollment in 4226 and 4333, and full admission to Professional Education. Supervised teaching experience in grades 1-3. Graded on a pass-fail basis.

4333 Early Childhood Capstone. Prerequisites: concurrent enrollment in 4223 and 4226, and full admission to Professional Education. Examination of the role of the early childhood professional in broader society contexts such as policy, advocacy, research and funding.

4413 (S)Adulthood and Aging. Study of the unique characteristics of development during the middle and later years of development. Emphasis on the aging process and the effects on the individual and family.

4423* Family Risk and Resilience. Examination of selected theoretical approaches; areas of family risk; protective factors; individual and family qualities relating to resilience; and prevention and intervention strategies.


4473 Policy, Law and Advocacy. Prerequisites: 1112 and 2113. The study of local, state, and federal legislation, regulations, social policies, and advocacy that affect children and families. Domestic relations, child welfare, health, education, social services, employment, and housing.

5143* Parent-Child Relations. Examination of theory and research related to parenting and the impact of parenting on the well-being of children, parents and the broader family system. Application of research to parenting on parent education and child guidance.

5190* Teaching Practicum. 1-3 credits, maximum 3. Prerequisites: six hours of graduate course work and consent of instructor. Teaching human development and family sciences; content and techniques.


5213* Child Behavior and Development. Prerequisite: consent of instructor. Current issues in child development beyond infancy explored within the context of recent research. Contrasting theoretical and methodological approaches critically evaluated.

5223* Theories of Child Behavior and Development. Prerequisite: 6 credit hours at graduate level in child development or related areas. Major theories and supportive research that contribute to the understanding of child behavior and development.

5243* Infant Behavior and Development. Prerequisite: consent of instructor. Survey of research and theory pertaining to infant development, including behavioral genetics, perception, cognition and learning, social and emotional development, and assessment.

5273* Assessment of Infant and Child Development. Prerequisite: consent of instructor. Study and application of formal evaluative methods for the investigation of infant and child development. Supervised practice in administration, scoring, and interpretation of individual tests of cognitive ability, adaptive behavior, language development, and psychomotor development.

5290* Practicum. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Supervised experience in various settings relevant to human development and family sciences.

5333* Early Childhood Education: Curriculum. Implications of child development theory and research for planning educational programs and learning experiences appropriate for young children.

5343* Assessment Within Early Childhood Programs. Prerequisite: consent of instructor. Examination of standardized and alternative assessment strategies for documenting children’s learning and development within early childhood educational contexts. Exploration and critical review of strategies for evaluating early childhood classrooms.

5353* Diversity in Early Childhood. Exploration and critical review of the state of early childhood programs for children through third grade emphasizing individual differences, equipment and materials, physical facilities and space, teacher roles, and philosophical objectives.

5363* Early Childhood Models and Practice. Curricular and program models for children through third grade emphasizing individual differences, equipment and materials, physical facilities and space, teacher roles, and philosophical objectives.


5470* Developments and Innovations in Family Relations, Child Development and Early Childhood. 1-9 credits, maximum 9. Analysis of current developments and innovative practices in one or more of the specified areas. Emphasis upon evolving concepts with implications for programs serving societal needs in these areas.

5513* Issues in Family Science. Current and classic literature in family studies. Consideration of philosophical bases and current research issues relevant to the family as a field of study.

5523* Family Therapy. Theoretical frameworks and processes in family science. Overview of the interface between theory, research, and application in family science.

5543* Coping with Family Crises. Strategies for helping families deal with various family crises including illness, death and divorce. Focus on dealing with these from a family systems approach.

5553* Marital and Premarital Enrichment Education. Analysis of educational models and processes that relate to enriching couple relationships. Approaches to facilitating premarital and marital enrichment, emphasizing program development and implementation and evaluation.

5573* Adolescent in Family Context. Physical, social, emotional and intellectual development of adolescents within the context of family relationships. Examination of research and theory as it relates to adolescent development and parent-adolescent relationships.

5583* Human Sexuality. Multiple aspects of human sexuality including physiological and psychological development and response, sexual relationships, and sexual dysfunction.

5602* Pre-practicum in Marriage and Family Therapy: Counseling Skills. Pre-clinical experience for students in the marriage and family therapy (MFT) specialization, emphasizing counseling skills and structured observations.

5612* Pre-practicum in Marriage and Family Therapy: Group Processes. Prerequisites: admission to marriage and family therapy specialization and consent of instructor. Pre-clinical experience for students in the marriage and family therapy specialization emphasizing group processes, designing and running therapy groups.

5613* Theoretical Models of Marriage and Family Therapy. An introduction to the historical context of marriage and family therapy. An overview of the major schools of marriage and family therapy and emerging models.

5623* Systems Theory and Applications to the Family. Examination of the cybernetic roots and terminology used with general systems theory providing an understanding, appreciation and integration of the role of “systems” approaches to family therapy and clinical practice.

5633* Couples Treatment in Marriage and Family Therapy. Prerequisite: graduate standing or consent of instructor. Focus on assessment of couples and the systemic interventions available to address common couple issues. Premarriage, divorce and remarriage, sexuality, domestic violence, infidelity, and gender.

5643* Child and Adolescent Treatment in Marriage and Family Therapy. Prerequisite: graduate standing or consent of instructor. An overview of the issues surrounding children and adolescents in marriage and family therapy including child and youth development, oppositional behaviors, ADHD, and family structures and hierarchies. Assessment and treatment methods. Strategies for engaging families.

5653* Systemic Approaches to Psychopathology and Psychopharmacology. Prerequisite: graduate standing or consent of instructor. Overview of major mental disorders and other conditions that maybe the focus of clinical mental health treatment. Treatment issues and an introduction to psychopharmacology.

5663* Professionalism and Ethics in Marriage and Family Therapy. Prerequisites: graduate standing or consent of instructor. Study of the ethical and philosophical bases and current research issues relevant to the family as a field of study.

5690* Marriage and Family Therapy Practicum. 1-3 credits, maximum 15. Prerequisite: admission to marriage and family therapy specialization. Supervised clinical experience for students in the marriage and family therapy specialization.

5743* Management of Family and Community Service Programs. Functions of management applicable to programs and services for children and families. Program planning, personnel decisions, resource development, marketing, community engagement, employee development, and evaluation.

5750* Seminar in Child Development and Family Relationships. 1-8 credits, maximum 8. Credit for a child development and family relations course. An overview of marriage and family therapy specialization.

5933* Evaluation Design. Fundamental principles of evaluation, emphasis on instrumentation.

6000* Doctoral Thesis. 1-12 credits, maximum 30. Prerequisite: consent of instructor. Research in human environmental sciences for the Ph.D. degree under supervision of a graduate faculty member.
6110* Directed Study in FRCRD. 1-9 credits, maximum 9. Prerequisites: 5523 or 5223 and consent of instructor. Doctoral level directed individual study in human development and family sciences.

6133* Advanced Research Methods in Family Relations and Child Development. Prerequisites: one course in research methods and one in statistics. Research design and analysis of data appropriate to the areas of family relations and child development.

6190* Research Internship. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Special research studies under the supervision of a graduate faculty member.

6223* Analysis and Application of Child Development Theory. Prerequisite: 5223. Critical analysis of selected child development theories using primary source material with demonstration of application to development, research and practice.

6243* Theory and Research in Early Cognitive Development. Prerequisites: 5213, 5223 or consent of instructor. Critical examination of the concepts and principles derived from cognitive developmental theory with special emphasis on research and methodological literature.

6250* Seminar in Child Development. 1-6 credits, maximum 6. Prerequisite: 5223 or equivalent. Selected topics in child development with special attention given to recent research literature and current theory.

6253* Theory and Research in Early Social Development. Prerequisites: 5213, 5223 or consent of instructor. Research and theory pertaining to social and emotional development, including attachment, social interaction, friendships and temperament.

6363* Theories and Research in Early Communication Development. Prerequisites: 5213, 5223 or consent of instructor. Recent theories and research in language communication development, including receptive and active language and the relationship of language to early social and cognitive development.

6373* Theory and Research in Developmental Disabilities. Prerequisites: 5213, 5223 or consent of instructor. Recent theories and research related to developmental disabilities, including both physical and mental handicapping conditions and their impact on human development.

6523* Analysis and Application of Family Theory. Prerequisite: 5523. Family theory process, including logic, theory construction, and relating conceptual orientations to current research areas.

6580* Seminar in Family Sciences. 1-6 credits, maximum 6. Prerequisite: 5513 or consent of instructor. Current research and theory in the family area; selected topics.

6613* Contemporary Issues in Marriage and Family Therapy. Prerequisite: admission to marriage and family therapy specialization. Critical issues facing students in the marriage and family therapy program (MFT) specialization, while taking advantage of the unique expertise of clinical faculty. Professional seminar on dialogue with participants taking an active role in the learning process.

6843* Economic and Social Foundations of Family Economics. Prerequisites: graduate standing, consent of instructor. The lives, times and ideas of great economic and social thinkers and how their influence on the economic and social development of our society affects the economics of family living.

Human Environmental Sciences (HES)

1111 Directions in Human Environmental Sciences. A survey of the majors and career opportunities in the various human environmental sciences departments. The transition from high school to university life, awareness of campus and college resources, and enhancement of study skills and attitudes that contribute to academic success. Required of all first semester freshmen in the College of Human Environmental Sciences.

2111 Career Exploration in Human Environmental Sciences. Acquisition of career information critical to introduce students to the world of work. Career searches, processes for interviewing and acquiring careers.

3002 Contemporary Issues in Human Environmental Sciences. Exploration of the mission of the College of Human Environmental Sciences and subject matter interrelationships; ethical issues and professionalism in the field; effect of global interdependence and public policy on individuals, families and professionals. Required of all students in the College of Human Environmental Sciences.

3080 International Experience. 1-18 credits, maximum 36. Prerequisite: consent of associate dean. Participation in a formal or informal educational experience outside of the USA.

3090 (I)Study Abroad. 1-18 credits, maximum 36. Prerequisites: consent of the Office of the Study Abroad and associate dean of the College of Human Environmental Sciences. Participation in an OSU reciprocal exchange program.

3111 Directions in Human Environmental Sciences. An exploration of the career opportunities and curriculum in the various human environmental sciences departments. Transition to university life at OSU, awareness of campus and HES resources; and enhancement of skills and attitudes that contribute to academic success. Required of all first semester transfer students in the College of Human Environmental Sciences (CHES).

4000 Honors Seminar in Human Environmental Sciences. 1-6 credits, maximum 6. Prerequisites: junior standing and admission to the Honors Program. In-depth interdisciplinary seminar focused on a current national or international issue having an impact on quality of life. Exploration of the issue utilizing various theoretical and national resources. Dialogue and debate from multiple perspectives with emphasis on verbal and written expression.

5240* Master’s Creative Component. 1-6 credits, maximum 6. Prerequisite: consent of instructor. An in-depth application of theoretical models and philosophies related to area of specialization.

5253* Family Economics. Issues related to the economics of families, household production, and human capital development; economics of credit; public policy and family life cycle spending, saving and borrowing; special attention to the role of ethics in family economic issues. A theoretical and a research perspective used to illuminate the concepts in the course. Web-based instruction.

5303* Fundamentals of Family Financial Planning. The nature and functioning of financial systems, including currencies, markets, monetary and fiscal policy, and supply and demand for land, labor and capital. Focus on the impact of global financial interdependence on individuals and families in the U.S. Current and emerging issues, as well as current research and theory relative to financial systems. Web-based instruction.

5353* Financial Counseling for Family Financial Planning. Theory and research regarding the interactive process between client and practitioner, including communication techniques, motivation and esteem building, counseling environment, ethics, and data intake, verification, and analysis. Legal issues, compensation, technology to identify resources, information management, and current or emerging issues. Web-based instruction.

5403* Estate Planning for Families. Fundamentals of estate planning process, estate settlement, estate and gift taxes, property ownership and transfer, and powers of appointment. Tools and techniques in implementing effective estate plan, ethical considerations in providing estate planning services, new and emerging issues in the field. Experience with case studies in developing estate plans for varied family forms. Web-based instruction.

5453* Retirement Planning, Employee Benefits and the Family. Study of micro and macro considerations for retirement planning. Survey of various types of retirement plans, ethical considerations in providing retirement planning services, assessing and forecasting financial needs in retirement, and integration of retirement plans with government benefits. Web-based instruction.


5603* Investing for the Family’s Future. Evaluation of investment markets for the household. Analysis of how families choose where to put their savings. Using the family’s overall financial and economic goals to help make informed decisions about which investments to choose. Web-based instruction.
5653*  Personal Income Tax for Family Financial Planning. Information on income tax practices and procedures including tax regulations, tax return preparation, tax audit processes, appeals process, preparation for an administrative or judicial forum, and ethical considerations of taxation. New, emerging issues related to taxation. Family and individual case studies practice in applying and analyzing tax information and recommending appropriate tax strategies. Web-based instruction.

5703*  Professional Practices in Family Financial Planning. Challenges of managing financial planning practices including, business valuation, personnel, marketing, client services, ethics and technological applications. Relying on theoretical as well as applied approach, analysis of case studies that provide relevant, practical exposure to practice management issues, with strong emphasis on current research findings. Web-based instruction.

5803*  Case Studies in Family Financial Planning. Prerequisites: 5303, 5403, 5453, 5603, 5653 or consent of adviser. Professional issues in financial planning, including ethical considerations, regulation and certification requirements, communication skills, and professional responsibility. Utilization of skills obtained in other courses and work experiences in the completion of personal finance case studies, the development of a targeted investment policy, and other related financial planning assignments. Web-based instruction.

6180*  Research Seminar. 1-3 credits, maximum 3. Prerequisite: graduate course in research methods or consent of instructor. Research in human environmental sciences with emphasis on problems involving a multidisciplinary approach. Methodological analysis of research. Development and evaluation of research focused on current problems.

6993*  Graduate Seminar in Human Environmental Sciences. 1-3 credits, maximum 3. Prerequisite: consent of instructor. Analysis of philosophy, critical issues, current developments and interrelationships among elements in human environmental sciences.

Human Resources and Adult Education (HRAE)

4010*  Occupational and Adult Education Workshop. 1-3 credits, maximum 6. Professional workshops of various topics and lengths. Each workshop focused on a particular topic from such areas as the development, use and evaluation of instructional methods and materials.


5000*  Thesis or Report. 2-10 credits, maximum 10. Students studying for a master's degree may enroll in this course a total of two credit hours if they write a report or six hours if they write a thesis. Students working on a specialist's degree may earn a maximum of 10 hours credit.

5010*  Seminar. 1-3 credits, maximum 6. Graduate student seminars focusing on current and critical issues and common problems relevant to occupational and adult education.
6303* Special Topics in Adult Education. 1-3 credits, maximum 9. Prerequisites: 5203, 5213. Analysis and critique of the application of adult learning principles and methods in one of the numerous diverse settings in which adult education is practiced.

6340* Independent Study in Human Resources and Adult Education. 1-3 credits, maximum 9. Directed independent study for doctoral students involved in a research-based project.

6533* Organization Development. Seminar examining the field of organization development. Emergence of the field, diagnosis, performance, change management, the client, and the consultation.

6633* Advanced Human Resource Development. Prerequisite: 5533. Scholarly critique of organizations as adaptive systems and the role human resource development plays in organization, process and individual performance.

6871* Doctoral Seminar: Level 1. Orientation to doctoral program in HRAE. May be taken prior to program application; required of all applicants.

6880* Internship in Human Resources and Adult Education. Directed field experiences related to the participant’s area of concentration. Provides opportunities for an individual to put into practice and test ideas, theories and concepts learned in graduate study.


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Industrial Engineering and Management (IEM)

2903 Introduction to Industrial and Systems Engineering. Lab 1. Prerequisites: ENGR 1111; MATH 2144. Industrial engineering concepts and techniques in production control, quality control, layout, methods engineering, material handling, mathematical programming, and engineering economy. Laboratory sessions provide additional learning experiences with these topics and with computer software used in industrial engineering analyses.

3303 Industrial Processes I Lab 3. Prerequisites: ENGR 1322 and ENSC 3313. Manufacturing processes used to transform raw materials including metals and non-metals into finished goods. Near-shape processing and basic metal cutting theory, process selection, and planning. Field trips to manufacturing plants.

3313 Industrial Processes II Lab 3. Prerequisite: 3303. Manufacturing processes in joining, finishing, metrology, nontraditional machining, tool design, electronics manufacturing assembly and numerical control. Field trips to manufacturing plants.

3503 Engineering Economic Analysis. Prerequisite: MATH 2153. Development and use of time value of money interest formulas. Bases for comparison of alternatives, including present worth, annual worth, rate of return and payout period methods. Decision making among independent, dependent, capital-constrained and unequal-lived projects. Replacement, break-even and minimum cost analyses. Depreciation and depletion methods and their effect on corporate income taxes, leading to after-tax cash flow analysis.


3523 Engineering Cost Information and Control Systems. Prerequisite: MATH 2144. Basic cost measurement and control concepts. How to measure and interpret cost data and define its use in planning, control and estimating. Role of accounting in cost control.

3703 Engineering Computation and Interactive Modelling. Prerequisite: ENGR 1412, MATH 2144. Using the computer for engineering problem solving through analysis, design and pseudo-code. Applications using computer languages, spreadsheets, statistical packages and equation solvers.


4010 Industrial Engineering Projects. 1-3 credits, maximum 6. Prerequisite: consent of school head. Special problems in industrial engineering and independent study in industrial engineering.

4014 Operations Research. Prerequisites: 3703, MATH 3263, STAT 4033. Fundamental methods, theories, and computational techniques of operations research. Linear programming, including transportation and assignment models. Network models, dynamic programming, decision theory, and queuing theory.

4020 Undergraduate Engineering Practicum. 1-3 credits, maximum 4. Prerequisites: consent of IEM adviser, admission to the Professional School of Industrial Engineering and Management and satisfactory completion of at least 12 hours of IEM 3000 or 4000 level courses. Professionally supervised experience in real life problem solving involving industrial projects for which the student assumes a degree of professional responsibility. Activities approved in advance by the instructor. Must consist of full or part-time engineering experience, on-campus or in industry, or both, either individually or as a responsible group member. Periodic reports both oral and written required as specified by the adviser.


4113* Industrial Experimentation. Prerequisite: 4103. Analytical methods for the purpose of continuous process improvement using the Deming approach. Experimentation driven by the Taguchi loss function, Taguchi arrays, linear graphs, triangular tables, and Taguchi’s concepts of parameter and tolerance design. Extensive use of factorial and fractional factorial designs for measurement and attributes data. Analysis of variance and graphical interpretation of significant factors and interactions. Wide variety of industrial applications.

4121* Facility Location and Layout and Material Handling Systems. Prerequisites: 3813, 4014 and senior standing. Design principles and analytical procedures for locating and developing an overall functional relationship plan and the methods for materials receipt, storage and movement for either an industrial or service oriented industry. Product-quantity analysis and material flow, and information routing warehouse design, various layout methodologies, and their measures of merit. Introduction to material handling methods and technologies including automated systems. Case studies and field trips are required.

4323* Manufacturing Systems Design. Prerequisites: 3313, 3503. Principles and procedures related to the design, implementation, documentation, and control of manufacturing systems. Consideration of transfer lines, numerical control, flexible automation, robotics, and manufacturing support activities such as cost, quality, and materials control. Introduction to basic computer-aided design and computer-aided manufacturing (CAD/CAM).

4413* Industrial Organization Management. Issues, concepts, theories and insights of management with a focus on productivity. Application of management, emphasizing effective performance.

4613* Production Control. Prerequisite: 4014. Concepts of planning and control of production environments. Design of operation planning and control systems. Technologies used in demand forecasting, operations planning, inventory control, scheduling, and progress control. A production simulator is used to provide a realistic application experience.

4713* System Simulation. Prerequisites: 4014, STAT 4033. Simulation of discrete-event systems. Problem formulation, translation to a computer model, and use of a model for problem solution. Simulation concepts and theory including random variable selection and generation, model validation and statistical analysis of results. Use of GPSS and survey of other languages and related simulation tools.
4723* Information Systems for Management Decisions and Control. Prerequisite: 3703. Systems engineering methodology applied to the design of information systems for management of all types of organizations. Data base management systems. Distributed and centralized systems. Different phases of system design and implementation.

4823* Industrial Ergonomics. Lab 3. Prerequisite: 3813. Characteristics of humans, equipment, and work environment examined using a systems approach. Job designs that concurrently emphasize multiple goals of productivity, safety and employee satisfaction, investigation of psychological, social, safety, reward, training and ergonomic parameters that affect work life of both employee and supervisor.

4913 Senior Design Projects. Lab 6. Prerequisite: limited to students in the final semester of their professional program. Student teams work on professional-level engineering projects selected from a wide range of participating organizations. Projects are equivalent to those normally experienced by beginning professionals, and require both oral and written reports. (Open only to students in industrial engineering and management.)

4923 Energy and Water Management. Prerequisites: 3503, ENSC 2213, 2613. Design, implementation and management of energy and water management programs. Energy and water conservation through energy sources, safety and security of fuel storage, contingency planning and use of standby fuels, and choice of rate schedules. Improvement of profits through optimal energy and water utilization. Outside speakers when appropriate.

4931 Industrial Engineering and Management Seminar. Prerequisite: senior standing. Designed to orient seniors to their professional work environment. Topics include placement procedures, resume construction, interviewing skills, professional dress, graduate school, professional societies and registration, personnel management of time and money, and job-related expectations. Taught by senior faculty; utilizes outside speakers.

5000* Research and Thesis. 1-6 credits, maximum 6. Prerequisite: approval of major advisor. Research and thesis for master's students.

5003* Statistics and Research Methods. Prerequisite: STAT 4033. Statistical and research methods used in various areas of industrial engineering including problem definition, managing the research process statistical methods and analysis tools, survey vs. experimental research techniques.

5010* Industrial Engineering Projects. 1-6 credits, maximum 9. Prerequisites: consent of school head and consent of major advisor. Special graduate projects and independent study in industrial engineering.

5013* Linear Modeling. Prerequisite: 4014 or equivalent. Model formulation and modeling of linear optimization problems using linear programming and network optimization techniques. Product mix, blending, staffing and covering, and multi-period planning models. Formulation of network problems as linear programming models, including maximum flow, minimum cost, and capacitated flow networks.

5020* Graduate Engineering Practicum. 1-3 credits, maximum 3. Prerequisites: consent of IEM advisor and 12 credit hours of IEM 5000- or 6000-level courses. Professionally supervised experience in real-life problem solving involving projects for which the student assumes a degree of professional responsibility. Activities approved in advance by the instructor and must reflect graduate level analysis. May consist of full or part-time engineering experience, on-campus or in industry, or both, either individually or as a responsible group member. Periodic reports both oral and written required as specified by the adviser.

5023 Optimization Applications. Prerequisite: graduate standing. A survey of various methods of unconstrained and constrained linear and non-linear optimization. Applications of these methodologies using hand-worked examples and available software packages. Intended for engineering and science students. Same course as CHE 5703, ECEN 5703 and MAE 5703.

5030 Engineering Practice. 1-9 credits, maximum 12. Prerequisite: approval of advisor. Professionally supervised experience in a real-life problem involving authentic projects for which the student assumes a degree of professional responsibility. Activities must be approved in advance by the student's advisor. May consist of full or part-time engineering experience, on-campus or in industry, or both, either individually or as a responsible group member. Periodic reports both oral and written required as specified by the adviser.


5043* Nonlinear Optimization. Prerequisite: 5033 or equivalent. Theoretical and practical aspects of nonlinear optimization, integer optimization, and nondifferentiable optimization. Development and application of nonlinear optimization techniques for unconstrained and constrained problems; sequential search, gradient, penalty and barrier, and projection methods. Development and application of integer and mixed integer techniques for unconstrained and constrained problems; branch and bound, and cutting methods.

5093* Special Topics in Operations Research. Prerequisite: graduate standing and consent of instructor. Special and contemporary topics relevant to professional practice. Elements of quality systems, quality initiatives, automated quality control, quantitative methods in quality assurance, contemporary models in quality, reliability and maintainability, and process design and integration.

5103* Breakthrough Quality. Prerequisites: 4103 and 4113 or equivalents. Structured, systematic approach and advanced statistical and modeling tools to improve products and processes across all areas of an enterprise. Rigorous application, integration, and betterment of strategies and tools for improving or redesigning products and processes such that performance gains are noticeably higher or quicker than those achieved under traditional incremental improvement approaches.

5113* Strategic Quality Leadership. Prerequisites: STAT 4013 or equivalent. Quality-related strategies. Critical elements that differentiate high performing organizations from their competitors. Delivering value to customers. Quality leadership, strategic planning, customer value, learning organizations, knowledge management, quality systems, and business results.

5123 Service Quality. Prerequisites: STAT 4013 or equivalent. Theory and application of service quality, including characteristics of services (intangibility, heterogeneity, perishability and inseparability of production and consumption), dimensions of service quality, measurement methodologies for service quality and improvement methodologies for service quality. Certification and accreditation processes for service industries.

5133* Stochastic Processes. Prerequisites: MATH 2233, MATH 3013, STAT 4113. Definition of stochastic processes, probability structure, mean and covariance function, the set of sample functions. Renewal processes, counting processes, Markov chains, birth and death processes, stationary processes and their spectral analyses. Same course as STAT 5133 and MATH 5133.

5143* Reliability and Maintainability. Prerequisites: STAT 4033 or equivalent. Probabilistic failure models of components and systems. Detailed study of reliability measures, and static and dynamic reliability models. Classical and Bayesian reliability testing for point and interval estimation of exponential and Weibull failures. Reliability optimization through allocation and redundancy. Fundamentals of maintainability.

5153* Process Design and Integration. Prerequisite: STAT 4033 or equivalent. Process design, integration, control, and improvement within and between enterprises. Analytical and systems approaches to address physical and statistical characterization of inputs, transformations, and outputs. Modeling issues, including process mapping, cause and effect analysis, and impact projection. Purpose, linkages, value, leverage, measurement, creativity and leadership.

5193* Special Topics in Quality and Reliability. Prerequisites: graduate standing and consent of instructor. Special and contemporary topics relevant to professional practice. Elements of quality systems, quality initiatives, automated quality control, quantitative methods in quality assurance, contemporary models in quality, reliability and maintainability, and process design and integration.

5203* Advanced Facility Location and Layout and Material Handling Systems. Prerequisites: 3503, 4014, 4203. A continuation and expansion of topics covered in 4203 with an emphasis upon model development for predicting and evaluating the effectiveness of production and/or service systems. Advanced analytical and computer techniques.
5303\textsuperscript{*} Computer Integrated Manufacturing Systems Design for Higher Volume Products. Prerequisites: 4613, 3313 or equivalents. Principles and procedures related to the design, implementation, documentation, and control of manufacturing systems focusing on higher volume, lower production rate. Development of information systems and the application of artificial intelligence (AI) and computer-aided manufacturing (CAM); design methodology and the need for absolute minimization of unit costs. Product and production system design, analysis, and operation for fixed automation. Optimization of manufacturing and applicable system concepts, especially those relating to line design, analysis, efficiency, and unit production cost reduction.

5313\textsuperscript{*} Computer Integrated Manufacturing Systems Design for Lower Volume Products. Prerequisites: 3313, 4613, 4723 or equivalents. Principles and procedures for design, implementation, documentation, and control of manufacturing systems focusing on lower volume, higher product variety production systems. Product life cycle concepts, concurrent engineering, and computer-aided design and manufacturing practices for systems characterized by frequent product, product mix or product volume changes. Product and production system design and analysis for flexible automation. Operational philosophies and applicable systems engineering concepts, especially those providing system flexibility and those regarding the critical role of information availability and exchange in rapidly changing environments.

5350\textsuperscript{*} Industrial Engineering Problems. 1-6 credits, maximum 6. Prerequisite: approval of major adviser. A detailed investigation into one area of industrial engineering with a required written report.

5363\textsuperscript{*} Management of Cellular Manufacturing Systems. Prerequisites: graduate standing and consent of instructor. Issues related to cellular manufacturing systems, including group technology, production control, cell formation and design, office cells, industrial relations, performance measurement, just-in-time and implementation.

5393\textsuperscript{*} Special Topics in Manufacturing Systems. Prerequisites: graduate standing and consent of instructor. Special and contemporary topics relevant to professional practice. Design practices, computer-aided manufacturing, production systems and control, cellular manufacturing, lean manufacturing, and automation.

5413\textsuperscript{*} Managing the Engineering and Technical Function. Prerequisite: 4413 or equivalent industrial experience. Advanced study of the engineer and technical organization. Engineering and technical functions, management process, roles, and activities. Individual study of current technical management issues of student interest.

5493\textsuperscript{*} Special Topics in Engineering Management. Prerequisites: graduate standing and consent of instructor. Special and contemporary topics relevant to professional practice, including engineering and technology management, leadership, project management, economic analysis, performance measurement and incentives, organizational improvement, and human factors.


5603\textsuperscript{*} Project Management. Prerequisite: 4413 or equivalent. A systems approach to planning, organizing, scheduling and controlling projects. The behavioral and quantitative aspects of project management. Importance of working with personnel as well as technology. Project management software utilized.

5613\textsuperscript{*} Integrated Manufacturing Control Systems. Prerequisite: 4613. Application of computer-aided design and computer-aided manufacturing systems characterized by dedicated production equipment and the need for absolute minimization of unit costs. Product and production system design, analysis, and operation for fixed automation. Optimization of manufacturing and applicable system concepts, especially those relating to line design, analysis, efficiency, and unit production cost reduction.

5623\textsuperscript{*} Project Planning and Control Technologies. Prerequisites: graduate standing and consent of instructor. Project planning and control technologies including time and cost resources required to accomplish projects related to manufacturing, service, and software development enterprises. Project planning and control software: purpose, methods of use, progress reporting, deviation correction, and validation issues.

5632\textsuperscript{*} Advanced Production Control. Prerequisites: 4014, 4613, corequisite: 5003. Advanced concepts and quantitative techniques used in production planning and control, including demand forecasting using regression, time series analysis, and Box-Jenkins models, mathematical programming approaches, to aggregate planning and job shops, the use of stochastic and dynamic scheduling of machines and cells, and independent demand inventory management. Deterministic and stochastic models and their relationship to Just-in-Time and Zero Inventory practices.

5703\textsuperscript{*} Discrete Systems Simulation. Prerequisite: 4713. Discrete-event systems via computer simulation models. Model building and the design and analysis of simulation experiments for complex systems. Application to a variety of problem areas. Use of ARENA simulation language.

5713\textsuperscript{*} Statistical Topics in Simulation Modeling. Prerequisite: MATH 4033 or equivalent. A level graduate course in simulation modeling of discrete-event systems. Modeling of input processes, random variate generation and analysis of simulation output. Methods applied to any discrete-event simulation.

5723\textsuperscript{*} Data, Process and Object Modeling. Prerequisites: graduate standing or consent of instructor. Logical and physical models in the analytical design and implementation of enterprise systems. Structured and object-oriented analysis and design techniques. Data modeling using entity-relationship diagrams and IDEFix. Data normalization techniques. Process modeling using data flow diagrams, IDEF0, IDEf3, and Petri nets. Object modeling using the unified modeling language (UML).

5743\textsuperscript{*} Information Systems and Technology. Prerequisites: graduate standing or consent of instructor. Focus on managing and designing enterprise information technology. Information systems and technology to lead the specification, selection, implementation, and integration of information technology in manufacturing and service organizations. Management issues involved in the use of information technology in organizations.

5753\textsuperscript{*} Manufacturing Enterprise Modeling. Prerequisites: 5723 or equivalent. Generic Enterprise Reference Architecture (GERAM). Review of data, process, and object modeling techniques. Overview of enterprise modeling tools, methods, and architectures including the CIMOSA method and architecture, IDEF modeling tools, SAP's event-driven process chain (EPC) model, Baan's Dynamic Enterprise Modeling (DEM) approach, and integrated enterprise modeling (IEM) using the object-oriented (OO) approach. Role and scope of methods and tools in enterprise analysis, design and improvement. Emerging modeling frameworks and techniques for next-generation enterprises.

5763\textsuperscript{*} Supply Chain Strategy. Prerequisites: 4613 and 5503 or equivalents. Supply chain strategy including the philosophical base of business practice and the analytical base of modeling. Supply chain strategy, including key objectives and financial considerations, supply chain dynamics, supply chain performance measurement, supply chain integration, characteristics of different supply chains and supply chain performance modeling.

5773\textsuperscript{*} Supply Chain Modeling. Prerequisites: 4713 or 5703; 5013 or 5503 or 5763; or equivalents. Supply chain analysis using different approaches to the supply chain modeling, including the Supply Chain Council's SCOR (Supply Chain Operations Reference) model, optimization and simulation. Specialized software is used to develop each modeling approach.

5793\textsuperscript{*} Special Topics in Enterprise Systems and Supply Chains. Prerequisites: graduate standing and consent of instructor. Special and contemporary topics relevant to professional practice, including enterprise-wide information systems, supply chain systems, and large-scale systems modeling.


5813\textsuperscript{*} Performance Measurement Systems. Prerequisites: 3813, 4413 or equivalents. Strategies and methods to define, measure, and apply individual, group and organization performance metrics in a variety of service and production contexts. Implementation and effective use of metrics. Measurement's role in a management system, managerial decision styles and preferences, operational definitions of performance, processes for identifying and applying metrics, performance measurement tools and techniques, data collection, portrayal of quantitative and qualitative information, and the role of computer technology in measurement system application.
5823* Performance Management and Improvement. Prerequisites: 3813 and 4413 or equivalents. Philosophies and approaches for managing and improving organizational-, group-, and individual-level performance. Historical roots, theoretical foundations, implementation and use, and demonstrated efficacy of these approaches in production and service contexts. Planning, leadership, employee involvement and teams, culture, technology, training, and measurement and reward.

5913 Decision-making Models for Multi-objective Analysis. Prerequisite: 4014. Quantitative and qualitative aspects of multiple-criteria decision making. Dynamics of the decision process are examined and the multi-objective nature of most managerial decision problems is illustrated. General concepts and solution methodologies of the multi-objective problem. Multi-objective linear programming, goal programming, and compromise programming. Attribute importance, risk measurement, and utility measurement.

5923* Advanced Energy and Water Management. Prerequisite: 4923. Continuation of material covered in 4923 with an emphasis on modern management techniques. Cogeneration, energy management control systems, private purchases of gas, energy accounting. Significant case study or term paper required.

5943* Hazardous Material and Waste. Prerequisites: 3503 or equivalent, CHEM 1515. Management of hazardous materials and waste by the generator to reduce operating costs and protect employees. Emphasis on hazard communications program, reducing volume and toxicity, and management activities.

5993* Special Topics in Facilities, Energy, and Environmental Management. Prerequisites: graduate standing and consent of instructor. Special and contemporary topics relevant to professional practice. Topics include elements of facilities design and maintenance, energy management, and waste management.

6000* Research and Thesis. 1-15 credits, maximum 30. Prerequisites: approval of major adviser and advisory committee. Independent research for Ph.D. dissertation requirement under direction of a member of the Graduate Faculty.

6093* Advanced Topics in Operations Research. Prerequisites: graduate standing and consent of instructor. Advanced study and research in theoretical and applied topics in optimization techniques and models, simulation, applications and modeling, and stochastic models.

6110* Special Problems in Industrial Engineering. 1-6 credits, maximum 12. Prerequisites: consent of school Head and approval of major adviser. Special problems in industrial engineering and management under supervision of a member of the Graduate Faculty.


6193* Advanced Topics in Quality and Reliability. Prerequisites: graduate standing and consent of instructor. Advanced study and research in theoretical and applied topics in quality systems, quality initiatives, quality, reliability, maintainability, and process modeling and associated research methodologies, design of experiments, data collection, and analyses.

6243* Engineering and Technical Consulting. Prerequisite: 5413 or consent of instructor. Theory and practice of internal and external engineering and technical consulting. Investigation of the engineering and technical client interface, effective engineer consultations in relationship to existing organizational cultures and practice, and the engineering and technical practitioner's impact on organizational improvement.

6493* Advanced Topics in Engineering Management. Prerequisites: graduate standing and consent of instructor. Advanced study and research in theoretical and applied topics in engineering and technology management, leadership, project management, economic analysis, performance measurement and incentives, organizational improvement, and human factors.

6793* Advanced Topics in Enterprise Systems and Supply Chains. Prerequisites: graduate standing and consent of instructor. Advanced study and research in theoretical and applied topics in enterprise-wide information systems, supply chain systems, and large-scale systems modeling.

6993* Advanced Topics in Facilities, Energy, and Environmental Management. Prerequisites: graduate standing and consent of instructor. Advanced study and research in theoretical and applied topics in facilities design and maintenance, energy management, and waste management.

International Studies (INTL)

5010* Contemporary Issues in International Studies. 1-6 credits, maximum 6. Prerequisite: graduate standing. Study of contemporary international issues including news reports, speeches from foreign dignitaries, political leaders and experts in selected international fields.

5110* International Studies Practicum. 1-6 credits, maximum 6. Prerequisites: graduate standing and consent of adviser. For students studying for a master's degree in international studies under the creative component option.

5213* International Relations, Affairs and Policy. Prerequisite: graduate standing. Research on the mechanics and theories of interaction between economic and political phenomena. Same course as POLS 5213.

5223* Culture, History and World Systems. Prerequisite: graduate standing. Study of the impact and influence of culture and history on the development of contemporary world systems with future projections.

5233* Global Competitive Environment. Prerequisite: graduate standing. Development of a global business strategy for the organization. Issues of highly diversified markets and business environments, global competition, financial markets, and complex organizational relationships. Same course as MBA 5233.

Japanese (JAPN)


3112 (I)Advanced Japanese Conversation II. Designed to increase facility and naturalness of delivery in dialogue. Development of general oral and aural proficiency.

3133 (I)Readings in Japanese I. Development of the student's competence in reading a wide variety of materials by contemporary Japanese writers. Designed to be taken concurrently with 3223.

3333 (I)Readings in Japanese II. Prerequisite: 3133. A continuation of 3133.
Journalism and Broadcasting (J B)

1143 (S) Media and Society. An overview of the characteristics of newspapers, magazines, photojournalism, radio, television, film, advertising, public relations and interactive media, emphasizing the media's impact and role in American society. 2003

2003 Mass Media Style and Structure. Lab 2. Prerequisites: CS 1003, ENGL 1113 and ENGL 1213 with grade of "C" or better. Elementary writing and editing techniques in print, broadcasting and other media.

2013 Principles of Advertising. Process of advertising examined from the perspectives of art, business and communication. Introductory course for majors and non-majors that surveys advertising and how it fits into society. Applications of integrated marketing communication, consumer behavior, segmentation and target marketing, advertising research, creative and media strategy, international advertising and local advertising. 2183

2183 Principles of Public Relations. An introduction to the history, development and current practice of public relations as a process in building relationships between organizations and publics. 3013

3013 Advertising Media and Markets. Prerequisites: 2003, 2013. Introduction to the strategic use of media. Major principles of media planning and buying, audience measurement, media research, new media technology, and market segmentation. Television, radio, magazine, newspaper, outdoor and the Internet. 3153

3153 Fundamentals of Audio and Video Production. Lab 2. Prerequisite: 2003. Theory and practice of basic audio and video production techniques leading to later applications in radio, television and multimedia production. 3173

3173 History of Mass Communication. Growth and development of mass communication systems in America, with emphasis upon the economic, social and political interaction of the media. 3263

3263 Reporting. Lab 3. Prerequisite: 2003. Reporting and writing through enterprise techniques for news coverage. 3283

3283 Public Relations Communications Methods. Prerequisites: 2003, 2183. An analysis and application course focused on the communication methods and techniques used in the practice of public relations. 3293

3293 Visual Communication. Prerequisite: 2003. Use of photographs, charts, graphs and other visual representations in the mass media; the language of pictures; theories of nonverbal communication; visual aids in education and other information systems. 3313

3313 News Editing I. Lab 3. Prerequisite: 3263. Copy editing, design and headline writing for newspapers and magazines. 3383

3383 Public Relations Management and Strategies. Prerequisites: 2003, 2183. The practice and techniques of public relations as a management function in business, industry, agriculture, government, education and other fields. 3400

3400 Journalism, Advertising and Public Relations Laboratory. 1-3 credits, maximum 3. Prerequisite: junior standing and consent of instructor. Laboratory and/or internship practice for qualified students who wish creative communications experience beyond that available in the classroom. 3593

3593 Broadcast News Writing I. Lab 3. Prerequisites: 3153, 3263. Broadcast news writing and reporting techniques with emphasis on radio coverage. Familiarization with news values, news services, broadcast equipment. Lab work in news reporting and writing. 3603

3603 Advertising Copywriting. Lab 2. Prerequisites: 2003, 2013. An examination of the language of advertising. In-depth skills development in commercial writing for print, broadcast, and direct mail. 3623

3623 Internet Communications. Lab 2. Prerequisite: 2003. Theoretical and practical understanding of how the Internet is changing the way mass media and media-related organizations communicate with audiences. 3753

3753 Graphic Communication. Lab 3. Creative and practical aspects of typography, layout and design, and production of printed communication. 3800

3800 Broadcast Operations. 1 credit, maximum 2. Lab 2. Prerequisite: 3153. Preparation and participation in the operation and coordination of student managed radio and television facilities. 3803

3803 Advertising Layout and Design. Prerequisite: 3603. A comprehensive look at the design of print advertising, magazine, outdoor, direct mail, and others. Lab component offers hands-on instruction and skills development. 3823

3823 Photography I. Lab 3. Taking and processing photographs: cameras, lenses, films, printing, and developing; essentials of good pictorial composition. For students who want an elementary understanding of photography, or to prepare for advanced work in photography or photojournalism. 3843

3843 Sports Journalism. Lab 2. Prerequisite: 3263. Reporting skills to cover the sports beat and an understanding of the history of sports journalism and sports and culture in America. Reporting, feature writing and column writing in sports for print journalism. 3873

3873 Audio Production. Lab 2. Prerequisite: 3153. Theory and practice of communication using electronic media. Students prepare and present materials in a broadcasting situation. 3900

3900 Radio-Television Laboratory. 1-2 credits, maximum 3. Prerequisite: 3153 and consent of instructor. Preparation and participation in all phases of radio-television and cable through active internship program. 3913

3913 Video Production. Lab 3. Prerequisite: 3153. Television production techniques, including camera, audio, lighting, staging, producing, graphics and on-camera performance. 3943

3943 Photographic Journalism. Lab 2. Prerequisite: 2003. Theory and practice in the digital techniques of photographic journalism. Intermediate concepts of light, composition, action and story telling via digital photography. A basic understanding of photography and photo developing necessary. Must have access to 35mm single reflex or digital camera. 4033

4033 Communication Technology. Prerequisite: 2003. Overview of satellite delivery of print media, radio, television and cable program services, data services, computer technology; public relations and advertising uses of the new technologies. 4163

4163 Mass Communication Law. Prerequisite: 2003. Stausted in region-specific realities. The political, economic, social, cultural and historical forces determining media practice in a global environment. Meets with MC 5163. No credit for students with credit in MC 5163. 4223

4223 Media Sales and Marketing. Prerequisite: 2003. Sales development, pricing, promotion and other aspects of broadcast sales and sales management. 4243

4243 Programs and Audiences. Prerequisite: 2003. Audience analysis, proper construction of programs for greatest appeal and use of appeals to attract the desired audience. Program types, rating systems, program selection and audience attention. Design and discussion of programs to reach specific audiences. 4253

4253 (International Mass Communications. Examination of the nature and flow of news and information within and among nations, states and societies from a theoretical vantage point grounded in the political, economic, social, cultural and historical forces determining media practice in a global environment. Meets with MC 5253. No credit for students with credit in MC 5253. 4263

4263 Broadcast Management. Prerequisite: 2003. Functions, structure and organization of the broadcasting industry; special problems in broadcast station management, including personnel, sales, programming and government regulations. 4313

4313 Public Affairs Reporting. Lab 5. Prerequisite: 3263. Coverage of social problems, people and events in fields of government, business, science, sports and entertainment. 4360

4360 Special Problems in Journalism and Broadcasting. 1-3 credits, maximum 6. Prerequisites: junior standing, a minimum of 3.00 GPA, or consent of instructor. Independent study and project development to fit the student's major or minor specialization. 4393

4393 Computer-Assisted Journalism. Lab 6. Prerequisites: 3263, STAT 213. Access by news media and communication specialists to electronic sources of information primarily through the Internet. A skills course in understanding and applying ways to obtain and share information through computer access. 4413

4413 Advanced Reporting and Writing. Lab 5. Prerequisite: 4313. Enhancement of writing style and reporting techniques; evaluation of sources and polling practices, and investigative coverage of newsmakers and events.
The advanced design skills necessary to competing, television, web-based streaming and advertising is prepared for electronic media, site: 3603. A concentrated examination of how Electronic Media Advertising from conception to presentation. Satisfies teams produce all aspects of the campaign, campaigns for national or local clients. Student comprehensive advertising and marketing campaigns. Planning, preparation and presentation of communication to create maximum clarity and impact. Communication elements including advertising, public relations, direct marketing, sales promotion and examine strategies for combining and integrating them into an effective campaign. Theories, models and tools to make better promotional communication decisions. Meets with MC 5520. No credit for students with credit in MC 5520.

Lab 2. Prerequisite: 2003. Basic issues, theoretical concepts and special procedures associated with managing newspapers, magazines, advertising, public relations, broadcast and cable companies and firms specializing in computer-mediated communications. Meets with MC 5863. No credit for students with credit in MC 5863.

Lab 3. Prerequisite: 3913 or 4553. Advanced professional television production. Student produced and directed television programs, including "specials," for distribution on cable or other professional media.

Student Honors Thesis. Prerequisites: departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a faculty mentor with second faculty reader and oral examination. Required for graduation with departmental honors in journalism and broadcasting.

Broadcast Documentary. Lab 3. Prerequisites: 3553, 3913. Student-written and produced broadcast and cablecast mini-documentaries; analysis of selected programs.

Lab 2. Prerequisite: 2323, MKTG 3213. Planning and the value of coordinating the English media. Computer graphics applications including mechanical drafting and lettering techniques, understanding contours, principles of stormwater runoff, site grading and earthwork calculations, methods of managing stormwater runoff, erosion control, introduction to paving and drainage construction materials, specifications, cost estimating. Semester project covering grading, drainage, cut and fill, stormwater runoff, specifications, and cost estimating. Utilizing AutoCAD and other computer applications.

Landscape Architecture (LA)

Introduction to Landscape Architecture and Landscape Contracting. An overview of the field of landscape architecture and landscape contracting with emphasis on the role of the landscape architect and the need for design and management of outdoor space and structures and the environment.

Landscape Architecture Graphics I. Lab 6. Recommended: 3 hours credit in freehand drawing or drafting. Drafting and illustration techniques for developing and presenting landscape concepts and designs in black and white media. Computer graphics applications including illustration, typesetting, scanning and visualization techniques.

Landscape Architecture Graphics II. Lab 3. Prerequisite: 2213. The application of multimedia color presentation and delineation techniques to more complex plans, drawings and programs.

Computer-aided Design. Lab 2. Prerequisite: 1013, 2213. Introduction to computer operating systems. Principles of electronic drafting and visual communication techniques related to the landscape for two-dimensional and three-dimensional systems

Internship in Landscape Architecture and Landscape Contracting. 1-6 credits, maximum 6. Prerequisites: 45 credit hours, consent of internship chairperson. Supervised work experience with approved public and private employers in landscape architecture, landscape contracting or related fields. May not be substituted for other required courses.

Landscape Architecture Seminar I. Prerequisite: 1013. Professional analysis of various aspects of the landscape architecture profession and designed works with guest speakers and in-state or regional field trips to completed works. Required of fourth year students.

Landscape Architecture Design I. Lab 8. Prerequisites: 1013, 2223 and 2323. Introduction to the principles of design, problem solving, site analysis, and the correlation of aesthetic concerns with functional solutions in small-scale landscape architecture design problems and computer-aided design applications.

Landscape Architecture Design II. Lab 8. Prerequisite: 3314. The design of small to medium scale areas with an emphasis on design process, site analysis and computer-aided design applications.

(H)History and Theory of Landscape Architecture. History and historic styles and approaches to landscape architectural design. Past and present landscape design theory.

Land Use and Community Planning. Lab 3. Prerequisite: 3313. The inventory and analysis of natural and man-made landscape resources and their application to land use and community planning within the framework of a municipality's comprehensive plan and regulations.

Landscape Architectural Design V. Lab 8. Prerequisite: 4424, 4894. The design of large-scale sites with an emphasis on mixed use developments and computer-aided design applications.

Landscape Architectural Design VI. Lab 10. Prerequisite: 4514. A capstone course with a large scale development project in urban design, recreation or resource planning with computer-aided design applications, summarizing previous planning, design and construction course work.

Landscape Architecture Vertical Design Studio. Lab 8. Prerequisite: 2223. Individual studio projects geared to design, course level. Offered on demand. Can be substituted for one landscape architecture design course (LA 3314, 3324, 4414, 4424, 4514, or 4524).

Recreation Planning. Lab 6. Prerequisite: consent of instructor. Theory and methods for small and large scale area planning with emphasis on natural and cultural resources.

Landscape Environmental Planning. Lab 6. Prerequisite: 3324. Development of landscape architectural projects in the context of conservation, preservation, urban, regional planning and other developmental design problems encountered by the landscape architect.

Landscape Architecture Assembly. 1 credit, maximum 4. Presentations by faculty members and guest speakers dealing with various aspects of landscape architecture or related fields.

Landscape Architectural Construction III. Lab 4. Prerequisites: 2323, 3324, 3884. A capstone course utilizing design techniques, computer skills, construction materials, methods and applications for the landscape industry. Detailed computerized construction drawings of pavement, fences, walls, wood structures, irrigation, and water features will be prepared. Comprehensive construction documents are required as a semester project utilizing computer drafting, design and calculation applications.

Landscape Architecture Special Problems. 1-6 credits, maximum 12. Prerequisite: consent of appropriate faculty member. Landscape architectural related problems.

Advanced Special Problems. 1-12 credits, maximum 20. Prerequisite: consent of appropriate faculty member. Specific landscape architectural problems.

Latin (LATN)

Elementary Latin I. The rudiments of beginning Latin: grammar, vocabulary and elementary readings.

Elementary Latin II. Prerequisite: 1113 or equivalent proficiency. Continuation of 1113. Grammar, vocabulary and readings.

Elementary Latin III. Prerequisite: 1223 or equivalent. A continuation of 1223. Grammar and readings of Latin authors.

Intermediate Readings. Prerequisite: 2113 or equivalent proficiency. Readings from Virgil's Aeneid.

Advanced Readings in Latin. 1-6 credits, maximum 9. Prerequisite: 2213. Prose authors, poetry, and medieval Latin.

Legal Studies in Business (LSB)

Law in Society. Forms and types of law and their evolution, including antitrust, ecology, consumerism and civil rights. Political, social and economic forces affecting legal developments. Legal needs of society and the probable future direction of the law.

Special Topics in Legal Studies in Business. 1-3 credits, maximum 6. Prerequisites: 3213, prior consent of instructor. Analysis of a contemporary topic in business law. Changing social issues and trends in legal studies in business.

Legal and Regulatory Environment of Business. Prerequisite: junior standing. General concepts regarding the nature of the legal system, ethical issues in business decision making, dispute resolution processes, basic constitutional limitations on the power of government to regulate business activity, the nature of government regulation, fundamental principles of tort and contract law.

Law of Commercial Transactions and Debtor-Creditor Relationships. Prerequisite: 3213. Concentrated study of law relating to certain commercial transactions and debtor/creditor relationships. Includes law of sales, negotiable instruments, secured transactions, suretyship and bankruptcy.

Employment Law. Prerequisite: 3213 or equivalent. Legal foundations of employment in the United States. Contemporary topics relating to the employment environment such as state legislative and judicial limitations on employment at will doctrine, federal legislation relating to equal employment opportunity and affirmative action, fair labor standards, safety in the workplace and state workers compensation laws.

Law of Business Organizations. Prerequisite: 3213. General principles of law relating to the formation, operation and termination of various forms of business organizations. Includes a study of the law of agency, partnerships and corporations.

Law of Real Property. Prerequisite: 3213 or equivalent. Nature of real property and of the legal transactions relating thereto. Topics may include deeds and conveying, landlord-tenant relationships, mortgages, easements, oil and gas interests, types of estates, joint ownership, and legal descriptions.

([Legal Aspects of International Business Transactions. Prerequisite: 3213 or equivalent. Legal aspects of operating a business entity engaged in international commerce. Topics may include: foreign business organizations, U.S. taxation of foreign investors, common clauses in transnational contracts, problems of technological transfer on the international market, anti-trust aspects of international business, and jurisdictional problems in resolving disputes.

Legal Environment of Business. Prerequisite: graduate standing. Legal environment within which business must operate. Nature and source of law, the operation of the judicial system, the operation of administrative agencies, selected Constitutional provisions frequently involved in litigation of business problems, and selected substantive legal areas having a direct relationship with business operation and decision making.

Leisure (LEIS)

Beginning Swimming. Lab 2. Theory and practice of swimming strokes; techniques and basic water safety skills.

Beginning Golf. Lab 2. Theory and practice of basic skills, rules, terminology and etiquette.

Beginning Tennis and Racketball. Lab 2. Theory and practice of tennis and racketball; basic skills, rules, terminology, and game strategy for singles and doubles play. No credit for students with credit in 1252.

Beginning Tennis. Lab 2. Theory and practice of basic skills, rules, terminology and game strategy for singles and doubles play. No credit for students with credit in 1242.

Bowling. Lab 2. Theory and practice of approaches, deliveries, releases and mechanical principles involved in aiming and follow through.

Physical Fitness. Lab 2. Theory and practice of aerobic and weight training activities with learning experiences designed to promote physical fitness.

Weight Training. Lab 2. Improvement of muscular strength and endurance in the major muscle groups of the body through progressive resistive exercise. Fundamental anatomy, physiology, mechanical principles, methods and techniques as applied to weight training programs.

Self Defense. Lab 2. Theory and practice of self-defense; scientific principles of gravity and body control over opposing forces, and principles of contest judo.

Rock Climbing. Lab 2. Theory and practice in the basics of technical rock climbing, bouldering and spelunking.

Backpacking and Hiking. Lab 2. Theory and practice of outdoor skills and leadership techniques for executing and evaluating a wilderness activity.

Intermediate Tennis. Lab 2. Prerequisite: 1252. Theory and practice of advanced serves and strokes; strategy for singles and doubles play; rules and competitive tennis.

Racquetball. Lab 2. Theory and practice of traditional social dances and a variety of "free style" dance forms.

Introduction to Leisure Services. The nature, scope and significance of leisure and recreation. Delivery systems for leisure services, major program areas and the interrelationship of special agencies and institutions serving the recreation needs of society.

Introduction to Therapeutic Recreation. Theory and application of therapeutic recreation with emphasis on types of illnesses and disabilities, delivery systems, programming and services.

Diversity in Leisure Services. An exploration of the primary and secondary dimensions of diversity and their impact on leisure. Responses of the leisure services profession to cultural diversity.

Laboratory in Leisure Studies. Lecture, discussion and experiential learning of principles and practices of group dynamics and teambuilding. Emphasis on organization, supervision, personnel. Fee required.

Foundation of Leisure Service Leadership. Lab 2. Introduction to the principles and practical applications of group leadership techniques, problem solving, supervision and evaluation of personnel.

Leisure Services Workshop. 1-3 credits, maximum 8. Intensive training program on a specialized topic in leisure services.


Outdoor Pursuits. Lab 1. Field based course to understand origins and components of involvement in outdoor pursuits. Numerous skills applied to various outdoor settings.

Practicum in Leisure Services. 1-3 credits, maximum 3. Prerequisites: 2413. Supervised practical experience with leadership responsibilities for planning, conducting and evaluating activities and programs. Graded on a pass-fail basis.


Program Design in Leisure Services. Emphasis on organization, supervision, promotion and evaluation of programs.

Evaluation of Leisure Services. Prerequisite: 2413, 3463 or consent of instructor. Methods, techniques and application of the evaluation process related to a wide variety of leisure service functions: clientele, programs, personnel, facilities and organization.

Principles and Clinical Practices in Therapeutic Recreation. Prerequisite: 2433 or consent of instructor. Clinical intervention techniques and strategies, including treatment techniques, leisure education and role of recreation in the treatment process.

Pre-Internship in Leisure Services. Preparation for internship in therapeutic recreation and leisure services management.

Directed Studies in Leisure. 1-3 credits, maximum 6. Prerequisites: consent of instructor and program head. Supervised readings, research or study of trends and issues related to leisure studies.

Water Safety Instructorship. Lab 1. Methods of teaching swimming and aquatic safety with practical application of knowledge, principles and analysis of skills. May obtain American Red Cross Water Safety Instructor's Certification (WSI).

Outdoor Education. Development of a holistic approach to teaching and learning in the outdoors. Learning in, about, and for, the out-of-doors as a process for acquiring skills with which to enjoy outdoor pursuits.

Areas and Facilities in Leisure Services. Prerequisites: 3463 or consent of instructor. Planning, design and development of areas and facilities in leisure service delivery systems.

Outdoor Recreation. Theory and practical application of outdoor recreation concepts with emphasis on philosophies, principles, policies, economics, trends and problems.

Internship in Leisure Services. 1-12 credits, maximum 12. Prerequisite: last semester senior year with cumulative GPA of 2.50. Supervised field work experience in leisure services management or therapeutic recreation. Graded on a pass-fail basis.

Senior Seminar in Leisure Services. Prerequisite: LEIS major. Culmination of course work in leisure studies. Examination of current issues, professional practices and personal philosophies of leisure.

Administration of Leisure Services. Decision making, problem solving, personnel policies, legal issues, fiscal policies and budget procedures related to the delivery of leisure services.

Leisure Education. Prerequisite: 3463. Models of leisure education discussed and practiced in conjunction with enhancing student's ability with basic skills of leisure. Counseling to facilitate optimal leisure pursuits.

Program Design in Therapeutic Recreation. Prerequisite: 3463 or consent of instructor. Systematic approach to the development, design and evaluation of therapeutic recreation programs.

Entrepreneurial Leisure Services. Prerequisite: 3463 or consent of instructor. Introduction to the scope, characteristics and management aspects of the commercial recreation industry from an entrepreneurial perspective.

Leadership in Experiential Education. An investigation of leadership styles and management models with an application to adventure based education.

Technical Management in the Wilderness. 1-6 credits, maximum 6. Developing technical competencies in back country navigation, emergency medical care and evaluation, winter Nordic mountaineering, technical rock climbing, hazard analysis and expedition planning.

Grantwriting and Fund-raising in Non-profit Agencies. Methods, techniques and direct experience in acquiring funds and in-kind resources necessary for the operation of philanthropic agencies.

Managing Non-profit Agencies. Management skills necessary for the development and ongoing operation of a non-profit agency.

Advanced Methods in Therapeutic Recreation. Prerequisites: 3463 and consent of instructor. Theoretical and practical examination of contemporary implementation procedures used in therapeutic recreation practice.

Master's Thesis. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Advanced instruction on specialized topic area in leisure studies.

Legal Aspects of Health, Physical Education and Leisure Services. The application and interpretation of the law as it applies to teachers, coaches and administrators of health, physical education and leisure services programs.

Field Problems in Leisure Studies. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Applied research within the practice of leisure studies.

Interpretation in Leisure Services. Organization and administration of visitor centers and interpretive naturalist programs, philosophic approaches, and methods for interpreting the natural and cultural history of public parks and recreation areas.

Organization and Administration of Leisure Services. Current issues related to the leisure services profession. Investigation, discussion and analysis of contemporary issues.

History and Philosophy of Leisure. Contributions of recreation and leisure and its effect on humans throughout history. Additional philosophical foundations in relation to current times.

Social Psychology of Leisure. Inquiry into the understanding of human behaviors, thoughts and attitudes related to leisure, and the understanding of complex issues related to the social psychology of leisure.
4313* Young Adult Literature. Survey of print and non-print materials, including multicultural and multi-ethnic materials, for young adults from middle school through high school. History, criticism, selection and evaluation of young adult literature and exploration of its relation to the needs and interests of young people. Same course as CIED 4313.

5013* Library Media Center in the Schools. Effective utilization of the centralized school media center for the teaching-learning process.

5113* Selection of Print and Non-print Materials. Selection, evaluation and use of print and non-print materials including reference materials.

5413* Cataloging and Classification. Basic principles of cataloging, with practice based on functional application of current codes and manuals recognized by the profession.

5613* Library Networks and Databases. Introduction to the organization, retrieval and evaluation of information found in research libraries and on the Internet. Development of information-seeking competencies using both print resources and electronic databases.

5823* Administration of Library Media Programs. Selecting and purchasing equipment and materials for the school library media program, evaluating existing materials, for teachers who are responsible for school library media programs.

Management (MGMT)

3013 Fundamentals of Management. Management principles and techniques of analysis. Decision making as applied to management systems, organizations, interpersonal relationships and production. Does not apply to a College of Business Administration major.

3123 Managing Behavior and Organizations. Prerequisite: STAT 2023 or equivalent; junior standing. Managing behavior and organizations with an emphasis on performance. Process differences and performance expectations at the individual, team and organizational levels. Understanding of the components and dynamics of managerial and organizational behavior with the emphasis on management applications.

3133 Management Performance Development. Prerequisite: 3123. The study of personal, interpersonal and group factors relating to managerial performance. An integration of the theory and practice of management.

3213 Human Resource Management. Prerequisite: 3123. Policies and practices used in personnel management. Focuses upon the functions of a human resource management department.

4123 Labor Management Relations. Prerequisite: 3123. Labor relations and collective bargaining. Negotiation and administration of labor agreements and employee relations in non-union organizations. Modes of impasse resolution.

4133 Compensation Administration. Prerequisites: 3313, STAT 2023. Introductory course. Fundamentals of compensation such as the legislative environment, compensation theories, job analysis, job evaluation, wage structures and indirect compensation programs.

4213* Managing Diversity in the Workplace. Diversity in the workplace as a business issue that affects performance. Companies’ adaptation and alignment with the population they serve or represent. The development of a cohesive work team made up of individuals who differ in gender, age, race and national origin.

4413 Change Management. Prerequisite: 4313 or equivalent. Managing organizational change and redesign. The study of organizational change processes and the enhancement of performance through change management. Strategies and techniques for facilitating organizational change.

4533* Leadership Dynamics. Prerequisite: MGMT 3123 or equivalent. Leadership applications in business management. The business environment, organizational challenges require managerial leadership of the highest order. Students will be exposed to the latest developments in leadership theory and research. A cornerstone of the course will be the emerging construct of transformational leadership. The course emphasizes readings, class discussions, experiential exercises, and group projects to facilitate learning.

4613 International Management. Prerequisite: 3123. Survey of the organization, planning and management of international operations of business firms. Exploration of major cultural, economic and political settings, and their effects on the management function.

4713* Conflict Resolution in Industry. Prerequisite: 3123. An integrated and interdisciplinary approach to the issues of industrial conflict and conflict resolution. An analytical development stressing both theory and empirical research. Models of conflict, conflict between the individual, group and the organization; economic conflict and industrial conflict.

4813* Advanced Human Resource Management. Prerequisite: 3313. Management of human resources at the organization level including employment regulations law and human resource planning.

5113* Management and Organization Theory. Prerequisite: admission to MBA program or consent of MBA director. Contemporary theories of organization. Structure and dynamics of organizational goals and environments.

5123* Organizational Design and Research. Prerequisite: admission to MBA program. Contemporary consent of MBA director. An analysis of research which integrates theory and design of organizations. Reviews empirical research findings and stresses methods of organizational analysis; design and modification of organizations.

5213* Seminar in Organizational Behavior. Prerequisite: admission to MBA program or consent of MBA director. Current research on group behavior in organizations. Group processes and structural factors affecting the interaction process and intra- and intergroup performance characteristics. Laboratory simulation and team research projects used to pursue advanced topics.

Library Science (LBSC)

1011 Library and Internet Information Competencies. Introduction to the organization, retrieval and evaluation of information found in research libraries and on the Internet. Development of information-seeking competencies using both print resources and electronic databases.
5223* Seminar in Human Resource Management. Prerequisite: 5113 or consent of instructor. Principles, theories, and practices of human resource management applied to various types of organizations. Human resource functions of planning, staffing, training and development, performance management, compensation and benefits, safety and health, and labor relations.

5333* Managing the Electronic Commerce Enterprise. Prerequisites: 5113 and admission to the MBA, MSTM, or MS in MIS/SAIS program or consent of instructor. Organizational issues faced by nascent internal electronic commerce enterprises and traditional "brick & mortar" organizations as they navigate their worlds as internet pure-plays or evolve into "click & mortar" organizations. Strategic alliances, experimental organizational forms, and organization of human resource systems.

5513* Advanced Strategic Management and Business Policy. Prerequisite: MBA core courses. A terminal integrating course with emphasis on formulating and implementing basic policy decisions for business. An analytic approach to strategic decisions pursued through readings, cases and participation in a complex computer game.

6553* Management of Technology and Innovation. Prerequisite: MBA core courses or consent of instructor. Business applications of research, practice, and theory in the management of technology and innovation. To improve the effectiveness by which technologies are developed, implemented, and institutionalized. Emphasizes both management with advanced technologies and strategic management of technology.

5713* Labor Relations and Collective Bargaining. Prerequisite: admission to MBA program or consent of MBA director. A first course in labor relations. The industrial relations system, collective bargaining, labor legislation, the economic effects of unionization and other contemporary labor relations issues.

6313* Advanced Organizational Behavior. Prerequisites: doctoral standing and consent of instructor. Theory and research focusing on individual and group behavior in organizations. Both classic and contemporary topics in organizational behavior, including work attitudes, motivation, job design, leadership, group processes, power and politics, and individual differences.

6323* Advanced Strategic Management. Prerequisites: doctoral student standing and consent of instructor. Research concerning the content of organizational strategy and the process through which it is formulated and implemented.

6333* Meso Organization Studies. Prerequisites: doctoral student standing and consent of instructor. Integration of macro- and micro-level concepts and topics across individual, group and organizational levels of analysis. Work and organization design, teams and groups, decision making, and conflict management.

6343* Contemporary Research in Management. Prerequisite: doctoral student standing and consent of instructor. Specialized contemporary topics in management for doctoral students.

6353* Advanced Methods in Management Research. Prerequisites: doctoral student status and consent of instructor. Course examines issues in theory building and development, strategies for collecting behavioral research. At conclusion of course, student should be able to: develop research questions, develop appropriate measures for constructs to be tested, and design research study using various methodologies.

6553* Structural Equation Modeling Applications in Business. Prerequisites: doctoral student standing and consent of instructor. Conceptual and statistical underpinnings of structural equation modeling and application to organizational and business research including measurement development and model testing. Recent advances in this technique. Hands-on experience with structural equation modeling software.

Management Science and Information Systems (MSIS)

2103 Business Computer Concepts and Applications. Prerequisites: 30 credit hours and MATH 1513. Computer concepts, terminology, and software applications. Overview of hardware and software components, file structures, management information systems, futuristic trends, database management systems, systems analysis and design, and data communications. Introduction to database, spreadsheet, and word processing software application packages and application programming.

2203 Computer Programming for Business. Prerequisite: 2103 or CS 2113 or equivalent. Computer programs for business applications using the COBOL language. File structures, file updating techniques, sorting, report writing, magnetic tape and disk file handling.

3103 Management Information Systems. Prerequisite: 2103 or equivalent. Information technology (IT) management and the development and use of management information systems in today’s business organizations. Use of global IT tools including on-line communication tools, software for data use and integration, and user interface and presentation tools.

3203 Advanced Computer Programming for Business. Prerequisite: 2203. Advanced programming features are examined with an emphasis on the development of computer programs for business application. File processing including magnetic tape sequential files, disk-indexed sequential files, and virtual storage applications are an integral part of the course. Subjects and techniques such as TSO, segmentation, debugging tools and procedures, and pertinent JCL are also studied and applied.

3223 Production and Operations Management. Prerequisite: MGMT 3123. Production and operations management utilizing a management science approach. Management decision-making techniques and their application to problems in production and operations management. Exponent of application, design and including linear programming and decision analysis.

3233 Management Science Methods. Prerequisite: 3223. Deterministic operations research techniques applied to the resource allocation and operational problems encountered in accounting, marketing, finance, economics and management. Linear programming and network models.

3243 Managerial Decision Theory. Prerequisite: 3223. Decision processes under risk and uncertainty. The use of models in business decision making with outcomes governed by probability distributions. Bayesian decision analysis, utility measurements, game theory, Markov chains, queuing, simulation probabilistic forecasting and inventory, network models, and dynamic programming.

3303 Business Systems Analysis. Prerequisites: 2103, 2203, ACCT 2203. Systems analysis as a profession and role of the systems analyst in the analysis, design, and implementation of computer-based business information systems. Current system documentation through use of classical and structured tools and techniques for describing flows, data flows, data structures, file designs, input and output designs, and program specifications. Information gathering and reporting activities and transition into system analysis and design.

3363 Advanced Management Information Systems Programming. Prerequisite: 2203 or equivalent. Programming tools with applications in industry. Advanced programming procedures, processes and algorithms.

3373 File and Data Management for Business. Prerequisite: 3363. A survey of business data storage methodologies and approaches and of file management methodologies for business enterprises.

4013* Data Base Management. Prerequisite: 2103 or equivalent. Theoretical aspects and management applications of data bases, file organization, and data models, with emphasis on hierarchical network and relational structures. Discussion of storage devices, data base administration, and the analysis, design and implementation of data base management systems.

4113* Systems Design and Development. Prerequisites: 3303, 4013. Business information systems design and development with coverage of essential systems analysis techniques. Theory and application of prototyping. Computer-aided software engineering (CASE) and fourth-generation language tools used to develop a functioning business information system. Project management and additional analysis, design and development topics.

4133 Information Technologies for Electronic Commerce. Prerequisites: 3363 and 4013 or consent of instructor. The technologies, systems, and applications that allow organizations to overcome the barriers of time and distance in commerce. Overview of electronic-commerce, security issues including firewall technology, web-based tools for design and implementation, electronic payment methods, the Internet, intranets, and extranets. Applications using current technologies.
Advanced Information Technologies for Electric Enterprise Resource Planning. Same course the basis for study in this integrated approach planning, and supply chain analysis forming. Integration of transactional analysis, computer software for enterprise resource planning, organizations. Integrated data flow and communication. Resource planning for today's global business organizations. Management information systems, development and administration of groupware systems, and advanced object-oriented system development methodologies.

4373 Advanced Topics in Management Information Systems. Prerequisite: 2103 or equivalent. Advanced topics such as advanced network management, electronic commerce, international management information systems, legal and regulatory issues in telecommunications.

4443 Computer-based Simulation Systems. Prerequisites: 3223, completion of lower-division mathematics requirements and a course in a scientific programming language such as FORTRAN, BASIC, PL/1, or PASCAL. Discrete computer simulation using languages such as GPSS, GASP, or SLAM. Cases include queueing, layout planning and evaluation, and financial modeling.

4523 Data Communication Systems. Prerequisite: 3303. Management orientation to decisions necessary in the design, implementation and control of data communications. Transmission service and equipment characteristics, network design principles, data communication software and federal regulatory policy affecting data communication.

4533 Advanced Data Communications. Prerequisite: 4523. Continuation of MSIS 4523. With significant hands-on application of course material.

5033 Information Systems Project Management. Prerequisite: consent of MISAIS Director, MSTM Director or MBA Director. This class covers the important multi-faceted dimensions of directing and leading information systems projects. Topics will include behavioral, strategic, technical and quantitative issues faced by information system project teams.

5123 Enterprise Resource Planning. Prerequisites: graduate standing and ACCT 5103, ACCT 5113, MSIS 5643, or consent of director of MISAIS. Resource planning for today's global business organizations. Integrated data flow and computer software for enterprise resource planning. Integration of transactional analysis, fundamental accounting practice, financial planning, and supply chain analysis forming the basis for study in this integrated approach to enterprise resource planning. Same course as ACCT 5123.

5133 Advanced Information Technologies for Electronic Commerce. Prerequisites: admission to MBA, MSTM, or MS in MISAIS program or consent of instructor. Information technologies that enable electronic commerce, including data base and web technologies and infrastructure, FORTRAN, web software, transaction security, business web models, and applications.

5223 Object-oriented Programming Applications for Business. Prerequisites: 5643, graduate standing and computer programming proficiency, or consent of director of MISAIS. Object-oriented programming concepts and applications for business in a global environment. Implementation through an appropriate object-oriented programming language.

5303 Quantitative Methods in Business. Prerequisites: admission to the MBA program or consent of MBA director, and 5303. The management of decision-making processes, techniques and quality control. Emphasis is on a management science approach.

5313 Production Operations Management. Prerequisites: admission to MISAIS program or consent of MBA director, and 5303. The management of production planning, facility location and layouts, inventory control, waiting line problems and simulation. Project management and quality control. Emphasis is on a management science approach.

5333 Advanced Decision Theory for Management. Prerequisite: admission to MISAIS program or consent of MBA director. Decision analysis and modeling methods, with computer applications. Mathematical programming, simulation, forecasting, queuing, Markov processes.

5443 Advanced File and Data Management for Business. Prerequisites: 5223, or consent of director of M ISAIS program. A design perspective of business data storage methodologies, structures and approaches; and of file management techniques for business enterprises.

5600 Special Projects in Business Information Systems. 1-3 credits, maximum 3. Prerequisite: consent of the director of the M. S. in MISAIS program. Study of advanced topics not covered directly in other classes or directed study under the supervision of a faculty member.

5603 Introduction to Object-oriented Programming for Business. Prerequisite: admission to the MISAIS program or consent of director of MS in MISAIS. Introduction to object-oriented computer programming for business including fundamental constructs, construction and integration of objects, and the use of development tools and methodologies for successful development of business applications.

5613 Advanced Production and Operations Management. Prerequisites: 5313 or equivalent; admission to MBA program or consent of MBA director. Production system, including a synthesis of production and management techniques used by operations managers. A computerized management simulation game provides decision-making experience.

5623 Advanced Applications in Management Information Systems. Prerequisites: 5643 or consent of director of MISAIS program. Design and use of management information systems in businesses and other organizations. Model building, information resource management and decision support systems.

5633 Decision Support and Expert Systems. Prerequisite: BADM 5003 or equivalent. Technical and managerial issues involved in the evaluation, acquisition and implementation of advanced technologies, such as decision support systems, expert systems, artificial intelligence, executive information systems, neural networks and others.

5643 Advanced Data Base Management. Prerequisites: admission to the MBA, MSTM or MS in MISAIS programs or consent of director. Advanced theoretical and practical foundations. Brief review of classical issues surrounding design, analysis, and implementation of data bases, both from a micro and a mainframe perspective. Current and emerging issues in the data base field. Analysis, design, and implementation of distributed data bases, the object oriented data model paradigm, the use and management of automated design and support tools (e.g., CASE) from a data base perspective, and data security.

Marketing (MKTG)

3213 Marketing. Marketing strategy and decision-making. Consumer behavior, marketing institutions, competition and the law.

3323 Consumer and Market Behavior. Prerequisite: 3213. Qualitative and quantitative analyses of the behavior of consumers; a marketing consideration of the consumer, economics and the behavioral disciplines to consumer behavior.

3433 Promotional Strategy. Prerequisite: 3213. Promotional policies and techniques and their application to selling problems of the firm.

3473 Professional Selling. Prerequisite: 3213. Skills to understanding the professional personal selling process. Strong emphasis on the communications function of personal selling. Lecture sessions combined with experiential exercises and role playing.

3513 Sales Management. Prerequisite: 3213. Sales planning and control, organization of the sales department, developing territories, motivating salespersons and control over sales operations.
3613 Retailing Management. Prerequisite: 3213. Applied marketing knowledge, with attention given to those concepts and methods which provide the necessary foundation for a retailing manager.

3713 Sports Marketing. Prerequisite: 3213. Applied marketing knowledge with attention given to those concepts and methods used in sports marketing.

4113* Marketing Decision Analysis. Prerequisite: 3213. Decision making in a variety of marketing applications, including model building, analysis of courses of action, and development of online information systems. Applications with microcomputers to focus on decision areas such as sales forecasting, market selection, sales force allocation and site location.

4223 Supply Chain Management. Prerequisites: 3213 and MGMT 3223. An economic and operational analysis of the physical flow of goods and materials. A system interpretation of marketing channels.

4333* Marketing Research. Prerequisite: 3213; 3223; STAT 2023. Basic research concepts and methods. Qualitative and quantitative tools of the market researcher.

4443* Social Issues in the Marketing Environment. Prerequisite: 3213. Social and legislative considerations as they relate to the marketplace.

4550 Problems in Marketing. 1-9 credits, maximum 9. Prerequisite: 3213. Problems in marketing. Specific topics vary from semester to semester.

4553* (International Marketing. Prerequisite: 3213. The conceptual framework for marketing into and from foreign countries. The development of action-oriented strategies with emphasis on the uncontrollable factors that affect marketing decisions in an international setting.

4683 Managerial Strategies in Marketing. Prerequisites: ACCT 2103 and 2203, ECON 2103 and 2203, FIN 3113, LS B 3213, MGMT 3123, and MSIS 2103. Analysis of the marketing management decision process: market opportunity analysis, strategy development, planning and integration with corporate strategy.

4773* Services Marketing. Prerequisite: 3213. Conceptual and managerial tools for students who intend to be involved with the marketing of services. Characteristics of services, listening to customers, managing customer expectations, conceiving and creating service breakthroughs, service quality, positioning of services, managing demand and supply, creating a strategic service vision and designing a customer focused organization to create and retain customers.

4850 Applied Marketing Studies. 1-6 credits, maximum 6. Prerequisites: 12 credit hours of marketing and consent of instructor. Structured internship or field project with supporting academic study.

4973 New Product Development. Prerequisites: 3213, 4333. The elements involved in creating and marketing a successful new product. Qualitative and quantitative methods will analyze data collected from focus groups, including surveys to test a new product concept.
5020* Advanced Practicum or Internship in Mass Communication. 1-3 credits, maximum 3. Prerequisites: one semester of graduate course work and consent of instructor. Applied training allowing students to relate theoretical principles to situations in professional settings. Required for students without mass media backgrounds.

5030* Independent Study in Mass Communication. 1-3 credits, maximum 3. Prerequisite: consent of instructor. Independent study, directed readings or project development in mass communications to fit the student’s academic and professional interests.

5113* Methods of Research in Mass Communication. Principles and techniques of research; research planning, design and measurement in mass communication.

5163* Mass Communication Law. Prerequisites: 2003 and graduate standing. Statutes and case decisions in print and broadcast law, including government regulation of broadcasting by the FCC and media relations with other regulatory agencies. Meets with JB 4163. No credit for students with credit in JB 4163.

5223* Mass Communication Research Analysis and Interpretation. Prerequisite: 5113. Single- and multi-variate analysis, interpretation and reporting of mass communication research data. Use of computers in research analysis.

5253* International Mass Communications. Prerequisite: graduate standing. Examination of the nature and flow of news and information within and among nations, states, and societies from a theoretical vantage point grounded in region-specific realities. The political, economic, social, cultural and historical forces determining media practice in a global environment. Meets with JB 4253. No credit for students with credit in JB 4253.

5333* Process and Effects of Mass Communication. Mediating factors that affect interaction of ingredients in the communications process, and how these factors can affect the fidelity of information conveyed.

5520* Specialized Public Relations Applications. 3 credits, maximum 6. Prerequisites: JB 3283 and graduate standing. Professional public relations at an advanced level. Non-profit, corporate, agency, international and other specialized applications of content varies by semester. Meets with JB 4520. No credit for students with credit in JB 4520.

5603* Integrated Marketing Communications. Prerequisites: JB 2003, JB 2183 or MKTG 3213; and graduate standing. Planning and the value of coordinating the various promotional mix elements within a communication campaign to create maximum clarity and impact. Communication elements including advertising, public relations, direct marketing and sales promotion and examination of strategies for combining and integrating them into an effective campaign. Theories, models and tools to make better promotional communication decisions. Meets with JB 4603. No credit for students with credit in JB 4603.

5651* Introduction to Graduate Study in Mass Communications. Prerequisite: graduate standing. Orientation to skills necessary for successful completion of graduate work. Training in library and archival research, academic writing and preparation of research reports, familiarization with the theoretical concepts and issues associated with mass communication. Required of all mass communication M.S. candidates, and prerequisite to M.S. candidates enrolling in mass communication seminars.

5663* Public, Educational and Instructional Television. Uses of non-commercial television in public, educational and instructional applications. Analysis of program types and content.

5733* Responsibility in Mass Communication. Interaction between mass media and society, with emphasis upon the communicator’s ethics and responsibilities.

5770* Seminar in Communication Media. 1-3 credits, maximum 9. Prerequisite: graduate standing. International communication, media history, legal research, new technology, women and the media, television, industrial television, and communication research.

5863* Media Management. Prerequisites: 2003 and graduate standing. Basic issues, theoretical concepts and operational procedures associated with managing newspapers, magazines, advertising public relations, broadcast and cable companies and firms specializing in computer-mediated communication. Meets with JB 4863. No credit for students with credit in JB 4863.

5883* Advanced Media Management. Prerequisite: graduate standing. Management concerns in four areas of mass communication practice: public relations, broadcast and print journalism. Different emphases offered according to student demand or need.

Master of Business Administration (MBA)

5010* Independent Study. 3-6 credits, maximum 6. Prerequisite: admission to MBA program or consent of MBA director. Investigation of advanced research topics or directed study under the supervision of a faculty member. Consent of MBA Graduate Studies Committee required.

5100* Professional Development. 1 credit, maximum 6. Prerequisite: admission to MBA program or consent of MBA director. Career and professional development of MBA students. A blend of personal growth and professional development activities to assist students in preparing for advanced business careers.


5211* Business Ethics and Social Responsibility. Prerequisite: admission to MBA program or consent of MBA director. Introduction to ethical theory and its relationship to business practices. Meaning and implementation of socially responsible business actions. Provides mid-level managers with an understanding of ethical perspectives adopted by others. Development of tools needed to make ethical decisions.

5221* Public Environment of Business. Prerequisite: admission to MBA program or consent of MBA director. Survey of the external business environments that influence and shape the organizational environment. Strategies for forecasting, responding to, and influencing these forces.

5233* Global Competitive Environment. Prerequisite: admission to the MBA program or consent of the director. Development of a global business strategy for the organization. Issues of highly diversified markets and business environments, global competition, financial markets, and complex organizational relationships. Same course as IS 5233.

5240* Managerial Communication Skills. 1-2 credits, maximum 2. Prerequisite: admission to MBA program or consent of MBA director. Identification and analysis of interactive corporate communications: oral, written and interpersonal. Application of communication theories to business situations with the goal of behavior and skill development.

5251* Leadership Strategies. Prerequisite: admission to MBA program or consent of MBA director. Analysis of the basic concepts of public and private law related to business decisions. Overview of the laws affecting private business relationships including employment law, agency laws, and various forms of business organizations.

5303* Corporate and Business Strategy. Prerequisite: admission to MBA program or consent of the director. Key issues in formulating and implementing business and corporate strategies. The orientation of top management and diagnosis of what is critical in complex business situations and realistic solutions to strategic and organizational problems.

5310* Integrative Decision Making II: Crossing Organizational Boundaries. 2-6 credits, maximum 6. Prerequisites: consent of MBA director and completion of minimum of 24 MBA credit hours. Identification and analysis of environmental forces affecting an organization’s ability to compete and survive. Interaction among all corporate functional units. Development of a comprehensive, integrated plan of action for the firm.

5313* Current Business Topics. Prerequisite: admission to the MBA program or consent of the director. Examination of selected topics representing the most current and academic and business concepts.

5400* Business Practicum. 1-3 credits, maximum 3. Prerequisites: consent of MBA director and completion of 18 MBA credit hours. Application of knowledge and skills developed in MBA functional courses in an organizational environment. Integration of functional concepts, allowing students to experience the adaptation of concepts to fit organizational reality, and assisting students in understanding ways in which their academic learning can help organizations.
Mathematics (MATH)

0123 Intermediate Algebra. Prerequisite: one year of high school algebra or equivalent. Review of fundamental operations of algebra, rational expressions, exponents and radicals, linear and quadratic equations, inequalities, introduction to analytic geometry. Does not count for college credit. Graded on a satisfactory-unsatisfactory basis.

1483 (A)Mathematical Functions and Their Uses. Prerequisite: 0123 or placement into 1513. Analysis of functions and their graphs from the viewpoint of rules of change. Linear, exponential, logarithmic and other functions. Applications to the natural sciences, agriculture, business and the social sciences.

1493 (A)Applications of Modern Mathematics. Prerequisite: 0123 or placement into 1513. Introduction to contemporary applications of discrete mathematics. Topics from management science, statistics, coding and information theory, social choice and decision making, geometry and growth.

1513 (A)College Algebra. Prerequisite: two years of high school algebra or 0123. Quadratic equations, functions and graphs, inequalities, systems of equations, exponential and logarithmic functions, theory of equations, sequences, permutations and combinations. No credit for those with prior credit in 1715 or any mathematics course for which 1513 is a prerequisite.

1613 (A)Trigonometry. Prerequisite: 1513 or equivalent. A technical course in trigonometric functions, logarithms, solution of triangles and applications to physical sciences. No credit for those with prior credit in 1715 or any course for which 1613 is a prerequisite.

1715 (A)College Algebra and Trigonometry. Prerequisites: one unit of high school plane geometry, and 0123 or high school equivalent. An integrated course in college algebra and trigonometry. Combined credit for 1513, 1613, and 1715 limited to six hours. No credit for those with prior credit in any course for which 1613 is a prerequisite. Satisfies the six hour general education Analytical and Quantitative Thought area requirement.

2103 (A)Elementary Calculus. Prerequisite: 1513. An introduction to differential and integral calculus. For students of business and social sciences.

2123 (A)Calculus for Technology Programs I. Prerequisite: 1715 or 1513 and 1613. First semester of a terminal sequence in calculus for students in the School of Technology. Functions and graphs, differentiation and integration with applications.

2133 (A)Calculus for Technology Programs II. Prerequisite: 2123. Second semester of a terminal sequence in calculus for students in the School of Technology. Calculus of trigonometric, exponential and logarithmic functions and applications to physical problems.

2144 (A)Calculus I. Prerequisites: 1715, or 1513 and 1613. An introduction to derivatives, integrals and their applications.

2153 (A)Calculus II. Prerequisite: 2144. A continuation of 2144 including series and their applications, elementary geometry of three dimensions and introductory calculus of vector functions.

2163 Calculus III. Prerequisite: 2153. A continuation of 2153 including differential and integral calculus of functions of several variables and an introduction to vector analysis.


2653 Discrete Mathematics I. Prerequisite: 1513 or 1715. Logic, set theory proof techniques, probability and combinatorics, relations and functions, matrix algebra graphs, Boolean algebra and lattices.

2910 Special Studies. 1-3 credits, maximum 6. Prerequisite: consent of instructor. Special subjects in mathematics.


3263* Linear Algebra and Differential Equations. Prerequisite: 2153. An integrated treatment of linear algebra and differential equations. No credit for those with credit in 2233 or 3013.

3403* (A)Geometric Structures. Prerequisite: 1483, 1493 or 1513. Fundamentals of plane geometry, geometric motion (translation, rotations, reflections), polyhedra, applications to measurements.

3603* (A)Mathematical Structures. Prerequisite: 1483, 1493 or 1513. Foundations of numbers (set theory, numeration, and the real number system), number theory, algebraic systems, functions and applications, and probability.

3613* Introduction to Modern Algebra. Prerequisite: 3013. Introduction to set theory; elementary properties of rings, integral domains, fields and groups.

3653 Discrete Mathematics II. Prerequisite: 2653 or 3613. Algebraic structures, coding theory, finite state machines, machine decomposition, computability, formal language theory.

4002* Mathematical Logic and Computability. Prerequisites: 3613 or PHIL 3000 or 3003 or consent of instructor. The basic metatheorems of first order logic: soundness, completeness, compactness, Lowenheim-Skolem theorem, undecidability of first order logic, Godel's incompleteness theorem. Enumerability, diagonalization, formal systems, standard and non-standard models, Godel numbering. Turing machines, recursive functions, and evidence for Church's thesis. Same course as CS 4003 and PHIL 4003.

4013* Calculus of Several Variables. Prerequisites: 2163 and 3013. Differential and integral calculus of functions of several variables, vector analysis, Stokes' Theorem, Green's Theorem and applications.

4023* Introduction to Modern Analysis. Prerequisite: 2153, recommended 3613. An introduction to the theorems and proofs of one-variable calculus. Properties of the real numbers, sequences and series of constants and functions, limits, continuity, differentiation and integration.

4033* History of Mathematics. Prerequisite: 2153. Early development of mathematics as a science, contributions of Greek mathematics, mathematical advancements of the 17th and 18th centuries, and the mathematics of the 19th and 20th centuries. The emphasis in the course will be on replicating the setting and techniques of the times to understand the nature of a discovery and its relationship to contemporary thought.

4143* Advanced Calculus I. Prerequisites: 3013 and 4023. A rigorous treatment of calculus of one and several variables. Elementary topology of Euclidean spaces, continuity and uniform continuity, differentiation and integration.

4153* Advanced Calculus II. Prerequisite: 4143. Continuation of 4143. A rigorous treatment of sequences and series of functions, uniform convergence, differentiation and integration of vector-valued functions, and differential forms.


4263* Complex Variables. Prerequisite: 4013. Analytic functions, power series, residues and poles, conformal mapping, and applications.

4403* Geometry. Prerequisite: 3013, recommended 3613. An axiomatic development of Euclidean and non-Euclidean geometries.

4513* Numerical Mathematics: Analysis. Prerequisites: 2233, 3013, knowledge of FORTRAN or consent of instructor. Machine computing, algorithms and analysis of errors applied to interpolation and approximation of functions solving equations and systems of equations, discrete variable methods for integrals and differential equations. Same course as CS 4513.

4553* Linear and Nonlinear Programming. Prerequisites: 2163, 3013. Linear programming, simplex methods, duality, sensitivity analysis, integer programming and nonlinear programming.


4613* Modern Algebra I. Prerequisite: 3613. An introduction to the theory of groups and vector spaces.

4683* Combinatorial Mathematics. Prerequisite: 3013. Counting techniques, generating functions, difference equations and recurrence relations, introduction to graph and network theory.
Number Theory. Prerequisite: 3613. Divisibility of integers, congruences, quadratic residues, distribution of primes, continued fractions and the theory of ideals.

Groups and Representations. Prerequisites: 3013 and either 3613 or consent of instructor. An introduction to groups, group actions, symmetry groups, representations and characters. Further topics may include infinite symmetry groups, applications to chemistry and physics, and finite isometry groups and geometry.

Undergraduate Research 1-4 credits, maximum 4. Prerequisite: consent of instructor. Directed readings and research in mathematics.

Special Studies. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Special subjects in mathematics.

Problem Solving Seminar 1 credit, maximum 3. Prerequisites: 2233, 3013. The general process of problem solving. Selected problem-solving techniques. Applications to challenging problems from all areas of mathematics.

Senior Honors Thesis. Prerequisites: senior standing and Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a faculty member and including a public presentation. Required for graduation with departmental honors in mathematics.

Research and Thesis 1-6 credits, maximum 6. Prerequisite: consent of advisory committee. Directed reading and research culminating in the master’s report or master’s thesis.

Seminar in Mathematics 1-3 credits, maximum 12. Prerequisite: consent of instructor. Topics in mathematics.

Modern Algebra II. Prerequisite: 4613. Continuation of 4613. An introduction to the theory of rings, linear transformations and fields.

Advanced Linear Algebra. Prerequisite: 3013. A rigorous treatment of vector spaces, linear transformations, determinants, orthogonal and unitary transformations, canonical forms, bilinear and hermitian forms, and dual spaces.

Stochastic Processes. Prerequisites: 2233, 3013 and STAT 4113. Definition of stochastic processes, probability structure, mean and covariance function, the set of sample functions, stationary processes and their spectral analysis, renewal processes, counting analysis, renewal processes, counting processes, discrete and continuous Markov chains, birth and death processes, exponential model, queueing theory. Same course as IEM 5133 and STAT 5133.

Real Analysis I. Prerequisite: 4153. Measure theory, measurable functions, integration and differentiation with respect to measures.


Fourier Analysis. Prerequisite: 4013 or 4023. Orthogonal series expansions, Fourier series and integrals and boundary value problems. Applications.

Partial Differential Equations. Prerequisite: 4013 or 4233. Classification of second order equations, characteristics, general theory of first order equations, Dirichlet problem for Laplace’s equation and Green’s functions, eigenvalue problems, and variational methods.

Ordinary Differential Equations I. Prerequisites: 4143; 5013 or 5023. Existence and uniqueness of solutions, linear systems and their asymptotic behavior, oscillation and comparison and singularities.


Complex Analysis I. Prerequisite: 4143. Basic topology of the plane, functions of a complex variable, analytic functions, transformations in finite series, integration and conformal mapping.

Complex Analysis II. Prerequisite: 5283. Riemann Mapping Theorem, meromorphic functions, analytic continuation, Dirichlet problem, and entire functions.

General Topology. Prerequisite: 4143 or consent of instructor. Basic properties of topological spaces and continuous functions, including connectedness, compactness, and separation and countability axioms. Metric, product, and quotient spaces, Urysohn lemma, and Tietze extension theorem.

Geometric Topology. Prerequisites: 4613, 5303. Manifolds, complexes, the fundamental group, covering spaces, combinatorial group theory, the Seifert-Van Kampen theorem, and related topics.

Differential Geometry. Prerequisites: 4013 or 4143. Differential manifolds, vector fields, differential forms, connections, Riemannian metrics, geodesics, completeness, curvature, and related topics.

Numerical Analysis for Differential Equations. Prerequisites: 4513 or CS 4513, and 4233. Advanced machine computing, algorithms, analysis of truncation and rounding errors, convergence and stability applied to discrete vari- ables, finite elements, and spectral methods in ordinary and partial differential equations. Same course as CS 5543.

Numerical Analysis for Linear Algebra. Prerequisites: 3013, and 4513 or CS 4513. Advanced machine computing, algorithms, analysis of rounding errors, condition, convergence, and stability applied to direct and iterative solution of linear systems of equations, linear least squares problems, and algebraic eigenvalue problems, including LU and QR factorization, conjugate gradients, QR algorithm, and Lanczos method. Same course as CS 5553.


Algebra I. Prerequisite: 4613. A rigorous treatment of classical results in group theory and ring theory.

Algebra II. Prerequisite: 5613. A rigorous treatment of classical results in module theory and field theory.

Seminar and Practicum in the Teaching of College Mathematics. Prerequisite: graduate standing in mathematics or consent of instructor. Foundations of college mathematics teaching, including lecturing, grading and exam preparation. Adapting classroom activities to better serve different types of learners. Current trends in mathematics education such as calculus reform, cooperative learning, and technology in the classroom.


Advanced Seminar in Mathematics. 1-3 credits, maximum 12. Prerequisites: consent of instructor and student’s advisory committee. Directed reading on advanced topics in mathematics.

Functional Analysis I. Prerequisites: 4613 or 5023, 5153, 5303. Theory of topological vector spaces including metrizability, consequences of completeness, Banach spaces, weak topologies, and convexity.

Functional Analysis II. Prerequisite: 6143 or consent of instructor. Introduction to and basic results in several subfields of analysis which employ functional analytic methods. Topics from bounded and unbounded operator theory, Banach algebras, distributions, Fourier analysis, and representation theory.

Harmonic Analysis. Prerequisites: 5153, 5283. Classical results giving connections among the size of a harmonic or analytic function on a complex domain, the existence and smoothness of its boundary values, and behavior of the Fourier series; selected extensions, related topics and applications.

6283* Several Complex Variables. Prerequisite: 5293. Elements of function theory of several complex variables, including extension phenomena, domains of holomorphy, notions of convexity, holomorphic maps, and complex analytic varieties.

6290* Topics in Analysis. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Advanced topics in analysis.

6323* Algebraic Topology I. Prerequisite: 5313. Chain complexes, homology and cohomology groups, the Eilenberg-Steenrod axioms, Mayer-Vietoris sequences, universal coefficient theorems, the Eilenberg-Zilber theorem and Kunneth formulas, cup and cap products, and duality in manifolds.

6333* Algebraic Topology II. Prerequisite: 6323. Homotopy groups, the Hurewicz and Whitehead theorems, Eilenberg-MacLane spaces, obstruction theory, fibrations, spectral sequences, and related topics.

6390* Topics in Topology. 1-3 credits, minimum 9. Prerequisite: consent of instructor. Advanced topics in topology.

6433* Algebraic Geometry. Prerequisite: 5623. Affine and projective varieties, dimension, algebraic curves, divisors, and Riemann-Roch theorem for curves.

6453* Complex Geometry. Prerequisite: 5283. Complex manifolds, analytic sheaves, differential forms, Dolbeault cohomology, Hodge theory, line bundles, divisors, Kodaira embedding, and vanishing.

6490* Topics in Geometry. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Advanced topics in geometry.

6513* Theoretical Numerical Analysis. Prerequisites: 5153, 5533 or CS 5543, and 5553 or CS 5553. An advanced theoretical treatment based on function spaces and operator theory of algorithms for machine computing and analysis of errors.

6590* Topics in Applied Mathematics. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Advanced topics in applied mathematics.

6613* Commutative Algebra. Prerequisite: 5623. Commutative rings, exactness properties of modules, tensor products, integral dependence, chain conditions, completions, filtrations, local rings, dimension theory, and flatness.

6623* Homological Algebra. Prerequisite: 5623. Closed and projective classes, resolution and derived functors, adjoint theorem, construction of projective classes in the categories of groups, rings and modules; categories, Abelian categories.

6690* Topics in Algebra. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Advanced topics in algebra.

6713* Analytic Number Theory. Prerequisite: 4283 or 5283. Arithmetic functions, Zeta and L functions, distribution of primes and introduction to modular forms.

6723* Algebraic Number Theory. Prerequisite: 5013 or 5623. Number fields, ideal theory, units, decomposition of primes, quadratic and cyclotomic fields, introduction to local fields.

6790* Topics in Number Theory. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Advanced topics in number theory.

6813* Lie Groups and Representations. Prerequisites: 4153, 4613, 5303. Differentiable manifolds, vector fields, Lie groups, exponential map, homogeneous spaces, representations of compact Lie groups, and maximal tori.


6890* Topics in Representation Theory. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Advanced topics in representation theory.

6990* Topics in Collegiate Mathematics Education. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Advanced topics in collegiate mathematics education.

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**Mechanical and Aerospace Engineering (MAE)**

3033 Engineering Design. Lab 1. Prerequisite: ENGR 1332. Design methodology and practice. Design process, with emphasis on the broad range of technical, economic, and societal factors considered in design decision making. Designing and building a machine to participate in a design competition.

3113 Measurements and Instrumentation. Lab 4. Prerequisites: ENSC 2123 and ENSC 2613. Application of basic electronic laboratory measurement equipment. Selection and testing of transducers for measurement of displacement, time frequency, velocity, pressure, force, temperature, flow rate, and vibration, for machine design applications. Considerations of accuracy, uncertainty and repeatability. Design projects involving the use of analog and digital electronic and computer-based data processing. Practice in the use of computer-based data acquisition systems. Preparation of formal reports, including the presentation of plots, figures and tables.

3123 Manufacturing Processes. Prerequisites: ENSC 2143 and 3313 or equivalent. An introduction to manufacturing processes including the fundamental processes of casting, forging, rolling, extrusion, drawing and metal cutting. Quantitative relationships to identify important parameters which influence a given process.

3223 Thermodynamics II. Prerequisite: ENSC 2213. A continuation of ENSC 2213. Irreversibility and availability, power cycles, refrigeration cycles, mixtures and solutions, chemical reactions, phase and chemical equilibrium, and introduction to compressible flow.


3253 Applied Aerodynamics and Performance. Prerequisites: ENSC 2213, 3253, MATH 2233. Gas flows in one and two dimensions. Basic thermodynamic and dynamic equations. Nozzle and duct flows, choking, plane and oblique shock waves, Prandtl-Meyer expansions, radiative processes, frictional, high-velocity flows and heat addition effects. Two-dimensional ideal fluid flow, stream function, velocity potential, linearized flows and method of characteristics.

3323 Mechanical Design I. Prerequisites: ENSC 2113, 2143. Introduction to the design process. Consideration of reliability, factors of safety, product liability, and economics. Use of codes, standards, and other design resources. Design stress analysis of mechanical components such as beams, rings, cylinders, and shafts. Analysis of stiffness and deflection of straight and curved beams, columns, and links. Consideration of failure theories for various types of engineering materials. Application of fatigue analyses in the design process.


3723 Systems I. Prerequisites: ENSC 2123, 2613 and MATH 2233. Physical and mathematical modeling of electrical and mechanical dynamic systems. Transient response of first- and second-order systems. Laplace transform technique for solving differential equations; transfer functions, frequency response and resonance. Same course as ECEN 3723.

4010* Mechanical Engineering Projects. 1-6 credits, maximum 6. Lab variable. Prerequisite: consent of instructor. Special projects and independent study in mechanical engineering.

4053* Automatic Control Systems. Prerequisite: 3723 or ECEN 3723. Properties of feedback control systems, mathematical models of basic components, state-variable models of feedback systems, design specifications of control systems, time-domain analysis, stability, stability robustness, transform analysis, frequency domain techniques, root-locus, design of single-input-single-output systems and compensation techniques for engineering systems. Same course as ECEN 4413.
Mechanical Vibrations. Prerequisite: 3723. Lumped parameter analysis of multi-mode vibratory systems. Analysis techniques including classical analytical methods, matrix methods and numerical methods. Selection and design of vibration isolation systems. Selection of vibration isolation system elements. Design of vibration isolation systems. Design of power plants and auxiliary systems associated with power plants. Overall design of power plants as well as component design. Power system economics and analysis. Extensive use of software design and analysis packages.

Experimental Fluid Dynamics. Lab 3. Prerequisites: 3113 and ENSC 3233. Experimental study of basic and applied fluid dynamics systems with comparisons to analytical predictions. Fluid dynamics instrumentation, digital data acquisition and processing, design of facilities and experiments, technical report writing and design project with experimental verification.


Advanced Processing of Engineered Materials. Prerequisites: 3313. Introduction to novel processing methods for a range of engineered materials, such as electro-slag remelting, vacuum melting, melt-to-shape and remelting processes, tape laying, microwave processing, laser processing, CVD and PVD, sputtering, ion plating, ultraprecision machining and grinding, polishing and lapping, multilayer coatings, Czochralski single crystal growth, processing of nanocrystalline materials, engineered surfaces and surface modification, and layer processing for electronic materials.

Design for Manufacturing. Lab 3. Prerequisite: 3123. Integration of concepts of product design and design of manufacturing processes. Emphasis on analysis of manufacturing processes, including cutting behavior and properties of materials, stress analysis, heat transfer and lubrication. Processing techniques and economics. Emphasis on analysis of manufacturing processes and applications of processing parameters and design variables, in CAD/CAM.

Mechanical Metallurgy. Lab 2. Prerequisite: 3113. ENSC 3313. Mechanical deformation processes and strengthening mechanisms in engineering materials. Material failure modes including creep, fatigue, stress corrosion, ductile and brittle fractures.

Aerospace Systems Design for Mechanical Engineers. Lab 8. Prerequisites: 3033, 3313 and 3323. Multidisciplinary design of aerospace vehicles. Multidisciplinary teams that work on a semester-long project that includes the design, construction, and flight test of an aerospace vehicle optimized for a given set of requirements. Teamwork, leadership and presentation skills emphasized. Students from all appropriate disciplines who wish to participate in this course are encouraged to so by enrolling in MAE 4010.

Experimental Methods in Design. Lab 6. Prerequisites: 3113 and 3323. Laboratory techniques for the experimental analysis of vibration, stress, force and motion. Projects involve the use of strain gages, brittle lacquer techniques, reflection and transmission polariscopes, load cells and accelerometers.

Aerospace Systems Design. Lab 8. Prerequisites: 4243, 4283, 4513. Multidisciplinary design of aerospace vehicles. Multidisciplinary teams that work on a semester-long project that includes the design, construction, and a flight test of an aerospace vehicle optimized for a given set of requirements. Teamwork, leadership and presentation skills emphasized. Students from all appropriate disciplines who wish to participate in this course are encouraged to do so by enrolling in MAE 4010.


Design of Indoor Environmental Systems. Prerequisites: 3223, 3323. Design of heating, ventilating and air conditioning systems. Calculation of heating and cooling loads.

Thermal Systems Design, Simulation and Optimization. Prerequisites: 3233, 3233; ENSC 3233; co-requisite MAE 3403. Design, modeling, simulation and optimization of thermal systems. Analysis and modeling of components such as fans, pumps, ducts, pipes, fittings, heat exchangers, compressors, thermal storage equipment.

Mechatronics Design. Prerequisites: 3033, 3313. Design of mechanical and electrical components including sensors and actuators into an integrated system using microcontrollers.

Software design using an easy-to-program microcontroller embodies the importance of software implementation into the overall engineering system. Design practice with given design projects to build up skills plus an open-ended term design project of the student's choosing.

Thesis. 1-6 credits, maximum 6. A student studying for a master's degree who elects to write a thesis must enroll in this course.

Mechanical Engineering Projects. 1-12 credits, maximum 12. Project in research or design selected by the student, or assigned by the instructor. A student who wishes to complete a master's degree under Plan III must enroll in this course.

Engineering Practice. 1-12 credits, maximum 12. Prerequisites: senior or graduate standing and consent of instructor. Solution of real-life engineering design and development problems in an actual component using industrial environments. Activities include application of design and testing procedures, economic evaluation and periodic oral and written reporting on one or more assigned problems. Activities must be approved in advance by the adviser.

Advanced Mechanical Vibrations. Prerequisite: 4063 or consent of instructor. Analysis of non-linear vibrations, classical analysis of continuous systems and numerical methods.

Engineering Acoustics. Acoustical analysis and measurement techniques, with emphasis on design applications for noise and vibration control in machinery and in buildings.

Numerical Engineering Analysis. Prerequisite: basic FORTRAN programming. Practical digital methods for obtaining steady-state and transient solutions to lumped and distributed mechanical, fluid and thermal problems.

Metal Cutting. Prerequisite: ENSC 3313. Understanding the fundamental principles and practice (mechanics and material aspects) of machining and grinding of materials. Historical aspects; physics of metal cutting, mechanics of machining (orthogonal and oblique); shear stress and shear strain in machining, dynamometry; tool materials; tool wear, tool life, and machinability; vibrations in machining; thermal aspects of machining, cutting fluids; economics; surface finish accuracy and surface integrity, and grinding.

Mechanical and Aerospace Engineering 303
5133* Mechanical Behavior of Materials. Prerequisite: ENSC 3313 or equivalent. A unified approach to the behavior and response of engineering materials to applied loads. Mechanical and metallurgical fundamentals of deformation processes. Spatial scales of atomic physics, micromechanics and continuum mechanics.

5143* Tribology. The principles of tribology. Definition of tribology, contact of solids, surface topography, real area of contact, friction of various materials, basic mechanisms of friction, frictional properties of wear (adhesion, abrasion, fatigue, erosion, and fretting), hardness of solids, frictional heating and surface temperatures, material properties that influence surface interactions, surface roughness measurement, surface integrity - residual stresses and subsurface deformation, application of tribology to manufacturing, wear resistant materials, wear-resistant coatings, experimental methods in tribology, surface analytical tools in tribology, scanning tunneling microscopy/atomic force microscopy, wear monitoring and wear prevention, and systems approach to tribology.

5153* Precision Engineering I. Prerequisite: graduate standing or consent of instructor. An integrated approach to underlying engineering principles governing product and process designs requiring accuracies typically better than 1 part in 10^6. Design and control of precision machines and instruments, dimensional and surface metrology, micromechanics and continuum mechanics, ultra-precision machining and grading, and precision assembly.


5373* Instrumentation. Lab 2. Analysis and design of instrumentation systems, laboratory experiences with electronic instrumentation and transducers, application of digital and analog integrated circuit components to measurement problems.

5403* Computer-aided Analysis and Design. Prerequisite: basic FORTRAN programming. Theory, application and implementation of digital-computer-oriented algorithms for the synthesis, simulation, analysis and design of engineering systems. Advanced FORTRAN methods for optimization, simulation and data analysis. Implementation of these methods uses program libraries, batch processing, remote terminals and graphic display units.


5453* Fluid Power Control I. Prerequisite: 4053 or concurrent enrollment. Static and dynamic modeling of hydraulic and pneumatic control systems and components. Energy and power transfer and impedance matching concepts. Dynamic performance and stability of open and closed-loop servodrives. Introduction to system design.

5463* Nonlinear System Analysis and Control. Prerequisite: 4053 or ECEN 4413. Failure of superstability; phase-plane analysis; limit-cycles; Lyapunov stability; hyperstability and input-output stability; controllability and observability of nonlinear systems; feedback linearization; robust nonlinear control of system design. Same course as ECEN 5463.


5483* Digital Data Acquisition and Control. Prerequisite: undergraduate course in programming. Use of microcomputers operating in real-time applied to engineering systems for data acquisition and control, use of analog to digital, digital to analog, and digital input/output, synchronous and asynchronous programming. Competence in the engineering use of microcomputers through lectures and laboratory applications. Same course as ECEN 5483.

5503* Mechanics of Advanced Composites for Structural Design. Prerequisites: ENSC 2113, ENSC 2143 or consent of instructor. Basic principles governing the micro-mechanics of a laminate, and the macro-mechanics of a laminate. Analysis of continuum fiber, short-fiber, and woven-fiber polymer matrix composites. A computer program for a analysis and design of composite laminates is developed.

5513* Stochastic Systems. Prerequisites: ECEN 3513 and 4503 or STAT 4043 or MAE 4053 or MAE 4063 or consent of Instructor. Theory and applications involving probability, random variables, functions of random variables, and stochastic processes, including Gaussian and Markov processes. Correlation, power spectral density, and nonstationary random processes. Response of linear systems to stochastic processes. State-space formulation and covariance analysis. Same course as ECEN 5513.

5523* Estimation Theory. Prerequisite: 5513 or ECEN 5513. Stochastic model development, parameter estimation and state estimation. Linear and nonlinear, discrete-time and continuous-time systems. Basic principles, model order determination, least squares estimation, maximum likelihood estimation, Bayesian estimation. Gaussian random vectors, estimation in linear and Gaussian models, state estimation, Kalman filter, prediction and smoothing. Same course as ECEN 5523.

5533* Analysis of Structural Systems. Prerequisite: 3323. Computer-oriented matrix methods in the analysis of linear structural systems; energy principles; matrix equations for static and dynamic analyses of elastic systems; stability.


5553* Fatigue and Fracture Mechanics. Prerequisite: 4323 or consent of instructor. Fracture processes in engineering materials including design considerations, failure avoidance and predictability. Fatigue processes and high-strength, toughness-limited materials. Same course as CIVE 5553.


5583* Corrosion Engineering. Lab 2. Prerequisite: ENSC 3313. Modern theory of corrosion and its applications in preventing or controlling corrosion damage economically and safely in service.

5593* Theory of Viscoelasticity. Prerequisite: consent of instructor. Advanced stress analysis in solids exhibiting time-dependent behavior. Material characterization and thermodynamic foundations of the constitutive equations of time-dependent materials such as polymers, solid propellants and metals near their melting points; time-temperature; superposition principle for thermo-rheologically simple materials; correspondence principle for linearly viscoelastic and associated linearly elastic solutions; integral formulation for quasistatic boundary value problems; treatment of time-varying boundary conditions such as moving boundaries and moving loads; linearly viscoelastic stress waves and approximate methods of linearly viscoelastic stress analysis.

5633* Advanced Thermal Systems. Prerequisites: 3223, 3233, ENSC 3233. Analysis, design, simulation and optimization of thermal systems. Engineering applications to HVAC systems, refrigeration systems, ground-source heat pump systems.
5663* Advanced Finite Element Analysis. Prerequisite: 5563 or consent of instructor. Development of three-dimensional isoparametric solid elements using Lagrange and serendipity family of elements, solution of three-dimensional thermoelasticity problems, linear time dependent problems, variational formulation and computer implementation of structural dynamics analysis using implicit operators, implementation of three-dimensional diffusion and heat transfer analysis, solution of a nonlinear system of equations, and finite element analysis using commercial software packages.

5703* Optimization Applications. Prerequisite: graduate standing. A survey of various methods of unconstrained and constrained linear and nonlinear optimization. Applications of these methodologies using hand-worked examples and available software packages. Intended for engineering and science students. Same course as CHE 5703, ECEN 5703 and IEM 5023.

5713* Linear Systems. Prerequisite: graduate standing or consent of instructor. Introduction to the fundamental theory of finite-dimensional linear systems with emphasis on the state-space representation. Mathematical representations of systems; linear dynamic systems; controllability, observability, and stability; linearization and realization theory; and state feedback and state observer. Same course as ECEN 5713.

5733* Neural Networks. Prerequisite: graduate standing. A rigorous examination of the fundamental theory of finite-dimensional linear systems with emphasis on the state-space representation. Mathematical representations of systems; linear dynamic systems; controllability, observability, and stability; linearization and realization theory; and state feedback and state observer. Same course as ECEN 5713.


5773* Intelligent Systems. Prerequisite: 5733 or ECEN 5733. Introduction to the state-of-the-art intelligent control and system successfully deployed to industrial and defense applications. Emerging intelligent algorithms (e.g., bottom-up, top-down, semiotics); reinforcement learning and hybrid systems; and case studies and design projects. Same course as CHE 5733 and ECEN 5733.

5803* Advanced Thermodynamics I. Prerequisite: 3223. A rigorous examination of the fundamental principles of engineering thermodynamics; the First Law, the pure substance, flow processes, Second Law availability, properties of substances, thermochemistry, mixtures and equilibrium.

5823* Conduction Heat Transfer. The mechanism of the transfer of energy by thermal radiation; radiant properties of materials, energy transfer prediction methods and solar energy topics.

5843* Conduction Heat Transfer. Prerequisite: ENSC 3233. Advanced heat transfer analysis and design, with primary emphasis on conduction.

5853* Computational Heat Transfer. Prerequisites: 3233, graduate standing, knowledge of FORTRAN. Computational techniques for the solution of two-dimensional heat transfer, fluid flow and related processes in problems of practical interest. A general-purpose computer program used to demonstrate the capabilities of the numerical method through a wide variety of engineering problems.


5873* Advanced Indoor Environmental System. Prerequisite: 4703. Heating, air-conditioning, ventilation and refrigeration systems. System and component analysis, design and simulation.

5913* Ideal-fluid Aerodynamics. Prerequisite: ENSC 3233 or equivalent. Principles of inviscid, incompressible flow. Small disturbance theory for flow about airfoils and wings. Two and three dimensional panel methods. Introduction to unsteady and compressibility effects.

5923* Guidance and Control of Aerospace Vehicles. Prerequisite: 4053 or ECEN 4413 or equivalent. Navigation, guidance and attitude control of aircraft, launch vehicles and spacecraft. Inertial navigation mechanizations and error analysis. Stability augmentation systems.

5933* Aeroelasticity. Prerequisite: graduate standing or consent of instructor. Interaction between fluid dynamic, inertial and elastic forces. Development of analytical and computational methods for analysis. Application to a broad range of problems in engineering.

5943* Unsteady Aerodynamics and Acoustoacoustics. Prerequisite: ENSC 3233 or equivalent. Development of governing fluid dynamic equations for unsteady flows; linear unsteady aerodynamics for isolated and cascaded lifting surfaces; acoustics of moving bodies; three-dimensional duct acoustics; sound generation from isolated airfoils, cascaded airfoils, rotor-stator interactions, multiple pure-tone sources, propellers, and jets.

6000* Research and Thesis. 1-15 credits, maximum 30. Prerequisites: consent of the head or the graduate committee of the School and approval by the student's advisory committee. Independent research under the direct supervision of a member of the graduate faculty. For students pursuing study beyond the level of the M.S. degree.

6010* Advanced Study. 1-12 credits. Prerequisite: approval of the student's advisory committee. Study and investigation under the supervision of a member of the faculty along lines of interest well advanced of and supported by the 5000-series courses.

6123* Non-traditional Machining. Prerequisite: consent of instructor. Rationale for non-traditional machining; various non-traditional machining processes including electro-discharge machining, electro-chemical machining, plasma arc, microwave, and laser assisted processing, waterjet (abrasive) cutting, ultrasonic machining, chemical machining, thermal spray processing, and electron beam machining.

6133* Surface Mechanics. Prerequisite: consent of instructor. Models and solutions basic to surface studies. Equations of continuum mechanics, thermal field solutions at sliding interfaces, elasticity, plasticity. Applications of solution techniques to surface, surface layer and interface phenomena.

6143* Thermal Analysis of Manufacturing Processes. Prerequisites: graduate standing and consent of instructor. Thermal analysis of various moving heat source problems encountered in a variety of manufacturing processes including machining, grinding, polishing, casting, welding, energy beam cutting and other tribological applications such as meshing of gears, cams, bearings. Analysis of both transient and steady state conditions.

6233* Turbulent Fluid Dynamics. Prerequisite: 5233. Isotropic turbulence, turbulent wakes and jets, boundary layer flows, transition, hydrodynamic stability and integral calculation methods for turbulent boundary layers.

6263* Computational Fluid Dynamics. Prerequisite: 5233. Steady and time-dependent velocity simulations of incompressible and compressible flows. Temperature and concentration solutions. Applications to various external and internal flow problems.

6423* System Identification. Prerequisite: 5473 or ECEN 5473 or ECEN 5713. Linear and nonlinear system modeling of random systems. Models of linear time-invariant systems, non-parametric methods and model development, parameter estimation methods, convergence and consistency, asymptotic distribution of parameter estimates, nonlinear modeling. Same course as ECEN 6423.

6453* Adaptive Control. Prerequisite: 5473 or ECEN 5473 or ECEN 5713 or MAE 5713. Analysis and design of control techniques which modify their performance to adapt to changes in system operation. Review of systems analysis techniques, including state variable representations, linearization, discretization, covariance analysis, stability, and linear-quadratic-gaussian design. On-line parameter estimation, model reference adaptive systems, self-tuning regulators, stable adaptive systems. Same course as ECEN 6453.

6463* Advances in Nonlinear Control. Prerequisites: 5463 or ECEN 5463. Introduction to vector fields and Lie algebra; controllability and observability of nonlinear systems; local decompositions; input-output and state-space representation on non-linear systems; feedback linearization; controlled invariance and distribution; control of Hamiltonian systems. Same course as ECEN 6463.

6483* Robust Multivariable Control Systems. Prerequisite: 5713 or ECEN 5713. Introduction to multivariable systems; SISO robustness vs. MIMO robustness; multivariable system poles and zeros; MIMO transfer functions; multivariable frequency response analysis; multivariable Nyquist theorem; performance specifications; stability of feedback systems; linear fractional transformations (LFT’s); parameterization of all stabilizing controllers; structured singular value; algebraic ricatti equations; H2 optimal control; H-infinity controller design. Same course as ECEN 6483.
Mechanical Engineering Technology (MET)

1103 Introduction to Mechanical Engineering Technology. Lab 2. Introduction to mechanical engineering technology, analytical techniques, and data presentation. Orientation to the mechanical engineering technologist's profession.


2103 Industrial Materials. Lab 3. Prerequisite: CHEM 1314. A survey of the properties, characteristics, and applications of metals, polymers, ceramics and other industrial materials. Terminology, concepts and principles involved in material selection, specification and processing. Laboratory activities include data collection and report generation, determination of material properties, and evaluation of material characteristics.


2313 Fundamentals of Hydraulic Fluid Power. Lab 2. Prerequisites: EET 1003 or CS 2103 or EET 1003 or ENGR 1412. Basic fluid power concepts. Standard hydraulic symbols, component design and application, fluid power system considerations, design and operation.

3003 Dynamics. Prerequisites: GENT 2323 and MATH 2123. Plane motion of particles and rigid bodies. Force-acceleration, work-energy, and impulse-momentum principles. Graphical analysis, mechanisms and vibrations.

3113 Basic Instrumentation. Lab 2. Prerequisites: GENT 3323, MATH 2123 and PHYS 1214. Data analysis, Theory, operational characteristics and application of transducers for measurement of strain, force, velocity, acceleration, displacement, time, frequency, temperature, pressure, fluid flow.

3213 Applied Fluid Mechanics. Prerequisites: 2313, MATH 2123. Fluid mechanical principles applied to fluid power systems and general fluid systems. Fluid system analysis using Bernoulli and general energy equations, laminar and turbulent flows, flow and pressure measurement, flow forces, lift and drag.


3343 Physical Metallurgy. Lab 3. Prerequisite: 2103. Analysis and evaluation of the properties of metals commonly used in product design. Property change caused by hot and cold working, and by heat treatment. Laboratory activities including metallurgical specimen preparation, inspection and testing; and standard tests of tensile properties, hardenability, hardness and toughness.

3413 Fundamentals of Pneumatic Fluid Power. Lab 2. Prerequisites: 2513, ECT 1003, MATH 1513. Basic pneumatics concepts, gas laws, component design and application, system design considerations. Air logic.

3503 Gas Turbines for Non-majors. Lab 2. Prerequisite: MATH 1513 or MATH 1715. Non-analytical, descriptive treatment of the operation of gas turbine engines including accessories and systems. Lab requires student participation in engines disassembly, inspection and reassembly. Field trips to engine overhaul and repair facilities.

3573 Advanced Production Processes. Lab 3. Prerequisites: 1223, 2013, GENT 1153, MATH 1513. Advanced manufacturing and production processes including polymers and plastics, powder metallurgy, foundry, welding and metal forming. Design for assembly ( DFA ) and design for manufacture (DFM).

4003 Machine Design I. Prerequisites: GENT 3323, CS 2103 or EET 1003 or ENGR 1412 and MATH 2133. Applications of statics and strength to the design of machine components. Problems of choosing materials, impact and fatigue loading.


4050 Advanced Mechanical Design. 1-3 credits, maximum 6. Lab 0-2. Prerequisites: junior standing and consent of instructor. Special problems in mechanical engineering technology.

4123 Senior Design Projects. Lab 4. Prerequisites: 1223, 4003 and ENGL 3323. Selected problems in design integrating principles of drafting, analysis, materials and manufacturing. Design projects are typically supplied by industry.

4203 Finite Element Methods. Prerequisite: 4003. Application of Finite Element Methods to machine component design. Problems involve stress, strain, temperature and vibration will be solved using state of the art Finite Element Software.

4213 Kinematics and Mechanisms. Lab 2. Prerequisites: 1223, 3003, CS 2103 or EET 1003 or ENGR 1412. Analysis and design of mechanisms such as the 4-bar linkage, slidercrank, cam and gear. Graphical and computer techniques.

4303 Computer Integrated Manufacturing. Lab 2. Prerequisite: GENT 1223, 2103, MATH 1613. Introduction to programming techniques and manufacturing applications of computer numerical control (CNC) and robotics. Machine capabilities and tooling requirements with programs being prepared manually and with COMPUTER II computer assistance.

4313 Electrohydraulics and Motion Control. Lab 2. Prerequisites: 2103, EET 3104. Principles of electronics as applied to fluid power controls. Trends in modern fluid power systems. Solenoid systems, proportional control, servosystems, programmable controllers, and robotics. Lab includes design, fabrication and operation of practical systems.

4453 Applied Thermodynamics. Prerequisite: ENSC 2213 or GENT 3433. Combustion, steam, gas, nucleonic cycles, internal and external combustion engines, refrigeration.

4463 Thermal Fluids Laboratory. Lab 3. Prerequisites: 3313, GENT 3433 and GENT 4433. Laboratory and industrial observation and analysis of thermal science applications including heat transfer, heat engines, and heat pumps.

4883 Tool Design. Lab 3. Prerequisite: 2213, 3343. Basic design and development of special tools for processing or manufacturing engineering materials. Design and specification and inspection tools and appropriate techniques of engineering graphics and analysis.

4993 Mechanical Engineering Technology Practice. Prerequisites: junior standing and consent of department head. Supervised industrial experience in mechanical engineering technology practice with minimal continual duration of eight weeks. Comprehensive journal, written report, and oral presentation.

Mechanized Agriculture (MCAG)

1413 Introduction to Engineering in Agriculture. Prerequisite: MATH 1513 or concurrent enrollment. Application of the physical and engineering sciences to agricultural problems. Energy: energy conversion, thermal, electrical, mechanical and fluid systems; equipment calibration; environmental control of agriculture buildings and irrigation system requirements.

2313 Surveying. Lab 3. Prerequisite: MATH 1613. A study of the equipment and practices used in surveying for small areas. Common practices of plane surveying: differential, profile, and topographic leveling; field notes, accuracy and precision, error and error control, and field measurement.

3211 Engines and Power. Lab 4. Prerequisites: 1413, MATH 1513. Theory, operation, performance and diagnostics of internal combustion engines for mobile applications.
3223 Metals and Welding. Lab 3. Prerequisite: 1413. Essential knowledge and theory necessary for understanding the principles of hot and cold metals and welding. Laboratory provides opportunity to apply and develop associated skills.

3311 Surveying. Lab 4. Prerequisites: 1413, MATH 1513. Use of surveying equipment and common applications in agriculture.

3321 Erosion Control Practices. Lab 4. Prerequisites: MATH 1513 and concurrent enrollment in MCAG 3311. Analysis, planning and management of soil and water resources.

4101 Agricultural Electrification. Lab 4. Prerequisites: 1413, MATH 1513. A study of electrical theory and electrical applications in agricultural environments.

4123* Principles of Food Engineering. Prerequisite: MATH 1513. For non-engineers. Application of the engineering approach to solving heat and mass transfer problems in food processing. An introduction to the basic concepts of the conservation laws, fluid flow, heat transfer, refrigeration, freezing, psychrometrics, and energy conservation.

4200* Topics in Mechanized Agriculture. 1-4 credits, maximum 4. Investigations in specialized areas of mechanized agriculture.

4203* Irrigation Principles. Prerequisite: MATH 1513. Sources, measurement and efficient use of irrigation water. Selection of pumping plants and power units. Layout and management of surface and sprinkler systems.

4212 Safety and Health in Agribusiness. Lab 2. Prerequisites as for above. Study of the causes and prevention of accidents in agribusinesses. Investigations including the acute and chronic risks of machinery, animals, gases, confined spaces, outdoor and hazardous materials.

4220* Advanced Methods in Agricultural Mechanics. 1-6 credits, maximum 6. Prerequisite: 4222. Developing agricultural mechanical programs for vocational agriculture and technical schools. Application of agricultural mechanics methods, practices and skills to advanced projects.

4223 Methods and Management of Agricultural Mechanization. Lab 3. Prerequisite: MATH 1513. The role of agricultural mechanics in educational systems. A study of the principles of agricultural mechanics, methods of teaching, instructor responsibility and liability, laboratory safety, project construction, selection of resources, project evaluation, and the selection, use and care of tools.

4311 Technology and Environment. Lab 4. Prerequisites: 1413, MATH 1513. A study of the impact of technology on the environment.

Medical Technology (MTCL)

4117 Clinical Microbiology. Lab 12. Prerequisites: concurrent internship in affiliated hospital, and all degree requirements for B.S. in medical technology except 30 hours MTCL. The theory and laboratory study of pathogenic bacteria, viruses, fungi, and parasites. Includes isolation, identification, antimicrobial susceptibility testing, and medical significance.

4125 Clinical Chemistry I. Lab 9. Prerequisites: concurrent internship in affiliated hospital, and all degree requirements for B.S. in medical technology except 30 hours MTCL. The theory and laboratory methodology of analytical biochemistry, clinical microscopy, routine and special procedures, and medical significance.

4226 Clinical Hematology. Lab 12. Prerequisites: concurrent internship in affiliated hospital, and all degree requirements for B.S. in medical technology except 30 hours MTCL. Systematic study of diseases, cell maturation and function, principles of hemostasis; methodology used in routine and special hematology studies; and correlation of hematological findings with physiological conditions.

4246 Clinical Immunology. Lab 12. Prerequisites: concurrent internship in affiliated hospital, and all degree requirements for B.S. in medical technology except 30 hours MTCL. Immunologic responses and procedures used in serological determinations; immunohematology, fundamentals of antigen-antibody reactions, blood groups and types, compatibility testing, blood components, and the lab methods used as they relate to the medical significance of immunology and infectious diseases.

4325 Clinical Laboratory II. Lab 9. Prerequisites: concurrent internship in affiliated hospital, and all degree requirements for B.S. in medical technology except 30 hours MTCL. Principles and practices of the medical laboratory including basic management, quality assurance, education methodology, computer applications, laboratory safety, and special projects in selected areas.

Microbiology (MICR)

1513 (L,N)Inquiry-based Biology. Lab 3. Prerequisites: CHEM 1413, GEOG 1613, PHYS 1313 recommended. Directed inquiry and hands on study of biological principles. Recommended for elementary education majors as model course to learn and teach science.

2125 Introduction to Microbiology. Lab 4. Prerequisites: one year of chemistry and BIOL 1114. General principles of microbiology.

3143 Medical Mycology. Lab 4. Prerequisite: 2125. Examination of fungi as animal pathogens; laboratory techniques used in the identification of human and animal pathogens, and differentiation from common contaminants.

3154 Food Microbiology. Lab 4. Prerequisites: 2125 and organic chemistry. Relationship of microorganisms to food manufacture and preservation, to food spoilage and microbial food poisoning and to various aspects of primary food production. Same course as ANSI 3154.


3254 Immunology. Lab 3. Prerequisite: 2125.Vertebrate host’s ability to defend itself against foreign intrusion. Chemistry and biology of the acquired immune response. Same course as CLML 3254.

4000 Honors in Microbiology. 1-4 credits, maximum 4. Prerequisite: consent of departmental honors committee. Supervised study and research in microbiology.

4001 Professional Transitions in Microbiology and Cell and Molecular Biology. Prerequisites: declared microbiology or cell and molecular biology major with minimum 70 hours earned and consent of instructor. Understanding major areas and employment activities in microbiology, cell biology and molecular biology fields. Evaluating and understanding scientific and professional literature, and making the transition from undergraduate education to postgraduate education or employment. Same course as CLML 4001.

4123* Virology. Prerequisites: CLML 3014 or one course in biochemistry. Corequisite: 3224. Virus-host interactions including structure-function of animal, plant and bacterial viruses. Discussion of the molecular biology of virus infection and development. Same course as CLML 4123.


4134* Pathogenic Microbiology. Lab 3. Prerequisite: 2125, corequisite: 3224. Examination of pathogenic bacteria as they relate to humans, other animals, plants and insects.


4323* Bioenergetics. Prerequisites: BIOL 3653 or CLML 3014. Bioenergetics reactions and mechanisms involved in energy production in plants, animals and microbial systems. Same course as CLML 4323.

4990 Special Problems. 2-4 credits, maximum 4. Prerequisite: consent of instructor. Minor investigations in the field of microbiology.
Microbiology

Senior Honors Project. Prerequisites: departmental invitation, senior standing, Honors Program participation. A research project under the direction of a faculty member resulting in a written report to be judged by a second faculty member as well. Required for graduation with departmental honors in microbiology.

Microbiology

500* Thesis. 2-6 credits, maximum 6. Prerequisite: consent of major professor. A student studying for the M.S. degree enrolls in this course for six hours credit.

5113* Advanced Immunology. Prerequisite: 3254. Advanced studies with emphasis on the regulation of vertebrate immune responses.

5142* Techniques in Molecular Biology. Lab 4. Prerequisite: consent of instructor. Comprehensive laboratory course in research techniques involving classical genetics and molecular biology.

5153* Emerging Infectious Agents. Prerequisites: 3134, 4123. An in-depth discussion of the importance of emerging infectious agents, the molecular basis for their emergence, and the broad spectrum of host-microbe interactions favoring the evolution of new infectious agents.

5160* Seminar. 1 credit, maximum 2. Required of all graduate students majoring in microbiology.

5213* Environmental Microbiology. Prerequisite: 3224, BIOL 3653 or equivalent. Microbial processes and diversity. Fundamental and applied aspects of microbial ecology, physiology, energetics, and mechanisms of energy conservation. Microbial transformation of organic, inorganic, and pollutant compounds, and bioremediation. Study of modern molecular tools for the detection of microbes in the natural environment.

5254* Biotechnology Projects. Lab 8. Prerequisites: 4133, MIRC 5142. An indepth exposure to the practical application of biological principles. Classical and modern (genetic engineering) biotechnology, within a framework involving the identification of a problem or need, determination of a solution or product, strain development, scale-up technology, and product recovery or process enhancement.

5990* Special Problems. 1-4 credits, maximum 10. Prerequisite: permission of instructor. Investigations in the field of microbiology.

6000* Dissertation. 1-15 credits, maximum 45. Prerequisite: consent of major adviser. Research in microbiology for the Ph.D. degree.

6112* Molecular Biology of Bacterial Viruses. Prerequisites: 4123 and 4133. Advanced study of bacteriophages.

6120* Recent Advances in Microbiology. 1-3 credits, maximum 6. Prerequisite: one graduate course in biochemistry. Discussion and evaluation of recent scientific contributions in terms of the living organism.

6143* Advanced Microbial Physiology. Lab 3. Prerequisite: 3224 or consent of instructor. Discussion of selected topics in microbial physiology. Critical analysis of research papers.

6153* Advanced Molecular Genetics. Prerequisites: 4133 or CLML 4133. Structure, function and regulation of nucleic acids. Gene transfer mechanisms, genetic recombination and plasmid biology. Recent developments in recombining DNA technology.

6253* Microbial Evolution. Prerequisites: 2124, BIOL 3653, BIOL 3024. The mechanisms and results of microbial evolution in nature and in the laboratory, with emphasis on microbes as model evolutionary systems, molecular evolution, characterization and phylogeny, and discussion of protobiology and the probable fate of engineered microbes.

6304* Genetics of Simple Eukaryotes. Prerequisites: solid understanding of basic cellular maintenance and propagation processes and consent of instructor. In-depth discussion of lessons learned from simple eukaryotes such as S. cerevisiae (yeast), A. nidulans (fungus), D. melanogaster (fly) and C. elegans (worm).

6323* Current Topics in Eukaryotic Signal Transduction and Gene Regulation. Prerequisites: BIOL 3653, BIOL 3024 and CLML 3014. Discussion of current literature on the mechanisms of eukaryotic signal transduction and gene regulation.

Military Science (MLSC)

1000 Leadership Laboratory. 1 credit, maximum 2. Lab 2. Prerequisites: concurrent enrollment in 1112 and 1212. Learning and practicing basic skills such as rappelling, drill and ceremony, land navigation, individual first aid, individual training in small unit tactics.

1112 Fundamentals of Military Leadership. Team study and activities in basic drill, physical fitness, leadership reaction course, first aid, presentations and basic marksmanship. Fundamentals of leadership. Optional weekend exercise. Concurrent enrollment in MLSC 1000 recommended.

1212 Introduction to Leadership. Principles of effective leading, communication skills, and organizational ethical values. Concurrent enrollment in MLSC 1000 recommended. Optional weekend exercise.

2130 Military Physical Conditioning. 1 credit, maximum 2. Lab 2. Prerequisite: must be enrolled in MLSC theory classes. Participation in and learning to plan and lead a physical fitness program. Development of an individual fitness program and the role of exercise and fitness in person's life.

2233 Self and Team Development. Lab 2. Ethics-based leadership skills that develop individual abilities and contribute to the building of effective teams. Skills in oral presentation, writing, planning, coordinating groups, land navigation and basic military tactics.

2313 Individual and Team Military Tactics. Lab 2. Prerequisite: 2233. Individual and team aspects of military tactics in small unit operations. Skills assessment, movement techniques, planning for team safety and security and methods and pre-execution checks. Training techniques for continued leadership development.

3113 Leading Small Organizations I. Lab 2. Prerequisites: completion of lower-division MLSC or equivalent, and approval of professor of military science. Practical opportunities to lead small groups in situations of increasing complexity receiving personal assessments and encouragement. Use of small unit defensive tactics and opportunities to plan and conduct training for lower-division students both to develop such skills and as vehicles for practicing leading.

3223 Leading Small Organizations II. Lab 2. Prerequisite: 3113. Analysis of tasks; preparation of written or oral guidance for team members to accomplish tasks. Delegating tasks and supervising. Planning and adapting to the unexpected in organizations under stress. Examination and application of lessons from leadership case studies. Examination of importance of ethical decision making in setting a positive climate that enhances team performance.

4014 Reserve Officers’ Training Corps (ROTC) Advanced Camp. Lab 8. Prerequisites: 3113 and 3223. A five-week camp conducted at an Army post. Individual leadership and basic skills performance.

4123 Leadership Challenge and Goal-Setting. Lab 2. Prerequisites: 3113 and 3223. Planning, conducting and evaluating activities of the ROTC cadet organization. Articulating goals, putting plans into action to attain them. Assessing organizational cohesion and developing strategies to improve it. Developing confidence in skills to lead people and manage resources.

4223 Military Ethics, Justice and Professionalism. Lab 2. Prerequisites: 3113 and 3223. Continuation of the methodology from MLSC 4122. Identification and resolution of ethical dilemmas. Refining counseling and motivating techniques. Examination of aspects of tradition and law as related to leading as an officer in the Army.

4422 The Tactical Planning Process. Prerequisite: ROTC advanced course status or consent of department head. The tactical planning process and its components. Computer tactical simulations used to organize and synchronize the process.

Music (MUSI)


1011 Piano Class Lessons. For students with no previous experience.

1021 Piano Class Lessons.

1031 Voice Class Lessons.

1071 Single Reed Techniques. Lab 2. Methods for playing and teaching the clarinet and saxophone.

1081 Double Reed Techniques. Lab 2. Methods for playing and teaching the oboe and bassoon.

1090 Secondary Harpsichord. 1-2 credits, maximum 8.

Prerequisite: 1230.

Secondary Woodwind

Prerequisite: 1220.

Secondary String

Secondary Voice

Prerequisite: 1190.

Prerequisite: 1180.

8. Prerequisite: 1170.

Elective Percussion

Prerequisite: 1160.

3160

requisite: 1150.

3150

requisite: 1140.

Elective Voice

requisite: 1120.

3120

3110

Elective Harpsichord

1-2 credits, maximum 8.

3100

Elective Organ. 1-4 credits, maximum 8. Prerequisite: 1110.

3110

Elective Piano. 1-4 credits, maximum 8. Prerequisite: 1120.

3120

Elective Voice. 1-4 credits, maximum 8. Prerequisite: 1130.

3130

Elective Brass. 1-4 credits, maximum 8. Prerequisite: 1140.

3140

Elective String. 1-4 credits, maximum 8. Prerequisite: 1150.

3150

Elective Woodwind. 1-4 credits, maximum 8. Prerequisite: 1160.

3160

Elective Percussion. 1-4 credits, maximum 8. Prerequisite: 1170.

3170

Secondary Organ. 1-2 credits, maximum 8. Prerequisite: 1180.

3180

Secondary Piano. 1-2 credits, maximum 8. Prerequisite: 1190.

3190

Secondary Voice. 1-2 credits, maximum 8. Prerequisite: 1200.

3200

Secondary Brass. 1-2 credits, maximum 8. Prerequisite: 1210.

3210

Secondary String. 1-2 credits, maximum 8. Prerequisite: 1220.

3220

Secondary Woodwind. 1-2 credits, maximum 8. Prerequisite: 1230.

3230

Secondary Percussion. 1-2 credits, maximum 8. Prerequisite: 1240.

3240

Major Organ. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2250.

3250

Major Piano. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2260.

3260

Major Voice. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2270.

3270

Major Violin. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2280.

3280

Major Viola. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2290.

3290

Major Cello. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2300.

3300

Major Double Bass. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2310.

3310

Major Flute. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2340.

3340

Major Oboe. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2350.

3350

Major Clarinet. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2360.

3360

Major Saxophone. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2370.

3370

Major Bassoon. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2380.

3380

Major Euphonium. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2420.

3430

Major Tubab. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2430.

3440

Major Percussion. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2440.

3450

Major Harpsichord. 1-4 credits, maximum 8. Prerequisites: upper-division examination, 2460.

3460

Secondary Harpsichord. 1-2 credits, maximum 8.

3470

Prerequisite: 3592. Advanced study of characteristics and performance of recording studio components through observation, reading and personal experience.

3552

Introduction to Recording Studio Techniques I. Prerequisite: 3592. Introduction to performance and characteristics of studio components. Basic signal flow, basic microphone design and application, recording session procedures, role of assistant engineers.

3562

Recording Studio Techniques II. Prerequisite: 3552. Advanced study of characteristics and performance of recording studio components through observation, reading and personal experience.

3583

Prerequisite: 2563. Study of specialized computer applications in music, including MIDI basics and sequencing.

3610

University Bands II. 1-2 credits, maximum 6. Lab 3-5. Prerequisite: 4 hours of 2610.

3620


3630

University Choral Ensembles II. 1-4 credits, maximum 6. Prerequisite: 4 hours of 2630.

3642

English and Italian Diction and Vocal Literature. Course is designed for vocal performance majors, vocal music education majors and other serious voice students to assist them in mastering correct pronunciation and diction for singing standard English and Italian through the study and use of the international phonetic alphabet, and to familiarize them with many of the composers and songs which comprise the standard English and Italian vocal literature.

3652

French Diction and Vocal Literature. Course is designed for vocal performance majors, vocal music education majors and other serious voice students to assist them in mastering correct pronunciation and diction for singing in French through the study and use of the international phonetic alphabet, and to familiarize them with many of the composers and songs which comprise the standard French vocal literature.

3662

German Diction and Vocal Literature. Course is designed for vocal performance majors, vocal music education majors and other serious voice students to assist them in mastering correct pronunciation and diction for singing in German through the study and use of the international phonetic alphabet, and to familiarize them with many of the composers and songs which comprise the standard German vocal literature.

3712

Basic Conducting. Principles of conducting choral and instrumental groups.

3722


3732

Teaching Choral Music. Prerequisite: 3712. Repertoire, rehearsal procedures, and vocal techniques for the public school choral teacher.

3743

Foundations of Music Education. Prerequisite: full admission to Teacher Education. Interdisciplinary approach including aspects of philosophy, aesthetics, sociology and psychology as they are applied in music in post-elementary public schools.
Prerequisite: 1513, 1533 or equivalent. Aids music majors and other qualified students in understanding the musical styles, forms, schools, composers and instruments that developed in Western civilization from the pre-classical period to the 20th century.

3772 Counterpoint. Prerequisites: 2563 and satisfactory upper-division examination. Analysis and application of contrapuntal techniques of the 18th century.

3783 Form and Analysis. Prerequisites: 2563 and satisfactory upper-division examination. Analysis of standard repertoire with emphasis on form and structural harmonic analysis.

3842 Marching Band Methods. Prerequisite: 3731. Organizational responsibilities and charting for public school marching bands.

3852 Instrumental Methods and Literature. Prerequisite: 3712. This course is designed to give instrumental music education majors an in-depth look at administering a public school band program. History and wind literature, literature selection, preparing budgets, preparing commissioning projects, and working with administration, school boards and parent groups.

3901 Junior Recital. Prerequisites: junior standing and consent of major applied music teacher.

4100 Music Industry Internship. 1-8 credits, maximum 8. Lab 8. Prerequisites: 90 credit hours and minimum 2.50 GPA in all music and business courses. Directed practical experiences in an approved work situation related to the music industry.

4250 Major Organ. 1-6 credits, maximum 12. Prerequisites: 3250 and successful completion of recital attendance requirements.

4260 Major Piano. 1-6 credits, maximum 12. Prerequisites: 3260 and successful completion of recital attendance requirements.

4270 Major Voice. 1-6 credits, maximum 12. Prerequisites: 3270 and successful completion of recital attendance requirements.

4280 Major Violin. 1-6 credits, maximum 12. Prerequisites: 3280 and successful completion of recital attendance requirements.

4290 Major Viola. 1-6 credits, maximum 12. Prerequisites: 3290 and successful completion of recital attendance requirements.

4300 Major Cello. 1-6 credits, maximum 12. Prerequisites: 3300 and successful completion of recital attendance requirements.

4310 Major Double Bass. 1-6 credits, maximum 12. Prerequisites: 3310 and successful completion of recital attendance requirements.

4340 Major Flute. 1-6 credits, maximum 12. Prerequisites: 3340 and successful completion of recital attendance requirements.

4350 Major Oboe. 1-6 credits, maximum 12. Prerequisites: 3350 and successful completion of recital attendance requirements.

4360 Major Clarinet. 1-6 credits, maximum 12. Prerequisites: 3360 and successful completion of recital attendance requirements.

4370 Major Saxophone. 1-6 credits, maximum 12. Prerequisites: 3370 and successful completion of recital attendance requirements.

4380 Major Bassoon. 1-6 credits, maximum 12. Prerequisites: 3380 and successful completion of recital attendance requirements.

4390 Major Trumpet. 1-6 credits, maximum 12. Prerequisites: 3390 and successful completion of recital attendance requirements.

4400 Major French Horn. 1-6 credits, maximum 12. Prerequisites: 3400 and successful completion of recital attendance requirements.

4410 Major Trombone. 1-6 credits, maximum 12. Prerequisites: 3410 and successful completion of recital attendance requirements.

4420 Major Euphonium. 1-4 credits, maximum 8. Prerequisites: 3420 and successful completion of recital attendance requirements.

4430 Major Tuba. 1-6 credits, maximum 12. Prerequisites: 3430 and successful completion of recital attendance requirements.

4440 Major Percussion. 1-6 credits, maximum 12. Prerequisites: 3440 and successful completion of recital attendance requirements.

4450 Major Harpsichord. 1-4 credits, maximum 8.

4490* Lessons in Applied Music (Major Field). 1-4 credits. Prerequisite: bachelor’s degree or equivalent performing level in applied major field. Major applied music field.

4600* Chamber Ensembles. 1-2 credits, maximum 12. Lab 2. Prerequisite: 4 hours of MUSI 2600 or equivalent. Combinations of voices, keyboard, and orchestral instruments for performing chamber music, music theater and duo piano repertoire.

4810* Problems in Musical Composition. 1-2 credits, maximum 2. Prerequisites: 1543 and consent of instructor. Practical experiences in musical composition.

4840* Special Studies in Music Literature. 1-2 credits, maximum 4. Prerequisite: junior standing or consent of instructor. Survey of music literature suitable for teaching various levels in applied music.

4890* Special Studies in Music Pedagogy. 1-2 credits, maximum 4. Prerequisite: junior standing or consent of instructor. Survey of music pedagogical methods suitable for various levels and types of applied music.

4901 Senior Recital. Prerequisites: senior standing and permission of major applied music teacher.

4912 Orchestration and Arranging. Prerequisite: upper-division standing as a music major or consent of instructor. Orchestration for instrumental ensembles and arranging for choral ensembles.

4940 Student Teaching in Public School Music. 1-12 credits, maximum 12. Prerequisites: 3501 and full admission to Teacher Education. Directed observation, seminars, and supervised student teaching in selected elementary and secondary music programs. Graded on a pass-fail basis.


4972 Twentieth Century Music Theory and Literature. Prerequisites: 2563, 3763. Melodic, harmonic and rhythmic techniques in 20th century music.

4990* Selected Studies in Music and Music Education. 1-3 credits, maximum 8. Short-term area studies in music and music education.

4993 Senior Honors Project. Prerequisites: departmental invitation, senior standing, Honors Program participation. A guided program in musicological research, music composition, or music performance, ending with an honors project under the direction of a faculty member with a second faculty member to complete an examining committee. Required for graduation with departmental honors in music.

5004* Final Degree Project. Preparation of a recital of significant repertoire to be conducted or played in public performance, depending upon the student’s degree track. Submission of a formal paper that is a formal interpretive analysis of each work.

5113* Introduction to Graduate Studies in Music. Prerequisites: admission to Master of Music program. Understanding of the resources available for research in the field of music. Explanation of the types of research materials needed for classes in the Master of Music degree program, as well as providing the groundwork for success in the professional world as a music educator and performer.

5480* Lessons in Applied Music (Minor Field). 1-4 credits, maximum 12. Prerequisite: bachelor’s degree or equivalent performing level in applied major field. Private Lessons.

5490* Lessons in Applied Music (Major Field). 1-4 credits, maximum 12. Prerequisite: bachelor’s degree or equivalent performing level in applied major field. Private Lessons.

5512* Advanced Studies in Music Literature and Pedagogy I. Prerequisite: 3753, 3763 or equivalent. Teaching and performance of ensemble literature through a survey of repertoire appropriate to the student’s chosen medium.
Natural Science (NATS)

5050  Report. 1-2 credits, maximum 2. Prerequisite: enrollment in program leading to M.S. in natural science. Guidance in reading and research required for M.S. in natural science degree.

5990*  Topics in Natural and Applied Sciences. 1-3 credits, maximum 9. Prerequisite: graduate standing. Special topics in the natural and applied sciences for students interested in topics not normally covered in existing course work.

Nutritional Sciences (NSCI)

2111  Professional Careers in Nutritional Sciences. Career opportunities in dietetics and foods and nutrition. Roles and responsibilities of nutritional sciences professionals. Routes to professional memberships and current issues in professionalism.


2850  Special Topics in Nutritional Sciences. 1-3 credits, maximum 4. Study of specific consumer education issues or topics in nutritional sciences.

3133*  Science of Food Preparation. Lab 3. Prerequisites: HRAD 1114, organic chemistry. Application of scientific principles to food preparation.

3213  Management in Hospitality and Food Service Systems. Prerequisite: a course in economics. Function and methods of management as related to the hospitality and food service industries.

3223  Nutrition Across the Life Span. Prerequisite: 2114 or equivalent. Nutritional needs and dietary concerns of individuals from conception through old age.

3440  Nutritional Sciences Professional Experience. 1-3 hours, maximum 3. Directed practical experience in an approved work situation related to the foods and nutrition industry.


3553  Purchasing in Hospitality and Food Service Systems. Prerequisite: 3133 or concurrent enrollment. Procurement of food and nonfood materials in hospitality and related industries.

3812  Nutrition Assessment and Counseling Skills. Lab 2. Prerequisites: 2114, 3223 or consent of instructor. Theory and practice of counseling and interviewing skills as applied to nutrition counseling. Collection and interpretation of anthropometric, biochemical and dietary data necessary to determine nutritional status.

3991  Pre-internship Seminar in Nutritional Sciences. Skills requisite for directed practical experience in a work situation in food and nutrition areas.

4013*  Experimental Foods. Lab 3. Prerequisite: 3133 or consent of instructor. Investigations in physical, chemical and sensoric, and functional properties of foods and their ingredients. Research project applying food science and nutrition principles to product development.

4023*  Nutrition and Health Issues. Prerequisites: 2114, 3223. Analysis of the role of specific nutrients in health maintenance and in prevention of chronic disease. Communication of nutrition information to the public.

4133*  Nutrition for Exercise and Sport. Prerequisites: HHP 3114, NSCI 4323 and BIOC 3653 or consent of instructor. Application of principles of nutrient metabolism as they relate to physical activity, sport and health.

4323*  Human Nutrition and Metabolism. Prerequisites: 2114 or equivalent, organic chemistry, physiology. Digestion, absorption and metabolism of nutrients; functions and health implications in the human organism.

4333*  Food, Beverage, and Labor Cost Controls. Prerequisites: ACCT 2203, junior standing. Menu analysis and food/beverage/labor cost controls associated with hospitality industry operations.

4365*  Quantity Food Production Management. Lab 5. Prerequisites: HRAD 2125, HRAD or NSCI 3553 and a course in accounting or mathematics or consent of instructor. Organizing, purchasing, costing, preparation and service of food in a quantity food production setting.

4373*  Creative Teaching of Nutrition. Prerequisites: 2114, 3223 or concurrent enrollment. Analyses of various methods, techniques, resources and evaluation for nutrition education. Experimental component required.

4573*  Food Systems Administration. Lab 3. Prerequisites: HRAD 3553, 4365. Management and integration of financial, human, physical, food and other material resources in various settings.

4643  Critical Issues in Nutrition and Healthcare. Prerequisite: senior standing. Integration of the body of knowledge of nutrition and healthcare through examination of critical issues.

4733*  Community Nutrition. Prerequisites: 2114, 3223. Application of nutrition, education and communication principles to community nutrition programs and services. Field work required.

4850  Special Unit Studies in Nutritional Sciences. 1-3 credits, maximum 6. Special units of study in nutritional sciences.

4853  Medical Nutrition Therapy I. Prerequisites: 3812, 4323 or concurrent enrollment. Physiological and metabolic bases for dietary modifications in disease states.

4863  Medical Nutrition Therapy II. Prerequisite: 4853. A continuation of 4853.
5000* Research in Nutritional Sciences. 1-6 credits, maximum 6. Prerequisite: consent of adviser. Individual research and thesis that will fulfill the requirements for the master’s degree.

5012* Public Policy Development in Food, Nutrition and Related Programs. Rational underlying governmental programs in food and nutrition and human environmental sciences and assessment of the effectiveness of the programs.

5123* Research Developments in Nutritional Sciences. Basic components of the research process and application of research methods to nutritional sciences.

5211* Contemporary Issues in Food Service and Management. Prerequisite: acceptance as a dietetic intern. Discern contemporary issues in food service and management in dietetics; formulate innovative solutions and processes to enhance effectiveness in the work place. Graded on a pass-fail basis.

5221* Contemporary Issues in Clinical Nutrition. Prerequisite: acceptance as a dietetic intern. Discern contemporary issues in the practice of clinical dietetics; formulate innovative solutions and processes to enhance effectiveness in the work place. Graded on a pass-fail basis.

5230* New Findings in Nutrition. 1-3 credits, maximum 6. Prerequisite: 2114 or equivalent. Current emphases in nutrition, with implications for nutrition research, education, and public service.

5231* Contemporary Issues in Community Nutrition. Prerequisite: acceptance as a dietetic intern. Discern contemporary issues in the practice of community dietetics; formulate innovative solutions and processes to enhance effectiveness in the work place. Graded on a pass-fail basis.

5343* Organization and Management of Food Service Systems. Prerequisite: 4573 or equivalent. Contemporary theories of organizational structures as applied in the management of food service systems.

5363* Maternal and Infant Nutrition. Prerequisite: 2114 or equivalent. Nutritional needs and dietary concerns during pregnancy, lactation and the first year of life. Implications for nutrition intervention, education and policy.

5373* Childhood Nutrition. Prerequisite: 2114 or consent of instructor. Normal nutritional needs of children, preschool through grade 12. Dietary implications for child care programs, school food service and parent education.

5393* Nutrition and Aging. Prerequisite: 2114 or equivalent. Nutritional needs, and dietary concerns of the elderly. Implications for food and nutrition programs, policies, research and education.

5412* Dietetic Internship Management Practicum. Prerequisite: acceptance as a dietetic intern. Supervised learning experiences in approved food service management for the achievement of performance requirements for entry level dietitians. Graded on a pass-fail basis.

5422* Dietetic Internship Clinical Practicum. Prerequisite: acceptance as a dietetic intern. Supervised learning experiences in approved clinical for the achievement of performance requirements for entry level dietitians. Graded on a pass-fail basis.

5432* Dietetic Internship Community Nutrition. Prerequisite: acceptance as a dietetic intern. Supervised learning experiences in approved community nutrition settings for the achievement of performance requirements for entry level dietitians. Graded on a pass-fail basis.

5463* Advanced Human Nutrition. Prerequisites: a biochemistry course and an upper-level nutrition course. Application to the human being of metabolic processes which involve essential dietary components.

5533* International Nutrition and World Hunger. Prerequisite: consent of instructor. Advanced study of the magnitude, causes, and nature of hunger and undernutrition in low income countries; emphasis on programs, policies and planning directed toward alleviating hunger.

5563* Nutritional Assessment. Prerequisites: 3223, 4323, or equivalent. Dietary, physical, and biochemical assessment techniques and their application to patient or client nutritional status assessment in health care systems.

5593* Quality of Work Life in Food Service Organizations. Prerequisite: one course in personnel management. Analysis of administrative problems in food service organizations. Focus on quality of work life assessment.

5612* Theory, Research and Practice of Nutrition Education. Prerequisites: 4373 or equivalent and consent of instructor. Analyses of various learning and behavior change theories and application in nutrition education.

5633* Nutrition and Immunology. Prerequisites: nutrition courses, or relevant training in physiology, immunology or consent of instructor. Principles and issues related to nutrition and immunology. Impact of nutrients and nutritional status on integrity of the immune system.

5643* Advanced Medical Nutrition Therapy. Prerequisite: admission to dietetic internship or consent of instructor. Physiological and metabolic bases for nutritional support in disease.

5673* Manpower Management in Health Care and Related Industries. Prerequisite: consent of instructor. Future role, focus, policies and governance of human resources in health care.

5713* Community Dietetics. Prerequisites: 4373, 4733 or equivalent. Analysis of the impact of political, legislative, economic and cultural diversity factors on dietetic practice in public health and other community nutrition programs.

5743* Experimental Methods in Nutritional Sciences. Prerequisites: a course in biochemistry, a course in statistics, a graduate course in food or nutrition. Experimental design for research in food and nutrition based on analytical laboratory techniques and other research methodology.

5753* Management in Health Care Systems. Prerequisite: consent of instructor. Overview of U.S. international and transcultural health care systems. Futuristic managerial roles of health care professionals and how they affect health and health care in various settings.

5783* Food Product Development. Prerequisite: 4013 or ANSI 3373 or MCAG 4123 or consent of instructor; graduate standing. Principles and pertinent issues in food product development, including concepts, experimental and product design, process development, evaluation, packaging and marketing.

5863* Sensory Evaluation of Food. Lab 2. Prerequisite: 4013 or consent of instructor. Basic principles of physiology and psychology as they pertain to sensory evaluation, importance of sensory evaluation to the food industry, organization and operation of a sensory program or facility, test strategies, design of experiments and testing instruments, discrimination testing, descriptive analysis, and affective testing.

5870* Problems in Nutritional Sciences. 1-4 credits, maximum 6. Analysis of emerging problems and trends in nutritional sciences.

5961* Seminar in Nutritional Sciences. Prerequisite: for Master of Science students. Individual and group seminars on current issues and research in nutritional sciences.

6000* Doctoral Thesis. 1-12 credits, maximum 30. Prerequisite: consent of major professor.

6113* Critical Analysis of Current Issues in Nutrition. Prerequisite: 5463 or consent of instructor. Current issues in human nutrition with emphasis on interrelationships of nutrients in metabolism and their impact on health.

6123* Micronutrients in Human Nutrition. Prerequisite: one course in biochemistry. In depth study of vitamins and minerals and their interrelationships in metabolism.

6233* Critical Analysis of Current Issues in Food Service Administration. Prerequisites: 5593, 5673. Current issues in food service administration with emphasis on total quality management, robotics, solid waste management and research needs.

6453* Advanced Research Developments in Nutritional Sciences. Prerequisites: one course in research methods and one course in statistics. Components of the research process for students who have completed an advanced degree. Development, application and interpretation of research methodology.

6870* Independent Study in Nutritional Sciences. 1-3 credits, maximum 6. In-depth analysis of research issues in nutritional sciences.

6961* Advanced Studies in Nutritional Sciences. Critical evaluation of research in nutritional sciences. Individual and group seminars on selected topics.
Occupational Education (OCED)

5000* Thesis or Report. 2-10 credits, maximum 10. Students studying for a master's degree may enroll for a total of two credit hours if they write a report or six hours if they write a thesis. Students working on a specialist's degree may earn a maximum of 10 hours credit.

5010* Seminar. 1-3 credits, maximum 6. Graduate student seminars focusing on current and critical issues and common problems relevant to occupational education.

5113* Principles of Occupational Education. Underlying principles and evolving concepts in occupational and adult education. Critical analysis of educational programs and service areas and the resulting implications for leadership personnel at all levels of program responsibility.

5123* Evaluation of Programs and Instruction in OCED. Philosophies, principles and techniques of evaluation and strategies for applying them in planning, managing and improving educational programs. Designing, conducting, and reporting evaluations of OCED programs and instruction.

5133* International Occupational Education. Prerequisite: graduate standing. Ideas, practices and systems of occupational education in other countries compared with contemporary practices in the United States to provide a basis for an enlarged, critical view of technical education.


5223* Program Planning for Occupational and Technical Educators. Approaches to program planning designed around continuous improvement methods for problem solving, flowcharting, budgeting, gaining program support, and Lifelong Education Program Planning (LEEP) model.

5232* Teaching Related Information. Selection of job-related topics common to most occupational programs; procedures for incorporating those topics into the regular curriculum.

5233* Advanced Instructional Procedures in Trade and Industrial Education. Advanced methods and procedures for effective teaching and learning in occupational education classrooms and laboratories. Teaching basic education and techniques of facilitating learning at a distance. Development of skills in designing and delivering instruction via current synchronous and asynchronous technologies such as video conferencing and Internet, fostering analysis of current research in distance learning, and encouraging real-world applications of acquired skills and knowledge.

5270* Workshop. 1-3 credits, maximum 10. Professional workshops of various topics and lengths. Each workshop designed to meet unique or special needs of individuals concerned with adult education and human resource development.

5313* History and Organization of Occupational Education. Prerequisite: graduate standing. Social, political, and economic forces acting upon occupational education studies in depth for leadership development.

5333* Administration and Supervision of Local Occupational Education Programs. The duties of administrative and supervisory personnel responsible for the development, coordination and promotion of occupational education programs.

5340* Special Problems in Occupational Education. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Directed independent study of special topics involving assigned readings, library research, field work or a combination of these.

5413* Guidance, Placement and Follow-up in Occupational Education. Teacher-counselor cooperation in occupational student advisement, placement and follow-up.

5423* Individualizing Competency-based Instruction Programs. Development of knowledge and skills utilizing the concept of open entry/open exit necessary for planning, developing and implementing a competency-based occupational education program.

5443* Interpreting Research in Occupational Education. Seminar on the methods of research, review, synthesis and interpretation with application to particular fields of occupational and adult education.

5480* Modern Technology in Occupational Education. 1-6 credits, maximum 6. Technical developments in specialized occupational areas examined and analyzed for educational curriculum and program implications.

5543* Occupational Education, Community and Industry Relations. Exploration of strategies for developing meaningful relationships among occupational educators, industry representatives, and community members to increase the likelihood that the needs of students, workers, employers and community members are met.

5553* Occupational Education for Students with Special Needs. Techniques and procedures by which occupational education may serve individuals with special needs. Field experiences an integral part of the course.

5673* Principles and Practices of Distance Learning in Occupational Education. Prerequisite: graduate student standing. Issues, methods, tools and techniques of facilitating learning at a distance. Development of skills in designing and delivering instruction via current synchronous and asynchronous technologies such as video conferencing and Internet, fostering analysis of current research in distance learning, and encouraging real-world applications of acquired skills and knowledge.

5720* Workshop. 1-3 credits, maximum 6. Professional workshops of various topics and lengths. Each workshop designed to meet unique or special needs of individuals concerned with adult education and human resource development.

5773* School-to-Work Transition. Strategies and procedures for coordinating school-to-work transition programs (e.g., cooperative education, youth apprenticeship, career exploration). Planning, organizing, implementing, and evaluating school-related, work-based learning.

5880* Internship in Occupational Education. 3-6 credits, maximum 6. Prerequisites: consent of instructor. Directed field experiences related to the participant's area of concentration. Practice and testing ideas, theories and concepts learned in graduate study.

5910* Developing and Analyzing Teaching Content. 1-3 credits, maximum 6. Provides opportunity for experienced teachers to incorporate the latest industrial technology into their course of study.


6103* Philosophy of Occupational Education. Alternative perspectives for developing a philosophic position in occupational and adult education.

6110* Graduate Reading in Occupational Education. 1-6 credits, maximum 6. Prerequisites: graduate standing and consent of supervising professor. Supervised readings of significant literature not included in regularly scheduled courses.

6113* Teacher Education and Personnel Development for Occupational Education. Prerequisite: 6103. Research, trends and innovative practices in teacher education and personnel development for occupational education.

6233* Contextualized Learning and Communities of Practice. An analysis of communities of practice, situated cognition, constructivism, and information on learning through occupations. Expansion of the understanding and knowledge of an active, student centered teaching/learning process, in work-based learning contexts.

6333* Strategic and Tactical Planning and Development. Theory, practice and trends in concepts and implementation. Analysis of comparisons and articulation among various public and private sector organizations.

6343* Financing Occupational Education. Prerequisite: graduate standing. Development of conceptual and legal bases for funding public occupational education programs. Sources of funds, distribution strategies, local, state and federal accountability requirements, and fraud and abuse funds.

6354* Educational Futures. Critical examination of the relationship between learning and facets of post-industrialism such as socio-economic inequities, rapid technological change, organizational change, and the changing nature of work.

6871* Doctoral Seminar: Level 1. Orientation to doctoral program in OCED. May be taken prior to program application; required of all applicants.

6880* Doctoral Internship in Occupational Education. 1-8 credits, maximum 8. Prerequisite: consent of instructor. Directed field experiences related to the participant's area of concentration. Practice and testing ideas, theories and concepts learned in graduate study.

Philosophy (PHIL)

1013 (H)Philosophical Classics. Basic works by great thinkers, including Plato, Descartes and Hume.

1213 (H)Philosophies of Life. Introductory ethics and social philosophy. Moral decision-making, the good life, social values, freedom and responsibility.

1313 (A)Logic and Critical Thinking. Formal and informal reasoning, common fallacies, definitions and language functions, patterns of explanation. Practical criticism and development of everyday arguments.

2113 (H)Introduction to Philosophy. Selected philosophical problems: the nature of reality, knowledge, value, social ideals and religion.


3113* (H)Ancient and Medieval Philosophy. Main systems of Western thought from the Greeks to 15th century Europe. Emphasis on Plato, Aristotle, Augustine and Aquinas.

3213* (H)Modern Philosophy. Major philosophers and problems in Western thought from the 18th through the 19th century. Emphasis on Descartes, Hume and Kant.

3313 (H)19th and 20th Century Philosophy. Major philosophers and problems in Western thought from Hegel to the present.

3413 (H)Ethics. Contemporary and classical views on the nature of moral judgements, moral value, validity and objectivity, freedom and responsibility.


3713 (H)Philosophy of Education. Classical and contemporary philosophers who have systematically developed their ideas about education, including Plato, Aristotle, Rousseau, Locke and Dewey.

3803 (H)Business Ethics. Ethical issues in business, such as employer-employee duties and loyalties, advertising uses, preferential treatment practices. Analytic grounding in basic theories of ethics.

3813* (H)Recent American Philosophy. Dominant trends in American philosophy during the last 100 years, with emphasis on pragmatism.

3823 (H)Engineering Ethics. Philosophical analysis of moral issues in engineering practice, such as whistleblowing, conflicts of interest and product liability. Professional codes of ethics.

3833* (H)Biomedical Ethics. Moral problems brought about by recent developments in scientific research and medical technology. Abortion, euthanasia, genetic engineering, and human experimentation.

3843 (H)Philosophy of Law. Prerequisite: upper-division standing. Philosophical issues related to U.S. law. The relationship between law and morality, the nature and functions of law, and grounds of liability.

3913* (H)Existentialism. Selected writings and themes in the development of existentialism and related intellectual movements. Subjectivity, phenomenological description, hermeneutics, freedom and value; and such writers as Kierkegaard, Nietzsche, Heidegger, Sartre, Marx and Buber.

3923 (H)Contemporary Issues in Philosophy. Selected current controversies and recent trends in philosophy.

3943* (H)Asian Philosophy. Three main streams of Asian thought: Indian, Chinese and Buddhist. How various thinkers in the three traditions have dealt with questions of being and becoming, knowledge, ethics and society.

4003 Mathematical Logic and Computability. Prerequisites: 3000 or 3003 or MATH 3613 or consent of instructor. The basic metatheorems of first order logic: soundness, completeness, compactness, Löwenheim-Skolem theorem, undecidability of first order logic, Gödel's incompleteness theorem. Enumerability, diagonalization, formal systems, standard and non-standard models, Gödel numberings, Turing machines, recursive functions, and evidence for Church's thesis. Same course as CS 4003 and MATH 4003.

4013* (H)Perspectives on Death and Dying. Issues that arise as individuals confront the fact of mortality. Dying patients, the ethical issues of euthanasia and suicide, the process of grief, death in literature and the arts, and philosophical and religious views on immortality.

4113* (H)Philosophy of Art and Literature. Nature of aesthetic objects and experiences; form, meaning and value in the arts; the function of art in society; criteria of criticism of the arts.


4453* (H)Philosophy in Literature. Selected literary works examined for philosophical ideas and themes. Attention to the interrelation of form and content. Thematic approach.

4543* Philosophy in Language. Prerequisites: 1313 or 3003. A survey of the development of the philosophy of language, including works of philosophers such as Frege, Wittgenstein, Russell, Strawson, Searle, Donnellan, Grice, and Kripke.

4553* Contemporary Ethical Theory. Debate in ethical theory since Moore. The naturalistic fallacy, intuitionism, and value realism.

4713 (H)Philosophy of Science. Philosophical issues related to science and its role in society. Topics include science and common sense, laws and theories, causality, nature of scientific progress.

4733* (H)Philosophy of Biology. Selected philosophical topics, such as Darwinism and other theories of evolution, physical reductionism, and issues of genetic engineering.

4983* Metaphysics and Epistemology. Prerequisite: 12 credit hours of philosophy. The study of the fundamental nature of reality and human knowledge of it.

4990* Special Studies in Philosophy. 1-3 credits, maximum 10. Selected philosophical topics or works.

4991* Contemporary Philosophy Research. Prerequisites: upper-division standing, at least 12 hours in philosophy completed. Study of leading edge research in philosophy through presentation and discussion of current philosophy journal articles with faculty.

4993 Senior Honors Thesis. Prerequisites: departmental invitation, senior standing. Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a faculty member, with second faculty reader and oral examination. Required for graduation with departmental honors in philosophy.

5000* Thesis in Philosophy. 1-6 credits, maximum 6. Supervised individual work on a thesis for a master's degree.

5210* Seminar on a Major Philosopher. 3 credits, maximum 9. Prerequisite: three courses in philosophy. The writings of a major philosopher and related material.

5303* Topics in Philosophy of Religion. An examination of central topics in the philosophy of religion, such as the existence of God, the problem of evil, divine attributes, miracles, revelation, faith and reason, religious pluralism and exclusivism, and morality.

5310* Seminar on a Field of Philosophy. 3 credits, maximum 9. Prerequisite: three courses in philosophy. Selected topics in one field of philosophy.

5313* Topics in Social Political Thought. Consideration of a single topic (e.g., justice), topics (e.g., distributive justice and citizenship) of a single philosophical school, or movement (e.g. Marxism) or several movements and schools (e.g. Marxism and liberalism).

5323* Seminar in Ancient Philosophy. Prerequisite: 3113. Philosophical problems that characterize ancient philosophy: form and matter, one and many, universal and particular, actuality and potentiality, stability and change, substance and accidents, first principles and elements. Close reading of Plato and Aristotle.

5333* Seminar in Modern Philosophy. Prerequisites: 3213 or 3313. Examination of the metaphysical and epistemological systems of philosophers over 17th-19th century Europe such as Descartes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant and Hegel.

5343* Seminar in East and West Comparative Philosophy. Prerequisite: 3943. Critical comparison between West European and East Asian traditions of philosophy, such as being and non-being, the nature of truth, self, human being, ethics, human rights, community and religion.
5353* Seminar in Contemporary Continental Philosophy. Prerequisites: 3213 or 3313. Themes such as presence and absence, intentionality and constitution, meaning and "being," identity and difference, history and consciousness, practice and power, construction and deconstruction. Philosophers such as Merleau-Ponty, Husserl, Heidegger, Sartre, Derrida and Fauchart.

5363* Topics in Metaphysics. Prerequisites: 3113 or 3213 or 4983. Selected topics that may be approached from an historical or contemporary standpoint, such as idealism, realism, causation, time, universals, personal identity, possibility, and free will.

5373* Contemporary Epistemology. Prerequisites: 3213 or 3113 or 4983. Recent approaches to the theory of knowledge. Origin and justification of belief and certainty, roles of the senses and the mind, and the nature of truth.

5383* Seminar in American Philosophy. Selected philosophical schools or traditions influential in American thought, such as transcendentalism, pragmatism, or naturalism.

5393* German Idealism. Prerequisites: 3113 or 3213. Selected major works of post-Kantian German Philosophy, such as the nature of a philosophical system, identity, and self-consciousness.

5423* Topics in Ethical Theory. Prerequisite: 3413. Central problems in ethical theory, such as ethical realism/anti-realism, motivational internalism/externalism, and problems within specific normative systems.

5423* Topics in Philosophy of Law. Prerequisite: 3843. In-depth examination of selected topics in philosophy of law, such as punishment, jurisprudence, and principles of legislation. Seminar format.

5443* Topics in Biomedical Ethics. Prerequisite: 3833. In-depth examination of selected topics in biomedical ethics, such as implications of the Human Genome Project, ethics of human reproduction, and research ethics. Emphasis on contemporary philosophical thought. Seminar format.

5453* Topics in Professional Ethics. In-depth study of ethical issues faced by business and engineering professionals (e.g., social effects of advertising, environmental impact of professional practice, product safety and consumer protection, whistleblowing and confidentiality.


5560* Philosophical Issues in Education. 2-3 credits, maximum 3. Contemporary issues in educational theory and practice. The relation of education to political thought, religion, public law and culture.

5713* Contemporary Philosophies of Education. Analysis of contemporary educational philosophies, with attention to recommended aims, curricula and methods.

5910* Research Problems in Philosophy. 1-3 credits, maximum 10. Prerequisite: consent of instructor and department head. Individual or group research on specific philosophical problems.

Physics (PHYS)

1014 (N) Descriptive Physics. A survey course presenting the basic concepts and principles of physics with a minimum of mathematics. Motion, waves, temperature, electricity, magnetism, optics, atomic structure, and nuclear energy. No credit for students with credit in 1114.

1114 (L,N) General Physics. Lab 2. Prerequisite: high school algebra and trigonometry, or MATH 1483 or MATH 1713. Algebra-based introductory course covering the basic concepts of physics. Practical examples of the role of physics in other disciplines. Newtonian mechanics, fluids, heat, thermodynamics, waves, sound.

1214 (L,N) General Physics. Lab 2. Prerequisite: 1114. Continuation of 1114; electricity, magnetism, optics, quantum physics, atomic and nuclear structure.

1313 (L,N) Inquiry-based Physics. Lab 3. Properties of matter, motion, light and color, electrical circuits and energy conservation. Recommended for elementary education majors as model course to learn and teach science.


2414 General Physics for Science Majors II. Lab 2. Prerequisite: 2014 or 2314. Continuation of 2314. Electrostatics, electric fields and currents, circuits, waves, physical optics, modern physics, nuclear physics, and thermodynamics.

3013* Mechanics I. Prerequisites: 2114 or equivalent, and MATH 2233 or concurrent enrollment. Mechanics of particles, systems of particles and rigid bodies.

3113* Heat. Prerequisites: 1214 or equivalent and MATH 2163 or concurrent enrollment. Thermodynamics, heat transfer, elementary theory of specific heat and the three laws of thermodynamics.

3213* Optics. Prerequisites: 2114 or 2414 and 3513, or consent of the instructor. Geometrical optics; interference, diffraction, dispersion, absorption and polarization of light.

3313* Modern Physics for Engineers. Prerequisite: 2114 or equivalent. Emphasis on nuclear, molecular and solid state physics with engineering applications.

3324* Modern Laboratory Methods I. Lab 6. Prerequisites: 2014, 2114. Introduction to electric and electronic measurements and computer applications in experimental control, data collection and laboratory computation. Experiments on test instruments, integrated electronics, signal processing, computer interfacing and data acquisition.

3513* Mathematical Physics. Prerequisites: 1214, 2114 or 2414 and MATH 2163. Physical applications of vectors, vector calculus and differential equations. Fourier analysis, orbital geometry, coordinate systems and transformation of coordinates. Matrices and determinants.

3622 Modern Laboratory Methods II. Lab 6. Prerequisites: 2014, 2114. Introduction to the operating principles and applications of modern physical methods used in research. Laboratory experiments with lasers, wave propagation, thermometry, radiodetection, optical interferometry and spectroscopy.

3713 Modern Physics I. Prerequisite: 2114. Atomic physics, special theory of relativity, and introduction to solid state and nuclear physics.

4003* Computer Simulation Methods in Physics. Prerequisites: 3013, 3113, 3313 or consent of instructor. Introduction to computer simulation methods used in the physical sciences. Linear systems, nonlinear systems, molecular dynamics, Monte Carlo methods, cellular automata, simple quantum systems. Some knowledge of either C, FORTRAN, Pascal, or BASIC required.

4010* Special Problems. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Individual laboratory work of an advanced nature.

4113* Electricity and Magnetism. Prerequisites: 2114 and MATH 2233, or their equivalents. Electrostatic fields, magnetic fields of steady currents, induced EMFs, Maxwell’s equations and introduction to electromagnetic wave theory. Vector analysis used.

4212* Introduction to Nuclear and Particle Physics. Prerequisites: 8 hours of physics and 8 hours of chemistry. For nonphysics majors. Fundamentals of nuclear physics with applications to chemistry, engineering and biology.

4263* Introduction to Solid State Physics. Structure, specific heat, dielectric properties, lattice vibrations, free electron theory, band structure and superconductivity of solids.

4313* Molecular Biophysics. Prerequisites: 1214 or 2114. Survey of experimental and computational methods for determining the structure and function of biomolecular assemblies such as proteins and membranes. Techniques to be discussed include: X-ray diffraction, nuclear and electron spin resonance, optical spectroscopy, photobiophysics, kinetic modeling, molecular dynamics, Monte Carlo, and homology modeling.

4413* Modern Physics II. Prerequisites: 3013 and 3713. Atomic and X-ray spectra; one-dimensional Schroedinger equation; nuclear structure; introduction to statistical mechanics and elementary quantum statistics.
4423* Mechanics II. Prerequisite: 3013. Coupled oscillators, propagation of waves in discrete and continuous media, mechanics of discrete and continuous media and acoustics.

4513* Introductory Quantum Mechanics. Prerequisite: 3713. Uncertainty principle, setting up Schrodinger equation (time-dependent as well as time independent) and solving it for linear oscillator, hydrogen atom, periodic and other potentials.

4663* Radioactivity and Nuclear Physics. Prerequisite: 3313. Natural and artificial radioactivity, decay laws; absorption, detection and measurement of radiations; nuclear transformations.

4712* Senior Project. Lab 6. Advanced individual experimental projects. Project proposal, formal laboratory report, and oral presentation are required.

4813* Electromagnetic Radiation. Prerequisites: 3213, 3513, 4113. Electromagnetic wave theory, reflection and refraction of electromagnetic waves; resonant cavities, wave guides, fiber propagation of electromagnetic waves; radiation sources; relativistic description of electromagnetic fields.

4993 Senior Honors Thesis. Prerequisites: departmental invitation, senior standing. Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a faculty member, with second faculty reader and oral examination. Required for graduation with departmental honors in physics.

5000* Master's Thesis Research or Report. 1-9 credits, maximum 9. Prerequisite: consent of major professor. Thesis research or report for master's degree.

5110* Seminar. 1-5 credits, maximum 20. Prerequisite: graduate standing in physics. Special topics in physics.


5133* Theory of Spectra. Line spectra, hyperfine structure, Lamb shift, band spectra, NMR spectra and ESR spectra.


5213* Statistical Mechanics. Prerequisites: 5113 and 5613 or consent of instructor. Classical and quantum mechanical distribution functions for independent particles; interacting classical and quantum systems, superfluidity, phase transitions and critical phenomena, approximation methods.

5263* Particle Physics. Prerequisites: 5613. Nuclear forces, structure of nuclei and nuclear models.

5313* Electromagnetic Theory. Prerequisite: 5453. Electric and magnetic fields in free space and in matter. Boundary value problems, Green's functions, stress tensors, multipole expansions, thermodynamics; electromagnetic waves.

5350* Special Problems. 1-3 credits, maximum 3. Prerequisite: graduate standing in physics. Special problems of experimental or theoretical nature. Largely individual work with written report required.

5413* Classical Mechanics. Prerequisite: 4423 or consent of instructor. Generalized coordinates and advanced dynamics; coupled systems, wave motion; theory of elasticity.

5453* Methods of Theoretical Physics. Prerequisite: 3513. Introduction to the various methods and techniques used in theoretical physics.

5613* Quantum Mechanics I Prerequisite: 5453. Postulates of quantum mechanics. Operators, commutation relations, eigenfunctions. Schrodinger, Heisenberg and interaction formalisms, angular momentum and central field problems; nondegenerate perturbation theory.

5663* Solid State Physics I Prerequisite: 4513. Crystal structure, cohesive energy of ionic crystals and metals, specific heats, free electron theory of metals, band theory, Brillouin zones, insulators and alloys; magnetic properties, optical properties and thermal and electrical conductivity of solids.

5713* Solid State Physics II. Prerequisite: 5663 or equivalent. Symmetry, dielectric properties, ferroelectrics, magnetic properties, mechanical properties and defects of solids.

5960* Problems in Chemical Physics. 3-6 credits, maximum 6. Prerequisite: consent of instructor. Intermolecular forces, interaction of matter with bulk form, dielectric properties of matter, polymer physics and quantum theory of biopolymers.

6000* Doctoral Dissertation Research. 1-15 credits, maximum 60. Prerequisites: admission to candidacy and permission of major professor.

6010* Advanced Graduate Seminar. 1-3 credits, maximum 9. Prerequisite: consent of instructor. Special topics of an advanced nature in physics.

6113* Advanced Theory of Solids. Prerequisite: 5663. Many-body techniques, transport processes, band theoretical techniques, superconductivity, dynamics of electrons in a magnetic field, and alloys.


6243* Semiconductors I. Prerequisites: 5113, 5613, 5663. The first part of a survey of the physics of semiconductors. Bonding and structure, crystal growth, epilaxial growth, transistor action, phosphorus, dopants, defects, intrinsic and extrinsic statistics, trapping and recombination.

6313* Quantum Mechanics II. Prerequisite: 5613. Scattering theory, many-particle quantum mechanics and application to atomic and molecular systems; degenerate and time-dependent perturbation theory.

6343* Semiconductors II. Prerequisite: 6243. The second part of the solid-semiconductors sequence. Transport phenomena, junctions, devices, heterostructures and optical properties.

6413* Modern Optics. Prerequisites: 5313, 5163, 5613. Non-linear optics, higher-order susceptibilities; four-wave mixing; quantum optics and photon statistics, Maxwell-Bloch equations.

6513* Advanced Topics in Solid State Physics. Prerequisite: 5663 or equivalent. Interaction of radiation and matter, neutron scattering, phase transitions, magnetic resonance and cooperative phenomena.

6613* Advanced Nuclear and Particle Physics. Prerequisites: 5263, 5613. Nuclear and elementary particle interactions, resonances, and models; relativistic quantum mechanics and quantum field theory.

6713* Classical Theory of Fields. Prerequisite: 5313. Radiation theory, waveguides, scattering and dispersion relations; relativity.

6803* Photonics I: Advanced Optics. Lab 9. Prerequisite: ECEN 3213 or 3813. Advanced optics including spectral and time characteristics of detectors, characteristics of lasers, time, spatial and spatial parameters of laser emission, interferometric techniques, and nonlinear effects such as two-photon absorption and second and third harmonic generations. Ultrashort laser pulses. Same course as CHEM 6803 and ECEN 6803.

6810* Photonics II: THz Photonics and THz-TDS. 1 credit, maximum 4. Lab 1. Prerequisite: 6803. THz photonics and THz-time-domain spectroscopy (THz-TDS). Concepts and techniques of driving electronic circuitry with ultrashort laser pulses to generate and detect freely propagating pulses of THz electromagnetic radiation using several operational research systems. Same course as CHEM 6810 and ECEN 6810.

6820* Photonics II: Spectroscopy II. 1 credit, maximum 4. Lab 1. Prerequisite: 6803. Operating principles and applications of laser spectroscopy of atoms, molecules, solids and complex fluids. Absorption, emission, photon correlation, coherence, time resolved Fourier transform, Raman spectroscopy and non-linear optical. Same course as CHEM 6820 and ECEN 6820.

6830* Photonics II: Spectroscopy III. 1 credit, maximum 4. Lab 1. Prerequisite: 6803. Advanced spectroscopic instruments and methods used for investigation of semi-conductors and solid state material. Stimulated emission characteristics both in wavelength and in time. Time resolved fluorescence measurements. Multiphotonic excitations. Fast measuring techniques including subnanosecond detectors, picosecond streak cameras, and ultrafast four-wave mixing and correlation techniques. Time-dependent photodconductivity measurements. Same course as CHEM 6830 and ECEN 6830.
Plant Pathology (PLP)

3344 Introductory Plant Pathology. Lab 2. Prerequisite: BIOL 1114 or 1404. Introduction to basic principles and concepts of plant pathology, including the nature, causation, and control of biotic and environmentally induced plant diseases, with emphasis on principles and methods of disease management.

5563 Turfgrass Integrated Pest Management. Lab 2. Prerequisite: 3344, ENTO 2023. The biology, ecology and identification of fungal, nematode and insect turfgrass pests. Contemporary concepts and applications of integrated control practices available for managing turfgrass pests presented along with decision-making tools for use in turfgrass pest management programs. Same course as ENTO 3663.

4400 Undergraduate Research. 1-3 credits, maximum 4. Lab 1. Prerequisite: consent of instructor. Undergraduate research problems in plant pathology.

4922 Applications of Biotechnology in Arthropod Pathogen Control. Prerequisites: introductory biology and chemistry or equivalent. Applications of biotechnology in controlling arthropod pests of plants and animals and plant pathogens. Introduction to underlying technology, products being deployed, their effectiveness and associated problems or concerns resulting from their use. Same course as ENTO 4922.

5000 Research. 1-6 credits, maximum 6. Research for the M.S. degree.

5004 Plant Nematology. Lab 3. Prerequisite: 3344 or concurrent enrollment. General morphology, taxonomy and bionomics of nonparasitic and plant parasitic nematodes. Plant parasitic nematode assay techniques, subfamily identification, symptomology, pathogenicity and control.

5012 Plant Virology Laboratory. Lab 4. Prerequisite: previous or concurrent enrollment in 5013. Methods of investigating plant viruses.

5013 Plant Virology. Prerequisites: 3344 or equivalent; one course in biochemistry or physiology. Transmission, characterization, differentiation, replication and control of plant viruses; discussion of current literature.

5043 Principles of Phytopathology. Lab 2. Prerequisite: elementary botany or plant physiology. An in-depth survey of the basic principles and practices of plant pathology presented at the graduate level. Ecology and epidemiology of plant pathogens. Field trips to view plant diseases in natural settings. Student-planned and conducted hands-on experimentation with plant pathogens.

5104 Mycology. Lab 4. Prerequisite: graduate standing. A systematic study of the fungi, with emphasis on taxonomy, comparative morphology and fungal biology. Taught in the Department of Plant Pathology. Same course as BOT 5104.

5304 Phytophagous Insects and Mites. Lab 4. Prerequisite: 3344. Bacteria, fungal pathogens, with examination of the taxonomy, genetics, ecology, physiologically host-parasite interaction and control of phytophagous insects and mites.
6030* Soilborne Diseases of Plants. Lab 3. Prerequisite: 2444. Soilborne diseases, their reception and importance, the pathogens involved, rhizoplane and rhizosphere influences, inoculum potential, specialization of pathogens, suppressive soil effects and disease management. Lecture and discussion sessions will emphasize in-depth understanding of problems and complexities associated with studies of soilborne pathogens.

Plant Science (PLNT)

1213 Introduction to Plant, Range, and Soil Sciences. Introduction to the concepts of three disciplines. Importance of plant and soil science to the producer, consumer, and citizen; modern management and production practices; maintenance of natural resources.

2013 Principles of Crop Science. Lab 2. Prerequisite: 1213 or BIOL 1404 or SOR 1123 or HORT 1013. Production, management, and improvement of modern agronomic crops. Structure and growth of crop plants relating to management strategies and adaptation to varying abiotic and biotic factors. Hands-on identification of crops, weeds, and seed quality factors; application of tools and techniques.

2041 Career Orientation. Prerequisite: sophomore standing in the Department of Plant and Soil Sciences. Development and improvement of written and oral communicative skills; orientation to research and extension activities related to plant and soil sciences, and academic requirements and procedures. Graded on pass-fail basis.

3111 Weed Control Laboratory. Lab 2. Prerequisites: 1213 and 2013. Identification of common weeds, principles and practices of herbicide application, and application equipment, handling and proper use of herbicides.

3112 Principles of Weed Control. Prerequisite: 1213. Weed control principles and practices included in cultural and chemical weed control. Current weed control practices in crops, rangeland and crop situations.

3213* Forage and Grazinglands Resource Management. Prerequisites: 1213 or BOT 1404. Management of introduced forages and native rangeland for maximum yield potential, economical livestock production, pasture system development and enhancement of wildlife habitat.

3554* (N)Plant Genetics and Biotechnology. Lab 2. Prerequisite: BIOL 1114. Basic principles of heredity. Interrelationship between classical genetics and molecular genetics emphasized. Mendelian genetics, cytogenetics, mutations, gene regulation and genetic engineering.

3782 Seed Technology. Prerequisite: 1213. Factors determining seed quality and utilization during growth, harvest, and storage. Modern techniques to determine seed quality for optimum processing and utilization of seed crops. Minimum of two field trips required.

3790 Seed and Plant Identification. 1 credit, maximum 2. Lab 3. Prerequisite: 1213. Identification and classification of agronomically important crop and weed species from seed and from seedling, vegetative, flowering or mature plants.

4080 Professional Internship. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Internship must be at an approved agricultural unit or other agency serving agronomic agriculture. Requires a final conference with an campus adviser and a written report. Graded on a pass-fail basis.

4112* Advanced Weed Science. Prerequisites: 3111 and 3112. Integrated approach for weed management. Weed life cycles and biology, weed crop interferences, herbicide families and their characteristics, and finally a systematic and integrated weed management system. Methods of conducting and interpreting research results in appropriate topics.

4123 Crop Physiology. Prerequisites: 1213 and BOT 3463. Application of basic physiological concepts of growth and cultural management and underlying crop production; environmental and genetic effects on growth of crop plants. Plant ecosystems at the community level relative to optimum yields and quality.

4353* Plant Breeding. Prerequisite: 3554 or equivalent. Basic principles dealing with the improvement of plants through application of genetic principles.

4470* Problems and Special Study. 1-3 credits, maximum 12. Lab 1-3. Prerequisite: consent of instructor. Problems in plant science selected from topics in range and turf, plant breeding and genetics, crop management and physiology, and weed control.

4571* Senior Seminar. Prerequisite: senior standing in plant and soil sciences. Career opportunities (talks and field trips); preparation of resumes and interviews. Graded on a pass-fail basis. Same course as RLEM 4571 and SOIL 4571.

4673* Grain Crops. Lab 2. Prerequisite: 1213. Production, distribution, classification, utilization and improvement of the major cereal crops.

4772* Oilseed, Pulse and Mucilage Crops. Prerequisite: 1213. Production, utilization and improvement of oilseed, pulse and mucilage crops with special emphasis on peanuts and soybeans.

4783* Cotton Production. Prerequisite: 1213. Production, utilization and improvement of cotton. Several other agronomic fiber crops briefly discussed.

5000* Master’s Thesis. 1-6 credits, maximum 6. Prerequisite: consent of adviser. Research planned, conducted and reported with the supervision of a major professor.

5020* Graduate Seminar. 1 credit, maximum per semester 1 credit on M.S. program and 2 credits on a Ph.D. program required. Prerequisite: graduate standing. Philosophy of research and methods of research, or interpretation of research.

5110* Problems and Special Study. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Supervised study of special problems and topics not covered in other graduate courses.

5112* Herbicide Fate in the Environment. Prerequisite: 4112. Processes involved in the behavior and fate of herbicides in air, soil, and water. Reaction, movement and dissipation of herbicides in soil.

5230* Research. 1-4 credits, maximum 4. Prerequisite: consent of a faculty member supervising the research. Supervised independent research on selected topics.

5293* Plant Response to Water Stress. Prerequisites: BOT 3653, BOT 3463. Physiological ramifications of water deficit stresses on cells, tissues, plants and canopies. Discussion of the soil/plant/atmosphere continuum, and avoidance and tolerance mechanisms leading to drought resistance and moisture plant transpiration and water-use efficiency and their relationship to biomass accumulation and crop yield.

5403* Physiological Action of Herbicides. Prerequisite: BOT 3463. The mode of action, uptake and translocation, and metabolism of herbicides in crops and weeds.

5414* Plant Breeding Theory, Methods and Strategies. Prerequisites: 3554, 4353 and STAT 3013. Development and application of statistical and genetic principles to breeding methodology of self- and cross-pollinated crops; emphasis on selection methods pertinent to plant improvement; examination of philosophies and strategies employed in private and public plant breeding programs.

5433* Biotechnology in Plant Improvement. Prerequisites: 3554, 4353, and BOT 3014. Development and application of molecular technology into plant breeding programs and issues concerning the release of genetically engineered organisms into the environment.

5443* Advanced Genetics. Prerequisites: 3554; BIOL 3653. Concepts of eukaryotic genetics with emphasis on classical, molecular and quantitative genetics.

5452* Cytogenetics. Prerequisite: 4443 or concurrent enrollment in BOT 5323. Behavior of chromosomes, cellular organelles and cytoplasm in relation to genetic behavior.

5863* International Agricultural Research Systems. Organization, management and budgeting of agricultural research systems with emphasis on developing countries. Analysis of research and training priorities, budgeting, staffing and management of projects.

6000* Doctoral Thesis. 1-6 credits, maximum 36. Prerequisite: consent of adviser. Independent research to be conducted and reported with the supervision of a major professor as partial requirement for the Ph.D. degree.

6010* Advanced Topics and Conference. 1-6 credits, maximum 12. Prerequisite: M.S. degree. Supervised study of advanced topics. A reading and conference course designed to acquaint the advanced student with fields not covered in other courses.
Political Science (POLS)

1010 Studies in American Government. 1-2 credits, maximum 2. Special study in American government to allow transfer students to fulfill general education requirements as established by Regents' policy.

1113 American Government. Organization, processes and functions of the national government of the United States. Satisfies, with HIST 1103 or 1483 or 1493, the State Regents' requirement of six credit hours of American history and American government before graduation.

2013 (S)Introduction to International Relations. Analysis of the major concepts in international relations - power, sovereignty, self-help, cooperation, dependency, and introduction to the dominant theoretical approaches to its study realism, pluralism, marxism and feminism.


2033 Introduction to Public Administration. Public administration, including administration, administrative organization, decision-making, governmental public relations, and administrative responsibilities.

2113 (S)Comparative Politics. A comparative study of the political processes and institutions of contemporary societies. Introduction to the concepts and methods of comparative politics.

2993 Honors Tutorial in Political Science. Prerequisites: 1013, honors standing, and invitation by head of department. For the special needs of the sophomore-level honors student majoring in political science who wishes to study individualized topics at an accelerated pace in a tutorial format. After mastering basic principles in an area of interest the student will conduct independent research under close faculty supervision and prepare a report or reports.

3003 (LS)The Soviet Union: History, Society and Culture. A comprehensive view of the Soviet Union, stressing those issues in the political, economic, technological, geographical and cultural spheres which are most relevant to the current situation. Accessible to beginning undergraduates.

3033* International Law. The nature and scope of public international law, with emphasis on problems related to the recognition of states and governments, jurisdiction over nationals and aliens, and state responsibility in cases of expropriation and revolutionary damage.

3043 Politics of International Trade and Development. Theory and practice of international political economics. The patterns of association between political and market-based processes among nation states. Emphasis on interactions among advanced industrial states, transnational phenomena, and opportunities and pitfalls in north-south relations.

3053 (I,S)Introduction to Central Asian Studies. A comprehensive view of newly-emerged Central Asian states examining the history, politics, economics, geography, and culture of Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan as reflected in their thoughts, religion, literature, and architecture, in the past, and the strategic importance of their natural wealth for the present and future. Same course as HIST 3053 and RUSS 3053.

3100 Political Science Internship. 1-6 credits, maximum 6. Prerequisite: consent of department. Internship education experience in a specific subfield in the discipline of political science.


3133* (I)Politics of Anglo-American Democracies. Political processes and governmental institutions of the United Kingdom, Ireland, Canada, Australia, and New Zealand with comparisons to the United States.

3143* (I)Politics of Western Europe. Political processes and governmental institutions of continental Western European states, with emphasis on France, Germany and Italy.

3193 (I,S)Government and Politics in Latin America. Analysis of processes, institutions and contemporary trends in the politics of selected Latin American countries; political development, democratization, political role of the military, political economy and social movements.

3223* (I)Politics and Administration in East Asia. Political processes, governmental institutions and administration in China, Japan and Korea.

3233* (I)Chinese Politics. Political process, government institutions and experience of development in People's Republic of China.

3243 Foreign Policies in the Former Soviet Bloc. The comparative foreign policies of the territories of the former "Eastern bloc" in the period following the revolutions of 1989-91. The resurgence of nationalism and the effects of defining and pursuing national self-interest on the foreign policies of Eastern European and former Soviet territories.

3313* (I)Governments and Politics in the Middle East. Analysis of political institutions and processes with emphasis on selected countries of the Middle East; the social and economic basis of politics; nationalism, political development and factors of instability and change.

3353* (S)Parties and Interest Groups. Political parties as interest groups as institutions; their role in elections and government.

3403 Political Campaigns. Lab 2. Planning, fundraising, targeting, public opinion, support operations, voter contact, the mass media and candidate activities. Lab work in campaigns or government offices.

3423 (S)Voting and Elections. Electoral systems and their relationship to political development, political socialization, issue emergence, voting patterns, and electoral cycles.

3453* (S)The Legislative Process. The power and organization of legislatures, as well as the selection and behavior of legislators. Special attention given to the U.S. Congress.

3483* (S)The American Presidency. The politics of presidential selection, removal and succession; formal and informal powers of the president; relations with Congress, the national judiciary and national executive branch; proposed reforms and the vice-presidency.

3493* Public Policy. Prerequisite: any one of 1013, 2033, 2113, ECON 1113, 2123, SOC 1113, PHIL 2113. Identification of policy options open to policy makers and examination of measurement and rationales underlying governmental programs.

3503 Campaign Research and Technologies. Prerequisite: 1113. An introduction to technical innovations in political management. Political commercial creation and testing involving digital video cameras and audience response systems such as the "perception analyzer." The use of computers for database management, on-line information retrieval and electronic mail systems. Integration of research skills and political techniques by using the advanced information technologies of neural networks, intelligence gathering, computer-mediated political communications and electronic focus groups.

3513 Public Opinion and Polling. The nature of public opinion. Public opinion polling, the factors influencing opinion formation, and the effects of public opinion on policy and policy makers.

3523 Campaign Fundraising and the Media. Prerequisite: 1113. Techniques used by successful candidates for elective office to present their positions to the voting public. Beginning with the basic elements of fundraising exploration of current campaign finance laws, funding techniques and campaign budgeting. Message development, media production and ad placement. Preparation of a fundraising strategy.

3533 Political Lobby and Grassroots Organization. Prerequisite: 1113. Traditional special interest lobbying and the rapidly emerging local grassroots constituent movement. New federal laws pertaining to lobbying and rules that govern the conduct of state lobbying. The implications of technology and the potential advent of a plebiscite form of government. Development of complete grassroots strategy on an issue either at the federal or state level. Meets with JB 3533. Same course as JB 3533.

3543 Political Candidacy. Prerequisite: 1113. The dynamics of political candidacy and theories of candidate motivation. The behavior exhibited by candidates will be examined in light of the various organizational roles associated with electoral processes.
3613* State and Local Government. Political processes, government and administration of American states, cities and counties; special emphasis on Oklahoma.

3663* Political Thought. The teachings of the three last traditions of Western political thought: classical, Christian and modern.

3733 Incident Management and Tactical Operations. Strategic management of an emergency incident through the use of the Incident Management System. A thorough study of the IMS system and tactical decision making forming the base for case study analysis and emergency operations simulations.

3813 Aim and Scope of Emergency Management. An overview of the history and philosophy of the current emergency management system. Concepts, issues and programs associated with the development of an emergency management program. Local, state and federal roles and responsibilities for responding to disasters and emergencies with emphasis on man-made natural and technological hazards.

3893 Terrorism and Emergency Management. A general introduction to the basic concepts for preparedness, response and command functions at the scene of a potential terrorist incident.

3953 (S) Minorities in the American Political System. Prerequisite: 1113. Examination of mass and elite level behavior of minorities in the contemporary U.S. political system.

3983* (S) The Judicial Process: Courts, Judges and Politics. The American judiciary and legal process from a political perspective with particular emphasis on judicial organization and powers, recruitment, fact-finding, decision-making, impact of decisions, the legal profession and relations among courts. Oklahoma judicial organization.

4003 Political Analysis. Prerequisites: 60 credit hours, or 45 hours with GPA of 3.25, including 2113. The scope and methods of political science. Scientific methodology applied to political phenomena, hypothesis, measurement, literature review, research designs, introductory data analysis and writing in political science. No credit for students with credit in POLS 5003.

4013* American Foreign Policy. Major problems and policies of American foreign relations since World War II and a description of foreign formulation and aid administration.

4053* World Politics. Foreign policies of major powers, areas of tension and sources of international conflict.

4100* Problems of Government, Politics and Public Policy. 1-6 credits, maximum 6. Prerequisites: 60 credit hours, or 45 hours with GPA of 3.25, including 1013. Special problem areas of government, politics and public policy concentrating on topics not covered in other departmental course offerings.

4113* International Institutions. The organization, procedures, functions and role of international institutions, with emphasis on the United Nations and related agencies.

4123 (I, S) The Politics of Globalization. Prerequisite: 2113 or consent of instructor. The policies and institutions that manage the economic and political consequences of the deeper integration of national economies into a world economy; how governments can manage the dilemmas placed on national policies and attempts at international cooperation in a rapidly changing and turbulent external environment. No credit for students with credit in POLS 5123.

4133 (I) Politics and Political Economy in the European Union. The institutions and policy-making process of the European Union (EU) and the theoretical traditions in the study of European integration. The institutional form of the EU and the type of European policy that is emerging. No credit for students with credit in POLS 5133.

4213* (S) Legal Problems of the International Environment. A case survey of diverse areas in which international law finds applicability; problems of territorial jurisdiction, continental shelves, straits, canals and international river systems, maritime law, national and outer space law and the international law of pollution.

4223 Comparative Political and Social Movements and the Politics of Protest. Prerequisite: 1113. The origins, activities and impact of political and social movements. Conceptual and theoretical approaches related to political and social movements and these concepts and approaches to case studies of several contemporary movements in the United States, Latin America, and Europe.

4343* The United States Constitution. An examination of the theoretical, philosophical, and legal underpinnings of the U.S. Constitution, relying heavily on a study of The Federalist Papers.

4353* (S) Administrative Law. Legal powers, limits, and procedures of administrative agencies with emphasis on federal and state administrative procedures acts.

4363* (S) Environmental Law and Administration. Statutory law, case law, and administrative practices relating to regulation of the environment including environmental impact statements, pollution, public lands, and preservation law.

4403* (S) Urban Politics. Problems of governing American metropolitan areas.

4413* Government Budgeting. The politics, planning and administration of government budgets.

4453* (S) Public Personnel Administration. Problems, processes and procedures of public personnel administration.

4513* American Politics. Significant developments and issues in American politics, including American political behavior and political leadership.

4553* (H) American Political Thought. A survey of the major developments in American political thought from the Colonial period to the present, followed by a topical analysis of important recent theoretical developments in political science.

4593* (S) Natural Resources and Environmental Policy. Current issues in the law, politics and administration of energy, land, water, mineral and other natural resources policy with particular emphasis on relations to environmental policies and law.

4653* (H) Contemporary Political Thought. An analysis of 19th and 20th century political ideas, with emphasis on the rise and fall of ideologies and along side controversies over relativism, positivism, pragmatism, and resurgent religious faiths.


4693* (S) American Constitutional Law: Equal Protection of the Laws. Prerequisite: 2023 or 3983 recommended. Development of principles of constitutional law by the Supreme Court concerning individual and group rights, with particular emphasis on equal protection of the laws concepts in matters of race, gender, wealth, citizenship, legislative reapportionment and voting rights, government employment and affirmative action programs. Legal research techniques.

4793* American Constitutional Law: The Division of Governmental Powers. Prerequisite: 2023 or 3983 recommended. Development of principles of constitutional law by the Supreme Court concerning federalism and separation of powers with particular emphasis on political and doctrinal developments surrounding judicial review, regulation of commerce, taxing and spending and presidential power. Introduction to legal research methods.

4893* (S) American Constitutional Law: Due Process of Law. Prerequisite: 2023 or 3983 re-com-mended. Development of principles of constitutional law by the Supreme Court concerning 5th and 14th Amendment due process concepts, with particular emphasis on suspect’s rights, search and seizure, free speech and press, religious liberty, property rights and procedural requirements at national and state level. Legal research techniques.

4993 Political Science Honors Thesis. Prerequisites: departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a faculty member, with second faculty reader and oral examination. Required for graduation with departmental honors in political science.

5000* Thesis. 1-6 credits, maximum 6.

5003* Political Analysis. Prerequisite: graduate standing. The scope of methods of political science. Scientific methodology applied to political phenomena, hypotheses, measurement, literature review, research designs, introductory data analysis and writing in political science. No credit for students with credit in POLS 4003.

5013* Quantitative Methods of Political Analysis. Required of all graduate students. Fundamental methodological issues in the scientific study of politics. Logic of science, principles of research design and computer data manipulation and analysis.

5020* Research in Public Administration, Public Policy and Politics. 1-6 credits, maximum 6. Individually supervised research.

5030* Internship in Public Administration and Government. 1-6 credits, maximum 6. Individually supervised internships in administrative and governmental career areas. Paper required.
5040* Readings in Politics, Public Policy or Public Administration. 1-6 credits, maximum 6. Prerequisite: consent of supervising professor. Readings in the student's major area of study.

5100* Advanced Problems in Government, Politics, and Public Policy. 3 credits, maximum 6. Special seminar, topics vary from semester to semester.

5113* Seminar in Public Program Evaluation. Methodology of evaluation research in public programs. Emphasis will be placed on designing and interpreting evaluative studies rather than the mastery of particular mathematical, statistical or computer skills.

5123* The Politics of Globalization. Prerequisite: 2113 or consent of instructor. The policies and institutions to manage the economic and political consequences of the deeper integration of national economies into world economy; how governments can manage the dilemmas placed on national policies and attempts at international cooperation in a rapidly changing and turbulent external environment. No credit for students with credit in POLS 4123.

5132* Politics and Political Economy in the European Union. The institutions and policy-making process of the European Union (EU) and the theoretical traditions in the study of European integration. The institutional form of the EU and the type of European policy that is emerging. No credit for students with credit in POLS 4133.

5210* Seminar in International Relations. 3 credits, maximum 6. Research on the dynamics and institutions of international politics.

5213* Seminar in the International Political Economy. Prerequisite: graduate standing. Research on the mechanics and theories of interaction between economic and political phenomena. Same course as IS 5213.

5300* Seminar in Emergency Management. 1-3 credits, maximum 6. Topics in emergency management such as terrorism, emergency management planning-mitigation, response, and recovery, or delivering emergency medical services (EMS).

5313* Public Management. Introduction to the general principles of management as they are applied in the public sector. Systems theory, organization design, and techniques of supervision.

5320* Seminar in Public Budgeting and Finance. 3 credit hours, maximum 6. Major processes and practices involved in governmental budgeting in the United States at national, state, and local level.

5332* Urban Politics and Management. Introduction to the concepts, processes and techniques of managing urban political systems to include problems of leadership, decision making, general management, and group behavior.

5333* Seminar in Public Personnel Administration. Current practices, problems and issues in public sector personnel administration, including merit system, civil service reform, collective bargaining, and equal opportunity and affirmative action.

5343* Seminar in Fire and Emergency Services Administration. Introduction to policies, procedures and administrative process required to deliver fire and emergency services; detailed examination of the social, political and economic issues that have an impact on service delivery and organizational approaches.

5352* Seminar in Design, Structure and Processes of Public Organizations. Administration in the public sector, stressing traditional and emerging organization structures. Awareness of administrative processes and environment that include program design and implementation and administrative accountability.

5363* Public Sector Dispute Resolution. Prerequisite: senior or graduate standing. Labor relations and employment issues in the public sector, and the various methods for resolving government personnel conflicts without resort to violence or litigation. Focus on labor law, employment law and Alternative Dispute Resolution as they apply to government employment.

5410* Seminar in Comparative Politics and Government. 3 credits, maximum 6. Research in the political processes and governmental institutions of foreign countries.

5510* Seminar in Political Behavior. 1-3 credits, maximum 6. Examination of contemporary theories of political behavior with emphasis on empirical studies.

5613* Seminar in Public Policy. Public policy process including policy design, implementation and change. Approaches to public policy including design science, rational choice, policy sciences, normative models, and institutionalism.

5620* Seminar in Natural Resource Policy, Law, and Administration. 3 credits, maximum 6. Analysis of the legal and public policy aspects of environmental regulation, including special emphasis on one of three components: environmental law, administrative law, and national resource law and policy.

5633* Practical Environmental Compliance. Environmental decision making, reading and understanding environmental statutes and regulations and effectively dealing with the EPA. Environmental permitting and enforcement, policies and procedures. Review of hazardous waste regulations with emphasis on ground water problems.

5643* Regulatory Risk Analysis. Risk-based decision making, government’s risk analysis paradigm, risk analysis policy, and social aspects of risk assessment. Review of the RCRA corrective action, CERCLA (Superfund) remedial action, and NEPA environmental impact study programs.


5663* Community Relations in Environmental and Emergency Management. Preparation for the environmental manager, emergency manager, and fire department manager to communicate and negotiate with the public and media concerning environmental threats to human health and non-routine releases of chemicals and radioactive materials. Strategies for community-based planning, emergency preparedness, environmental response, site damage, and conflict management.

5673* Understanding and Responding to Terrorism. Exploration of the experience of non-state terrorism in the U.S. and Western European democracies in the late 20th century. Understanding terrorism as a political, social, and historical phenomenon; the current and future threat of terrorism, both foreign and domestic; governmental choices in responding to terrorism in democratic societies and; U.S. anti-terrorism policies and considerations that emergency responders face in preparing for and responding to terrorist incidents.

5682* Emergency Management and Public Policy in the United States. Examination of natural and man-made disasters in the U.S. along with the policies and programs intended to prevent, respond to, mitigate, and recover from such events. The evolution of the U.S. Emergency Management System, the emergency management profession, and future directions in emergency policy.

5710* Seminar in American Political Institutions. 1-3 credits, maximum 6. American institutions, including Congress, the presidency, courts, political parties and interest groups.

5712* Seminar in Public Law. Literature of public law in the United States. Overview of the approaches that shape the theoretical and empirical contours of the public law field and contribute to multidisciplinary law and social science studies.

5810* Seminar in Women and Politics. 3 credits, maximum 9. Prerequisite: graduate standing. Research on a variety of topics concerning women and politics, including women’s movements, women and elections, and public opinion.

5903* Practicum in Fire and Emergency Management. Supervised practicum in fire and emergency management administration.

Psychology (PSYC)

1113 (S) Introductory Psychology. Principles, theories, vocabulary, and applications of the science of psychology.

2313 Psychology and Human Problems. Prerequisite: 1113. Personality dynamics and their application to personal, cultural and vocational experience.

2583 (S) Developmental Psychology. Prerequisite: 1113. The nature of pertinent studies, causes, and theories of human developmental phenomena across the life span.

2593 Psychology of Human Sexuality. Prerequisite: 1113. Survey of behavioral, personality and psychophysiological components of human sexuality, with special emphasis on the delineation of facts from sexual myths.
2743
(S)Social Psychology. Theories and applications of social cognition, the self, pro-social and aggressive behavior, groups, attitudes, and the environment.

3013
Psychology of Motivation. Prerequisite: 1113. Review of research and theory in such areas as motivation as hunger, sex, frustration, aggression, achievement, affiliation, and altruism.

3073
(N)Neurobiological Psychology. Prerequisite: 1113. Neural bases of human experience and behavior. Topics include sensation and perception, motivation and emotion, learning and thinking.

3113
(N)Comparative Psychology. Prerequisite: 1113. Comparative study of behavior characteristics of selected samples of the animal kingdom from protozoa to humans.

3173
Cognitive Neuroscience. Prerequisite: 1113, 3073. Multidisciplinary approach to understanding how mental activities of the mind are the result of the processing by the brain.

3214
Quantitative Methods in Psychology. Lab 2. Prerequisites: 1113, MATH 1513, or consent of instructor. Design and evaluation of research in psychology including scales of measurement, basic research designs, and quantitative procedures for data analysis, with emphasis on problems encountered in psychological research.

3443
(S)Abnormal Psychology. Prerequisites: 1113, and 60 credit hours or 45 hours with GPA of 3.25. Review of major approaches to conceptualizing abnormal behavior including dynamic, social, and learning-based theories. Discussion and illustration of the major forms of mental illness such as neuroses, psychoses and character disorders.

3513
Psychology of Learning. Prerequisites: 1113, 3213. Behavior change as a function of experience from relatively simple learning processes such as classical and instrumental conditioning to relatively complex processes such as verbal learning and concept identification.

3713
Psychology of Memory. Prerequisites: 1113 and three additional hours of psychology. Body of contemporary research on human memory and the process of knowledge acquisition with a focus on processes and strategies inside the human mind.

3823
Cognitive Psychology. Prerequisites: 1113, 3214 or equivalent. Cognitive processes. Thinking, problem solving, visual imagery, attention and memory search. Both theory and application emphasized.

3914
Experimental Psychology. Lab 2. Prerequisites: 1113, 3214 or equivalent and five additional hours in psychology. Problems, methods and applications of experimental psychology.

3990
Undergraduate Seminar. 1-6 credits. Maximum. Prerequisite: consent of instructor. For honors students and other outstanding students. Special topics in psychology.

4023
Human Evolutionary Psychology. Prerequisite: 1113. The conceptual and theoretical application of natural selection to human behaviors including sexuality, gender roles, emotion, personality, politics and religion.

4123
(S)Psychology of Women. Lab 1. Prerequisite: 1113. Sex differences and the development of sex role behavior. Encompasses the psychological dynamics of developmental and social issues for women.

4133
(S)Psychology of Minorities. Prerequisite: 1113. Review of psychological theories and research pertinent to minority group status.

4143
Psychology and Law. Lab 1. The new psycho-legal literature reviewed with emphasis on the psychological basis of voir dire, eyewitness behavior, courtroom persuasion, jury deliberation, and mental health issues.

4153
Psychology and Mass Media. Prerequisite: 1113. Survey of empirical evidence concerning the role of mass media in human psychological functioning. Psychological correlates of television and movie viewing; psychological needs met by media; the impact of various media content on behavior and cognition; and current social issues such as psychological effects of television violence, television sexuality, social stereotypes and advertising.

4183
Current Issues in Clinical Psychology. Prerequisites: 1113, 3443 and three additional credit hours in psychology. Problems of the individual in contemporary society and various clinical approaches that have been proposed as possible solutions to these problems.

4213
Decision Making and Problem Solving. Prerequisite: 3823 or consent of instructor, or graduate standing. An examination of the research literature on individual decision making and problem solving with dual emphases on theory and application. Thorough knowledge of human cognitive functioning needed.

4333
Personality. Prerequisites: 1113, 3443, or consent of instructor. Basic assumptions, research, and clinical issues relating to the major personality theories.

4483
(S)Psychology of Parent Behavior. Prerequisite: 1113. Historical and contemporary conceptions of parent-child relationship and approaches to communication and discipline; special problems in parenting.

4493
History of Psychology. Prerequisite: 1113. History of psychology as an aspect of European intellectual history. Psychological thought from early philosophical roots to modern conceptions of psychology as a science.

4813
Psychological Testing. Prerequisites: 1113 and 3214. Quantitative aspects of measurement and testing, with emphasis on scaling, standardization, reliability and validity. Basic principles of construction and the ethics of use.

4880
Senior Honors Thesis. 1-6 credits. Prerequisites: 3214, departmental invitation, senior standing, Honors College participation. A guided reading and research program ending with an honors thesis under the direction of a senior faculty member. Required for graduation with departmental honors in psychology.

4883
Current Issues in Psychology. Prerequisites: 3214, 3914. A capstone course examining current issues in psychology, their relationship to current issues in other academic disciplines, and their relevance in an educated society.

4990
Special Problems. 1-6 credits, maximum 6. Prerequisites: 1113, 3214 and consent of instructor. For honors students and other outstanding students. Experimental or library research.

5000
Thesis. 1-6 credits, maximum 6. Required of all graduate students majoring in psychology and writing a thesis.

5113
Psychopathology. Prerequisite: graduate standing in psychology or consent of instructor. Principles of diagnosis and treatment of major disorders.

5120
Psychology Workshop. 2-6 credits, maximum 6. Provides an opportunity to study specific psychological problems, both applied and theoretical.

5153
Cognitive Assessment. Lab 1. Prerequisites: 3443, 4813; graduate standing in the clinical program of the Department of Psychology, the doctoral school or counseling psychology program or the psychometry program, or consent of instructor. Cognitive and intellectual assessment of children, adolescents and adults. Fundamental skills in administration, scoring, and interpretation of cognitive tests and report writing. Application of cognitive tests to specific clinical problems.

5193
Ethics and Professional Development in Psychology. Prerequisite: graduate standing in the Department of Psychology. Principles of ethics with a focus on the guidelines and standards for psychology. Legal and ethical issues for the practice of clinical psychology.

5304
Quantitative Methods in Psychology I. Prerequisite: 3214 or equivalent. Hypothesis testing, chi-square, student’s t, bivariate correlation and linear regression in psychology. Critical thinking regarding the application of statistical methods is stressed. The use of contemporary statistical software for analyses is covered.

5314
Quantitative Methods in Psychology II. Lab 2. Prerequisite: 5304. Higher-order analysis of variance designs, correlation and regression techniques, and analysis of covariance, with emphasis on applications to psychological experimentation. Computer applications of all procedures using SPSS and/or SAS during the lab.

5333
Systems of Psychotherapy. Prerequisite: 5113; graduate standing in the clinical program of the Department of Psychology or consent of instructor. The major approaches to psychotherapy. Methods for creating multiple impact for behavioral change, including interpersonal, social, community and preventative interventions.

5380
Research. 1-12 credits, maximum 12. Prerequisite: consent of instructor. Research project on some psychological problem.

5620
Seminar in Psychology. 1-9 credits, maximum 9. Prerequisite: consent of instructor. Consideration of special topics that are particularly timely or technical in nature.
5660*  
Teaching Practicum. 1-2 credits, maximum 2.  
Prerequisite: consent of instructor. Primarily for graduate students with well-defined new teaching responsibilities.

5823*  
Cognitive Processes. Theory and experimental research findings dealing with human thought processes from a developmental and functional standpoint.

6000*  
Dissertation. 1-16 credits, maximum 60. Research and research theorems by graduate students in partial fulfillment of requirements for the Doctor of Philosophy degree.

6083*  
Principles of Behavior Therapy. Prerequisite: graduate standing in the clinical program of the Department of Psychology or consent of instructor. Principles and procedures of behavior therapy and modification.

6133*  
Ethnic and Cultural Diversity in Psychotherapy. Prerequisites: six credit hours of psychology and consent of instructor. Increasing understanding and appreciation of ethnic and cultural diversity in the psychotherapy context. Critical examination of theory and research related to psychotherapy with multicultural populations.

6143*  
The Psychology of Substance Abuse. Prerequisite: consent of instructor. Introduction to psychological classification of psychoactive substances (alcohol and drug) use disorders. Theory and research on psychological, biological, and environmental factors that are concomitants of substance abuse. Overview of major research techniques and treatment modalities in this area.

6173*  
Child Psychopathology and Treatment. Prerequisites: 2583, 3443 or equivalent; graduate standing in the clinical program of the Department of Psychology, the doctorate school psychology program or the psychometry program, or consent of instructor. Theoretical positions and issues in child psychopathology. Procedures used in the treatment of psychological disorders of children.

6223*  
Research Design. Prerequisites: 3914 and doctoral level standing. Experimental techniques in psychophysics, sensory processes, attention and perception, motivation and emotion, and learning and memory.

6233*  
Clinical Research Design. Prerequisites: 5304 and 5314 or consent of instructor. Methodology and research practices in clinical psychology, including experimental design, research practice, data analysis and interpretation, ethics, and dissemination of research findings.

6253*  
Seminar in Human Development. Prerequisite: consent of instructor. Behavioral aspects of development from the prenatal period to senescence. Normal development contrasted to exceptional development.

6283*  
Factor Analysis. Factor analysis and implications for measurement of mental abilities, personality traits and learning.

6353*  
Psychology of Motivation. Prerequisite: 3914. Outline of theory and research in human and animal motivation.

6393*  
Psychology of Language. Review of data and theories of speech and language behaviors. Laboratory techniques and experimental designs will also be reviewed to emphasize understanding of psycholinguistic research.

6433*  
Psychology of Information Processing: Development and Aging Aspects. Attention, list processing, pattern recognition, and related areas in terms of contemporary facts, theory and application. Special attention paid to development and aging aspects of information processing.

6443*  
Behavioral Medicine. Prerequisites: graduate standing in the clinical program of the Department of Psychology; consent of instructor. An advanced graduate course for students in training for a Ph.D. in clinical psychology. General considerations for psychophysiological disorders, general intervention strategies in behavioral medicine including biofeedback, and specific consideration and intervention strategies for specific disorders.

6453*  
Pediatric Psychology. Prerequisites: graduate standing in the Department of Psychology; consent of instructor. Overview of the field of pediatric psychology, including historical perspectives, theoretical underpinnings and application to a variety of child health problems. Childhood chronic illness, injury prevention, pain management, and consultation and intervention in medical contexts.

6483*  
Neurobiological Psychology. Prerequisites: 3073 and 3914 or consent of instructor. Physiological, neuroanatomical, and neurochemical underpinnings of human behavior. Emphasis on effects of central nervous system dysfunctions on behavioral processes ranging from sensation to concept formation.

6523*  
Family Treatment Methods. Prerequisites: graduate standing in the clinical program of the Department of Psychology or the doctorate counseling psychology program. Introduction to techniques and philosophies of family treatment. Includes marital counseling and emphases on family dynamics.

6553*  
Advanced Practice in Marital and Family Treatment. Prerequisites: 6523, concurrent enrollment in counseling or clinical practice; graduate standing in the clinical program of the Department of Psychology or the doctorate counseling psychology program, or consent of instructor. Advanced methods in assessment, diagnosis and treatment of marital and family problems. Skill development, professionalism, ethics and case management. Dynamics of co-therapy and conjoint treatment. Case consultation format. Same course as ABSE 6553.

6563*  
Advanced Social Psychology. Prerequisite: 2743. History, theory and experimentation of dynamic interaction of group membership and individual behavior.

6583*  
Developmental Psychobiology. Prerequisites: 3073 or equivalent; consent of instructor. An exploration of the biological aspects of human development, with particular emphasis on the physiological, ethological, and genetic perspectives.

6613*  
Experimental Learning Theories. Prerequisite: nine credit hours of psychology. Basic concepts and empirical findings in animal and human learning.

6640*  
Clinical Practicum. 1-12 credits, maximum 17. Prerequisite: graduate standing in the clinical program of the Department of Psychology. Practicum experience for graduate students in the clinical psychology program.

6643*  
Psychopharmacology. Prerequisites: 3073 or consent of instructor. A comprehensive course dealing with the various classes of drugs that affect the central nervous system. Primary focus is on clinical research with humans. Covers topics ranging from drug-receptor interactions through substance abuse and behavioral disorders.

6650*  
Practicum. 1-16 credits, maximum 16. Prerequisite: graduate standing in the clinical program of the Department of Psychology. For the marriage and family practicum only, doctoral level counseling psychology students may also enroll. Practicum experience for graduate students. Practicum experience for graduate students in the clinical program of Psychology who are doing supervised practicum in specific clinical areas of specialization.

6673*  
Neuropsychological Assessment. Prerequisites: 5153, 6483, 6753; graduate standing in the clinical program of Psychology or consent of instructor. Psychological assessments of the effects of cerebral damage or disease.

6723*  
Child Diagnostic Methods. Prerequisites: 5153, graduate standing in the clinical program in psychology or the doctoral school psychology program or consent of instructor. Administration and interpretation of diagnostic instruments used specifically with children.

6753*  
Assessment of Personality. Prerequisites: graduate standing in the clinical program of Psychology or consent of instructor. Personality assessment and training in the practice of clinical assessment. Trait theory and assessment, techniques of test construction, contemporary assessment techniques including the MMPI-2, test result interpretation and communication, and behavioral methods of assessment.

6883*  
Seminar in Psychological Testing. Prerequisites: 5153, 6713, 6753, and graduate standing in the clinical program of the Department of Psychology, or consent of instructor. The administrative, interpretation, and integration of projective and objective personality test data and intelligence test data with adult psychiatric patients.

6933*  
Communication and Persuasion. Seminar concerning the communication process at all levels, from face-to-face encounters to the mass media, with emphasis on the social-psychological factors that influence persuasive attempts.

Rangeland Ecology and Management (RELM)

1011  
Professions in Natural Resources. An examination of the profession of the ecology and management of natural resources. Exploration of academic and career options. Graded on a pass-fail basis. Same as ZOOL 1011.
(N)Ecology and Natural Resources. Prerequisite: BIOL 1114 or PLNT 1213. Introduction to understanding and applying general ecological principles to agricultural and natural ecosystems. Emphasis on relationships between climate, soils, agricultural, and natural ecosystems. Topics include nutrient cycles, energy flow, species interactions, biological diversity, productivity, sustainability, and landscape and ecosystem management.

Aerial Photogrammetry and Information Systems. Lab 3. Prerequisite: MATH 1613. Principles and techniques of aerial photogrammetry, remote sensing, aerial photo interpretation, and geographic information systems. Applications to management of natural resources utilizing photogrammetric instrumentation and geographic information system software. Same course as FOR 3883.

Principles of Rangeland Management and Restoration. Prerequisites: 2913, BIOL 1114 or PLNT 1213; SOIL 2124. Management of different kinds of land and different rangeland areas of the U.S.: rangeland plant response to fire and herbivory; rangeland inventory and monitoring; plant control; prescribed burning; grazing management; managing rangelands for wildlife and other values. Field trips required.

Senior Seminar. Prerequisite: senior standing in plant and soil sciences. Career opportunities (talks and field trips); preparation of resumes and interviews. Graded on a pass-fail basis. Same course as PLNT 4571 and SOIL 4571.

Rangeland Resources Planning. Lab 3. Prerequisites: 4954, ANSI 3612. Inventory of ranch resources, survey and evaluation of ranch practices, and economic analysis. Development of a comprehensive ranch management plan. Managing rangeland and ranch resources in a social context. Written and oral reports. Field trips required. Same course as ANSI 4973.

Prescribed Fire. Lab 3. Prerequisites: 3913. When to use prescribed fire and how to use prescribed fire to accomplish specific land management objectives. Writing prescribed fire plans, policy and laws, weather, equipment, conducting burns, and post-burn mop-up. Field trips required.

Special Topics in Range Management. 1-3 credits, maximum 3. Prerequisite: 15 hours of range management. Advanced topics and new developments in range management.

Advanced Prescribed Fire. Lab 3. Prerequisite: 4983 or consent of instructor. Preparing fire plans and executing prescribed fires as the fireboss. Same course as RLEM 4983. No credit for both RLEM 4993 or RLEM 5993.

Doctoral Thesis. 1-6 credits, maximum 36. Prerequisite: consent of instructor. Independent research to be conducted and reported with the supervision of a major professor as partial requirement for the Ph.D. degree.

Advanced Topics and Conference. 1-6 credits, maximum 6. Prerequisite: M.S. degree. Supervised study of advanced topics. A reading and conference course designed to acquaint the advanced student with fields not covered in other courses.

Religious Studies (REL)

The Religions of Native Americans. Recommended: 1103. Selected tribal worldviews, belief systems and religious ceremonies, as depicted in oral traditions, songs and literature. Emphasis on Northern and Southern Plains Indians.

Studies in Religion. 1-6 credits, maximum 6. Independent studies, seminars and courses on selected topics in religion.

The World of Islam: Cultural Perspectives. The cultural heritage of the world of Islam explored through its expression in the art, architecture and literature of the Muslim peoples.

Seminar in Biblical Studies. 3 credits, maximum 9. Prerequisites: two courses in Biblical studies. Selected topics in the academic study of the Bible.

Research, Evaluation, Measurement and Statistics (REMS)

Measurement and Evaluation in the School. Prerequisite: full admission to Professional Education. Construction and selection of classroom tests. Contrasts between criterion-referenced and norm-referenced measurement strategies. Grading techniques, rudiments of standardized test selection and score interpretation and the basic statistics used to summarize and analyze test results.

Master’s Thesis. 1-6 credits, maximum 6. Prerequisite: consent of instructor.

Research Design and Methodology. Required of all graduate students in education. Introduction to the concepts of research design, methodology, sampling techniques, internal and external validity and the scientific method in educational research. Critical analysis of educational research studies and the writing of proposals. No credit for student with credit in 5015.
5320* Seminar in Research, Evaluation, Measurement and Statistics. 3-6 credits, maximum 6. Prerequisite: consent of instructor. In-depth exploration of contemporary problems of research, evaluation, measurement and statistics.

5373* Educational Measurements. Appropriate applications of tests in the schools. Development of teacher-made tests, selection of standardized tests, interpretation of test results, understanding of the statistics reported in testing literature, uses of test results, and recent developments in educational measurement.

5953* Elementary Statistical Methods in Education. Elementary statistical methods needed by consumers of educational research. Descriptive and inferential statistics. No credit for students with credit in 5015.

6000* Doctoral Dissertation. 1-25 credits, maximum 25. Prerequisite: consent of instructor. Required of all candidates for doctorate in applied behavioral studies. Credit given upon completion and acceptance of dissertation.

6003* Analyses of Variance. Prerequisite: admission to a doctoral level program. A thorough examination of analysis of variance procedures as they relate to principles of experimental design in education and behavioral sciences.

6013* Multiple Regression Analysis in Behavioral Studies. Prerequisite: 6003 or consent of instructor. Applications of multiple regression as a general data analysis strategy for experimental and non-experimental research in behavioral sciences.

6023* Psychometric Theory. Prerequisite: 6013 or consent of instructor. Theoretical basis for applying psychometric concepts to educational and psychological measurement. The Classical True Score model and applications to instrument development and design of studies for evaluating instrument quality.

6373* Program Evaluation. Prerequisites: 5013 and admission to a doctoral level program or consent of instructor. Contexts, purposes and techniques of evaluating educational programs. Evaluation design, information collection, analysis, reporting and uses of results for programs ranging from individual lessons to nation-wide multi-year projects. Special emphasis on evaluation requirements of federally funded programs.

6663* Applied Multivariate Research in Behavioral Studies. Prerequisite: 6013 or consent of instructor. An overview and analysis of multivariate procedures commonly applied to educational and behavioral research. Emphasis on conceptual design and application of these procedures.

6850* Directed Reading. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Directed reading for students with advanced graduate standing.

Russian (RUSS)

1115 Elementary Russian I. Lab 1 1/2. Understanding, speaking, reading and writing. Method of instruction is audio-lingual.

1225 Elementary Russian II. Lab 1 1/2. Prerequisite: 1115 or equivalent. Continuation of 1115.

2115 (I)Intermediate Russian I. Prerequisite: 2225 or equivalent. Continuation of 2225. Russian grammar, composition and conversation.

2225 (I)Intermediate Russian II. Prerequisite: 2115 or equivalent. Continuation of 2115.

3053 (I,IS)Introduction to Central Asian Studies. A comprehensive view of newly-emerged Central Asian states examining the history, politics, economics, geography, and culture of Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan as reflected in their thoughts, religion, literature, and architecture, in the past, and the strategic importance of their natural wealth for the present and future. Same course as HIST 3053 and POLS 3053.

3113 (I)Russian Conversation. Prerequisite: 2225 or equivalent. Development of conversational skills in formal and informal Russian language; study of oral communication and idioms; vocabulary enhancement.

3123 (H,I)Russian Culture and Civilization. Art, literature, music, architecture, and contemporary life of Russia. Course taught in English.

3223 (I)Russian Composition. Prerequisite: 2225 or equivalent. The development of all forms of written communication in Russian through practice in writing compositions, letters, reports and other documents in Russian.

4013 (H)Survey of Russian Literature I. Prerequisites: 20 credit hours of Russian or equivalent. Survey of Russian literature from its beginning to late nineteenth century with readings in Russian of representative texts. Course conducted in Russian.

4023 (H,I)Survey of Russian Literature II. Prerequisites: 20 credit hours of Russian or equivalent. Survey of Russian literature from late nineteenth century to post-Soviet era with readings in Russian of representative texts. Course conducted in Russian.

4123 (H,I)Russian Literature in Translation II. Russian and Soviet literature from mid-19th century to present: Tolstoy, Chekhov, Gorky, Zamiatin, Sholokhov, Pasternak, Bunin, Solzhenitsyn, Azhakh (Daniel), Tertz (Sinyavsky), Voznesensky and Evstafenko. Readings in English. Classes conducted in English.

4223 (I)Russian Reading Skills. Prerequisites: 20 hrs. Russian or equivalent proficiency. Acquisition of skills in vocabulary enrichment, stylistic analysis and advanced proficiency in reading various styles of contemporary written Russian (newspaper, political, business).

Social Foundations (SCFD)

3223 Role of the Teacher in American Schools. Prerequisite: declaration of intention to pursue a program in Professional Education. One half-day per semester on-site lab required. A review of the school as an institution and an introduction to the role of the teacher as a professional in the schools. Socialization of the student socio-economic class and education, the nature of multicultural education, school experiences of women and ethnic groups, school governance, professional organizations, ethics, and the nature of teaching.

4123 (S)History of Education. The development of major educational ideas and programs with emphasis on the growth of public education in the United States from the Colonial period to the present.

4913 (I)International Problems and the Role of the School. Prerequisite: junior or senior standing. Extends the student's intercultural awareness by focusing on international problems and expanding their meaning to include the school and its relationship to existing international concerns in other types of societies. Consideration of such international problems as natural resources, environment, food supply, urbanization and conflict resolution.

5000* Master's Report or Thesis. 1-6 credits, maximum 6. Students studying for a master's degree enroll in this course for a total of 2 credit hours if they write a report, or 6 hours if they write a thesis.

5720* Education Workshop. 1-8 credits, maximum 8. For teachers, principals, superintendents, and supervisors who have definite problems in instruction or administration. Students must register for the full number of credit hours for which the workshop is scheduled for a particular term.

5850* Directed Study. 1-3 credits, maximum 3. Directed study for master's level students.

5883* Educational Sociology. The manner in which social forces and institutions influence education and the educational system in the United States.

5913* Introduction to Qualitative Inquiry. Examination of the major approaches and fieldwork techniques of qualitative research as well as the challenges associated with conducting this form of inquiry.


6023* Comparative Education. A systematic investigation of educational institutions in various nations for the purpose of an enlarged, critical view of American education. Researching specific transnational educational theories.

6113* Theoretical Foundations of Inquiry. Exploration of the history and philosophical assumptions undergirding theories, methods, and issues of ethics and rigor associated with both qualitative and quantitative research in education and related fields. An in-depth overview of research paradigms through readings and discussions. Introductory doctoral level course.

6123* Qualitative Research I. The traditions, philosophies, and techniques of qualitative research, including participant observation, interviewing and document analysis. Practice in qualitative techniques and in preliminary data analysis.
Sociology (SOC)

6133* Qualitative Research: Interviewing. Prerequisite: a 5000-level research course. Investigation of the traditions, philosophies, and techniques of qualitative interview research. Talking with people about the world they inhabit--how they think about and understand aspects of it, including their interactions with others, and how they come to make sense of it. Designing and conducting a limited interview study in order to get a "hands-on" feel for how to question, listen, transcribe, and undertake initial analyses of textual and narrative data.

6190* Qualitative Research: Selected Methods. 3 credits, maximum 3. Designing and conducting a limited study in order to get a "hands-on" feel for the focal method. Methods such as case study, grounded theory, ethnography, biography, historical social science, life history, phenomenology, and discourse analysis.

6193* Qualitative Research II. Prerequisites: 6123, 6133 or consent of instructor. Various approaches to qualitative data analysis, including the use of computer applications. Additional attention to issues of writing, representation, reflexivity, and reciprocity. Practice in analytic techniques and writing research.

6443* Ethics and Moral Education. Interdisciplinary perspectives of moral and contemporary ethical theories, focusing on application to professional practice and moral education. Moral development, the moral life, feminist ethics, and character education.

6823* Institutional History of Education. History of elementary, secondary, and higher education in Western civilization with emphasis upon the development of the American educational institution. Researching the impact of institutional development in a pluralistic society.

6850* Directed Reading. 1-6 credits, maximum 6. Directed reading for students with advanced graduate standing to enhance students' understanding in areas where they wish additional knowledge.

6880* Internship in Education. 1-8 credits, maximum 8. Directed off campus experiences designed to relate ideas and concepts to problems encountered in the management of the school program.

6883* Transforming Pedagogies. Contemporary pedagogical theories and school reform initiatives, including origins, purposes, underlying philosophical assumptions, cultural contexts, and implications for schooling.

6910* Practicum. 1-6 credits, maximum 6. The student carries out an acceptable research problem (practicum) in a local school situation. Credit given upon completion of the written report.

6984* Diversity and Equity Issues in Education. Many social, historical, and cultural constructions of "difference" and the impact in personal and professional relationships in education and related human service fields. Categories of race, class, and gender, but may also include ethnicity, sexual orientation, and special needs.

3823* (S)Sociology of Death and Dying. Death and dying as social phenomena including cross-cultural perspective. An understanding of occupations and professions dealing with terminal patients in hospitals and at funerals. Students required to engage in original research from community sources.

3952 Applied Sociology. Prerequisite: sociology majors or consent of instructor or adviser. Application of sociological theory and methods to various job situations.

3993 (S)Sociology of Aging. Sociological problems of aging, including the analysis of the behavior of the aged within the framework of social institutions.

4003 Senior Thesis in Sociology. Prerequisites: 3113, 4013, 4133, STAT 4013, and consent of instructor. Conduct a research project (review literature, prepare proposal, gather and analyze data and report results) on a sociologically significant topic or issue.

4013* Qualitative and Applied Social Research Methods. Prerequisites: 3113 and STAT 4013. Conducting, analyzing and reporting qualitative social research. Research design, data collection, analysis and write-up of evaluation research and social impact assessments. Individual research project included.

4023* (S)Juvenile Corrections and Treatment Strategies. Prerequisite: 3523 or 4333. The juvenile justice system, emphasizing the juvenile court, diversion and youth service bureaus as well as the more traditional training schools and foster homes. Experimental treatment strategies with institutionalized delinquents.

4043* (S)Gender and Work. Prerequisite: one upper-division course. Consideration of unpaid, paid and volunteer work and gender differences. Linkages between economy, work and family with examples from United States and less developed countries.

4103* Social Research Methods. Prerequisites: 3113 and STAT 4013. Applying sociological theory to designing quantitative and qualitative research; methods of data collection, processing and analysis; basic skills in computer analysis of social data. Research project included.

4213* (S)Sexuality in American Society. Prerequisite: junior standing or consent of instructor. Sociological aspects of sexual behavior, attitudes and belief systems in society. Similarities and differences in males and females in all types of sexuality.

4323* Sociology of Agriculture. Overview of U.S. agriculture focusing on changing markets and technologies and their impact on farm families and other social institutions and relationships. Emphasis on agricultural problems, policies and alternatives to traditional farming practices.

4434 S(Medical Sociology: Health and illness as social and societal phenomena including the doctor-patient relationship, distribution and etiology of disease, the social meaning of health and illness, basic epidemiology, and the social processes involved in medical practice. Cross-cultural comparisons and the sociology of the health professions.

4383 S(Social Stratification: Systems of class and caste, with special attention to the United States. Status, occupation, income and other elements in stratification.

4423 S(Community Organization and Development: Structure, change and development of the local community in rapidly changing society. Emphasis on community organization and planned change.

4433 S(Environmental Sociology: Critical assessment of the social causes and consequences of problems with resource scarcity and environmental degradation. Environmental problems viewed as social problems viewed as social problems, requiring an understanding of the structural conditions producing environmental problems and inhibiting resolutions.

4443 S(Sociology of Law and Legal Institutions: Prerequisite: 3523 or 4333. Criminal and civil law as mechanisms of social control; conflict and consensus models of legislation; legal doctrine and its application by police, prosecution and defense, courts and administrative agencies of control. Decision processes in the criminal justice system, personnel and case loads and related areas. Native American law; federal policy and trust status, criminal and civil law, tribal jurisdiction, tribal courts.

4513 S(Demography of Ethnic and Immigrant Population in Global Perspective: The population characteristics of immigrant, ethnic and racial groups along major demographic dimensions. Cross-national comparisons between minority groups on demographic and cultural factors.

4533 S(World Population Problems: Fertility, mortality, migration, and other factors related to population size, density, and composition; the population explosion, worldwide famine, birth control, and other serious social issues.

4623 S(International Industry and Work: Prerequisite: consent of instructor. A focus on work, industry and globalization within a sociocultural context. The impact of country cultures upon industry and work and adjustment to cross-cultural problem solving and development of global work teams.

4643 S(Women in Society: A sociological exploration of the image and status of women in society, including family, work and politics. Socialization, education and the women’s movement. Introduction to feminist theory.

4723 S(American Marriage, Family, and Male-Female Relationships: The sociological relationship between men and women and the social consequences of family and gender roles; marriage, sexuality, attraction, divorce, and other intimate situations.

4850 Internship in Sociology: 1-4 credits, maximum 4. Prerequisites: 3952. Completion of 12 hours of sociology courses and consent of the internship coordinator. Field experience in a variety of work settings.

4923 S(The Field of Corrections: An overview of correctional work and training environments and institutions. A survey of contemporary alternatives to conventional imprisonment.

4990 S(Exploration of Sociological Issues: 1-3 credits, maximum 6. Prerequisite: consent of instructor. Examines sociologically significant topics and issues.

4993 Senior Honors Thesis: Prerequisites: departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a senior faculty member, with second faculty reader and oral examination. Required for graduation with departmental honors in sociology.

5000 S(Thesis in Sociology: 1-6 credits, maximum 6. Prerequisite: consent of instructor. Examinations of substantive research questions and application of a variety of research procedures to answer such questions.

5263 S(Quantitative Methods of Social Research: Prerequisite: 4133, STAT 4013 or equivalent. Advanced techniques in sociological research, including the development and analysis of computer and social science research. Focus on the nature and current trends of the social movement of quantitative research and qualitative research in the United States and international comparisons.

5273 S(Qualitative Research Methods: Examination of ethnographic studies and the development of qualitative research. Research project required.

5323 S(Seminar on Collective Behavior and Social Movements: Prerequisite: graduate standing. Examination of major theoretical and empirical approaches employed in the study of social movements, with special emphasis on the nature and current trends of social movements and the development of new social movements.

5463 S(Seminar in Environmental Sociology: Critical overview of contemporary developments in environmental sociology. Environment concern, disasters, health issues, risk assessment and environmental conflict.

5533 S(Correctional Institutions and Residential Treatment: Prerequisite: 4923 or equivalent. Nature and effects of custodial institutions on the inmate. Prison community, its structure, social processes and dynamics. Resocialization of prison inmates in new vocational and social skills.

5553 S(Seminar in Medical Sociology: Advanced study in the sociology of medicine, including the doctor-patient relationship, the social meanings of health and illness, epidemiology, health care delivery, and the medicalization of American society. Analysis of the sociology of organic illness and mental illness using readings from both classical and contemporary sources.

5563 S(Community Treatment of Offenders: Prerequisite: 4923 or equivalent. Treating offenders in the community without incarcerating them in prisons. Probation, parole and other rehabilitative services. Impact of new community treatment centers, group homes, probation hotels and halfway houses. Effectiveness of the individual and group family therapies on the offenders.

5663 S(American Pluralism, Race and Ethnicity in American Life: Prerequisite: graduate standing. Analysis of the dynamics of intercultural and intergroup relations in America with special emphasis on the examination of major conceptual perspectives that have characterized the study of race and ethnicity in American life.

5753 S(Complex Organizations: Prerequisite: graduate standing or consent of instructor. Nature and types of complex organizations: organization structure and power, organizational alternatives and change; organizational deviance; and occupations and professions.

5763 S(Contemporary Organizational Theory: Prerequisite: graduate standing. Advanced study of contemporary theories used to explain, predict and understand organizations. Behavior of populations of organizations.
5793* Seminar on Organizational Deviance. Overview of contemporary theory and research on organizational deviance. Defining acceptable risk. Organizational structures, processes, and standard operating procedures that produce mistake, misconduct and disaster.

5813* Myths and Realities of Organizational Change. Prerequisite: graduate standing. A critical examination of the various theories and models that address change and improvement processes in complex organizations. Theoretical and methodological validity of assumptions underlying such organizational theories and models.

5883* Sociology of Education. Prerequisite: graduate standing or consent of instructor. The manner in which social and economic forces and educational systems exert mutual influence upon each other. Utilizes comparative international examples of how educational systems vary and how they compare to the U.S.


5990* Advanced Problems and Issues in Sociology. 1-9 credits. maximum 9. Prerequisite: consent of instructor. Group enrollment or individual research enrollment as needed. Graduate level analysis of special problems and issues in sociology not covered in other department offerings.

6000* Dissertation. 1-12 credits. maximum 18.

6213* Theory of Social Structure. Prerequisite: six hours of undergraduate sociology or equivalent. Relationship between human thought and the social context within which it arises.

6260* Seminar in Current Research Literature. 2-3 credits. maximum 6. Methodological analysis of advanced research in major areas of sociology.


6390* Seminar in the Family, Marriage and Male-Female Roles in American Sociology. 2-3 credits. maximum 6. Analysis of published research in sociology of family, marriage and male-female roles and relationships with special emphasis on American society.

6420 Seminar in Urban Sociology. 2-6 credits. maximum 6. A theoretical and applied approach to cross-cultural urban studies. Emphasis on different methodologies for urban community analysis.

6450* Seminar in Industrial Sociology. 2-3 credits. maximum 6. Intensive analysis of selected problems in industrial sociology.

6460* Advanced Studies in Environmental Sociology. 1-6 credits. maximum 6. Prerequisite: 5463 or consent of instructor. Intensive examination of selected topics in environmental sociology.

6463* International Issues in Environmental Sociology. Prerequisite: graduate standing. Advanced study of the international context of environmental issues.


6550* Seminar in Social Organization. 2-3 credits. maximum 6. Research and literature relating to macro-social analysis.


6673* Development of Social Thought. Historical and analytical studies of major contributions to social thought leading toward the works of modern theorists.

6750* Seminar in Deviance and Criminology. 2-3 credits. maximum 6. Current research and theory in criminology, penology and deviance in modern society.

6853* Seminar in Symbolic Interactionism. Symbolic interactionism, a major contemporary school of thought in sociology and psychology, emerging from philosophical pragmatism with special emphasis on the thoughts of George H. Mead and its derivatives including dramaturgy, existential social psychology and phenomenological.

6950* Seminar in Social Gerontology. 2-3 credits. maximum 6. A theoretical and practical examination of the sociological implications, both individual and societal, of an aging population.

**Soil Science (SOIL)**

2124 (N)Fundamentals of Soil Science. Lab 2. Prerequisite: CHEM 1215. Principal physical, chemical and biological properties of the soil related to plant growth; soil testing and fertilizer usage; formation and classification of soils, rural and urban land use.

3433* (N)Soil Genesis, Morphology, and Classification. Lab 3. Prerequisite: 2124. Basic principles dealing with how and why soils differ, their descriptions, geographic distributions and modern classification of soils. Soil genesis and classification a prerequisite to sound land use planning and land management.

3893* Soil Chemistry and Environmental Quality. Prerequisite: 2124. Soil chemical processes that affect plant nutrition, nutrient cycling, and fate of environmental pollutants. Chemistry of soil surfaces and soil solution, of important soil processes, and of agronomic and environmental topics such as water quality, soil acidity, pesticide resistance, environmental chemistry and risk assessment, soil remediation and contaminant bioavailability, land application of municipal and industrial wastes, long-term reactions and environmental fate.

4210* Describing and Interpreting Soils. 1 credit. maximum 3. Lab 3. Prerequisite: 2124. Describe and classify soil properties in the field and interpret for suitable agriculture, urban, and other land uses.

4213* Precision Agriculture. Lab 2. Prerequisites: MATH 1513, senior standing. Introduction to the concepts of precision agriculture including analysis of spatial variability, relationships of fertility and crop response, geographical information systems, variable rate technology, optical sensing, global positioning systems, and yield monitoring. Case studies included for detailed analyses. Same course as BAE 4213.

4234* Soil Nutrient Management. Lab 2. Prerequisite: 2124. Soil fertility and use of fertilizer materials for conservation, maintenance, and improvement of soil productivity and to minimize environmental concerns.

4363* Environmental Soil Science. Prerequisites: BIOL 1114 and CHEM 1215. Presentations of soil processes and interpretation for natural resource management; land reclamation; identification of wetlands; oil and soil damages; impact of fertilizer, pesticide and other agricultural chemicals on soil and water quality; water resources; long-term soil erosion and landscape formation; transformations of manure, sewage sludge and other organic by-products.

4463* Soil and Water Conservation. Prerequisite: SOIL 2124. Assess the importance, quality and quantity of soil and water as natural resources for ecosystems and societies. Principles of soil erosion processes and management practices to decrease erosion in urban, cropland and rangeland systems. Understand the principles of hydrologic cycle to improve water use efficiency of precipitation and irrigation resources. Examine resource mismanagement that have resulted in desertification, salinization and deforestation.

4470* Problems and Special Study. 1-3 credits. maximum 12. Lab 1-3. Prerequisite: consent of the instructor. Problems in soil science selected from topics in soil chemistry and fertility, soil physics, soil biology, soil conservation and soil morphology.

4483* Soil Microbiology. Prerequisite: 2124 and BIOL 1114 or consent of instructor. A comprehensive overview of microorganisms living in soil and activities that are of agricultural and environmental significance.

4563* Dynamics of Wetland, Forest and Rangeland Soils. Prerequisite: Dynamics of soils that receive minimal or no production input. Identification of wetland soils and the biogeochemical reactions occurring in wetland soil environments. Nutrient cycling, physical, chemical and biological properties of forest and rangeland soil systems.

4571 Senior Seminar. Prerequisite: senior standing in plant and soil sciences. Career opportunities (talks and field trips); preparation of resumes and interviews. Graded on a pass-fail basis. Same course as PLNT 4571 and RLEM 4571.

4683* Physical Properties of Soils. Prerequisites: 2124 and ENGS 1114. Soil physical properties and processes, and their influence on plant growth.

4863* Animal Waste Management. Prerequisite: 2124. Aspects of animal waste management related to animal nutrition, system design, land application and economic acceptance.
5000*  
**Master’s Thesis**, 1-6 credits, 6 maximum total credits under Plan I, and 2 maximum total credits under Plan II. Prerequisite: consent of adviser. Research planned, conducted and reported in consultation with a major professor.

5020*  
**Graduate Seminar**, 1 credit, maximum per semester 1 credit on M.S. program and 2 credits on a Ph.D. program required. Prerequisite: graduate standing. Philosophy of research, methods of research, or interpretation of research.

5110*  
**Problems and Special Study**, 1-4 credits, maximum 6. Prerequisite: consent of instructor. Supervised study of special problems and topics not covered in other graduate courses.

5193*  
**Spatial and Non-spatial Data Base Management of Natural Resources**, Prerequisites: one course in statistics and programming experience. Methods of acquiring, managing and analyzing spatial data using geographic information systems. Management of non-spatial data using relational database managers. Development of applications using these tools for evaluating and managing natural resources.

5224*  
**Soil Chemical Processes and Impact on Environmental Quality**, Lab 3. Prerequisites: 3893 and CHEM 2113 or CHEM 3324 or equivalent. A comprehensive study of chemical processes in soil systems that impact biogeochemical cycles and environmental quality. Modern theory of soil solution thermodynamics, kinetics of soil chemical processes, soil colloids chemistry, and soil geochemistry. Environmental soil science applications including environmental fate of toxic substances and remediation of contaminated soil. Laboratory component provides hands-on experience with techniques used for soil chemical investigations and with chemical speciation computer models.

5230*  
**Research**, 1-4 credits, maximum 4. Prerequisite: consent of a faculty member supervising the research. Supervised independent research on selected topics.

5353*  

5483*  
**Soil Biodegradation and Bioremediation**, Prerequisite: 4483. A comprehensive overview of microorganisms living in soil and their activities of agricultural and environmental significance, emphasizing their roles in improving soil quality, and biodegradation and bioremediation of soil.

5583*  
**Soil Physics**, Prerequisites: MATH 2265 or 2365, PHYS 1214. Fluid flow through saturated and unsaturated soils; temperature change and heat flow in soil; soil strength and deformation as it applies to plant response.

5613*  
**Laboratory Methods of Soil, Plant and Environmental Analysis**, Lab 3. Prerequisites: CHEM 2122, 3324 or equivalent. Theory, principles and techniques of laboratory methods used for chemical analysis of soil, plant material and environmental samples. Modern analytical methods used for soil testing of plant available nutrients, determination of environmental contaminants, and chemical characterization of soil. Operational theory of applicable instruments including atomic spectroscopic (ICP, AA, UV-VIS, XRF), chromatographic (GC, GC-MS, HPLC, IC), and potentiometric methods. Laboratory component hands-on experience of chemical methods.

5813*  
**Soil-Plant Nutrient Cycling and Environmental Quality**, Prerequisite: 4234 or equivalent. Theory and application of soil plant relationships in production and non-production environments. Nutrient cycling, mass balance, soil nutrient supply and plant response. Methods to reduce the impact of nutrients on environmental quality, soil-plant buffering and response models.

5980*  
**Soil Physical Analyses**, 1-2 credits, maximum 2. Lab 1 or 2. Prerequisite: 4683. Principles and techniques.

6000*  
**Doctoral Thesis**, 1-6 credits, maximum 36. Prerequisite: consent of instructor. Independent research to be conducted and reported with the supervision of a major professor as partial requirement for the Ph.D. degree.

6010  
**Advanced Topics and Conference**, 1-6 credits, maximum 12. Prerequisite: M.S. degree. Supervised study of advanced topics. A reading and conference course designed to acquaint the advanced student with fields not covered in other courses.

Spanish (SPAN)

1115  
**Elementary Spanish I**, Pronunciation, conversation, grammar and reading. Includes language lab work. Students may not receive credit for both this course and SPAN 1153.

1153  
**Accelerated Elementary Spanish I**, Prerequisites: 1-2 years high school Spanish or equivalent. Accelerated presentation of basic skills of the Spanish language for students with previous experience, but who are not yet ready for SPAN 1225. Students may not receive credit for both this course and SPAN 1153.

1225  
**Elementary Spanish II**, Prerequisite: 1115, or equivalent. Continuation of 1115. Includes language lab work.

1253  
**Accelerated Elementary Spanish II**, Prerequisites: 3-4 years high school Spanish or equivalent. Accelerated development of the second phase of Spanish language skills for students with previous experience, but who are not yet ready for SPAN 2115.

2115  
(l) **Intermediate Spanish I**, Prerequisite: 1225 or equivalent. Further development of speaking, listening, reading and writing skills, along with short cultural and literary readings.

2222  
(l) **Intermediate Composition and Grammar**, Prerequisite: 2115 or equivalent. Skill consolidation with emphasis on composition and grammar, with some conversation. May be taken concurrently with 2223.

2223  
(l) **Intermediate Reading and Conversation**, Prerequisite: 2115 or equivalent. Skill consolidation with emphasis on short literary readings and conversation. May be taken concurrently with 2222.

3003  
(H,I) **Survey of Peninsular Literature**, Prerequisites: 20 credit hours of Spanish or equivalent. Development of literature from Spain to the present.

3013  
(l) **Survey of Latin-American Literature**, Prerequisites: 20 hours of Spanish or the equivalent. Development of the literature written in Spanish in the new world.

3203  
(l) **Advanced Conversation**, Prerequisites: 20 credit hours of Spanish or equivalent proficiency. Practice in conversation skills, designed to bring students to a high level of proficiency in speaking and listening. Class conducted in Spanish.

3213  
(l) **Advanced Grammar and Composition**, Prerequisites: 20 hours of Spanish or equivalent proficiency. Study of advanced grammar and stylistics with emphasis on composition skills, designed to bring students to a high level of proficiency in writing.

3463  
(l) **Advanced Diction and Phonetics**, Lab 1. Prerequisite: 2222 and 2223, or equivalent. Required course for teacher certification/licensure. Spanish speech sounds and intonation patterns, with practice to improve the student’s pronunciation.

4163  
(H) **Don Quixote**, Prerequisites: one 3000-level Spanish course or equivalent. Seminar devoted to Cervantes’ novel.

4173  
(H) **Hispanic Drama**, Prerequisite: one 3000-level Spanish course, or equivalent. Reading and interpretation of dramatic works selected from the Hispanic literatures.

4223  
(l) **20th Century Hispanic Literature**, Prerequisite: one 3000-level Spanish course, or equivalent. Major 20th century Hispanic writers.

4253  
(H,I) **Masterpieces of Hispanic Literature I**, Prerequisite: one 3000-level Spanish course, or equivalent. Reading and analysis of classics selected from the Hispanic literatures.

4263  
(H) **Masterpieces of Hispanic Literature II**, Prerequisite: one 3000-level Spanish course, or equivalent. Reading and analysis of classics selected from the Hispanic literatures. A continuation of 4253.

4283  
(H) **Hispanic Civilization I**, Prerequisite: 2222 and 2223, or equivalent. Reading and discussion of selected texts outlining the development of contemporary Spanish civilization.

4333  
(H,I) **Hispanic Civilization II**, Prerequisite: 23 credit hours of Spanish or equivalent. Reading and discussion of selected texts outlining the development of contemporary Hispanic civilization outside the Iberian peninsula.

4550  
(l) **Seminar in Spanish**, 1-3 credits, maximum 9. Prerequisite: one 3000-level Spanish course, or equivalent. Readings and discussion of vital subjects in Spanish.

5101*  
**Advanced Hispanic Studies**, 1-3 credits, maximum 9. Lab TBA. Prerequisite: 22 hours of Spanish or graduate standing in foreign language.

Special Education (SPED)

3202  
**Education of Exceptional Learners**, Learning characteristics, needs and problems of educating the exceptional learner in the public schools. Implications of the learning, environmental and cultural characteristics; planning and program assistance available for accommodating the exceptional learner in regular and special education programs; observation of exceptional learners.
Assessment and Intervention for Exceptional Infants and Children-Birth to Age 6. Assessment techniques and intervention strategies appropriate for exceptional infants and young children. Basic theories of development and research supportive of various intervention strategies and assessment techniques.

Student Teaching in Special Education. 1-12 credits, maximum 12. Supervised teaching experience in the area of special education in which the student is preparing to qualify for a teaching certificate. Graded on a pass-fail basis.

Education of the Mentally Retarded. Education program needs and social-cultural environment of mentally retarded children, adolescents and adults.

Curriculum and Methods for Teaching Mentally Retarded Adolescents and Adults. Techniques for teaching the mentally retarded individual from adolescence through adulthood.

Techniques of Behavior Management and Counseling with Exceptional Individuals. Techniques to develop and evaluate programs of behavior change for exceptional students including counseling with the exceptional individual and conferencing with professionals and parents.

Characteristics of Students with Severe and Profound Disabilities. Educational, psychological and physiological characteristics of students with severe and profound disabilities.

Communication Strategies for Individuals with Severe and Profound Disabilities. Methods for communicating with severely or profoundly disabled persons and for facilitating their communication through speech, sign, assistive devices and technology.

Methods for Teaching Persons with Severe and Profound Disabilities. Instructural procedures and resources available for working with the severely or profoundly disabled learner.

Practicum with Exceptional Learners. 1-8 credits, maximum 8. Lab 1-8. Prerequisite: consent of instructor. Supervised individual and group experience with exceptional learners. The particular experience (learning disability, mental retardation, gifted, etc.) determined by the student's field of specialization.

Characteristics and Teaching Techniques for Individuals with Disabilities. Educational, psychological and physiological characteristics of individuals with mild and moderate disabilities. Professional roles of the teacher; current techniques, models and approaches used to teach, and their theoretical bases.

Behavior Characteristics of Exceptional Individuals. Individual differences and problems that exceptional individuals experience. Educational programs and resources available to assist administrators, teachers and parents in dealing with unique individual needs.

Counseling Parents of Exceptional Children. Aiding the classroom teacher and other professional personnel in the understanding of unique activities and interpersonal relations involved in counseling with parents of exceptional children.

Play Therapy in Special Education. Theories and practices of the principles of play therapy. The application of play therapy for special education children. Supervised clinical experience with children with emotional, social and psychological problems.

Developmental Language and Intervention Strategies for the Exceptional Individual. Normal language development and variations from norms demonstrated by exceptional learners. Assessment techniques and intervention strategies appropriate for exceptional infants and children; theoretical approaches to language training, formal and informal; assessment techniques, and techniques for exceptional individuals.

Techniques and Consultation Models for Teaching Individuals with Disabilities. Current techniques, models and approaches used to teach students with mild and moderate disabilities and the theoretical bases for these techniques and approaches. Professional roles of the teacher of students with mild and moderate disabilities including communication with other teachers.

Teaching Strategies for Students with Physical and Health Disabilities. Prerequisites: 5523 and graduate student standing. Design and implementation of educational programs, collaboration with families and other professionals, and advocacy for students with disabilities.

Curriculum Modifications for Exceptional Individuals. Materials and resources designed for use by teachers and other professionals, para-professionals and parents in working with exceptional individuals. Includes commercial and teacher-student-made materials.

Psycho-educational Testing of Exceptional Individuals. Intensive practice in the selection, administration and interpretation of individual tests, appropriate for exceptional individuals.

Characteristics of Interventions for Individuals with Emotional Behavioral Problems. Characteristics, identification, intervention instructional strategies, and resources available for working with learners with emotional and behavioral disorders. Exploration of a wide range of theoretical approaches.

Instructional Strategies and Resources for the Emotionally Disturbed Learner. Instructional procedures and resources available for working with the emotionally disturbed/behavior-disordered learner. A wide range of theoretical approaches explored.

Behavior Management and Affective Education. The utilization of various approaches to the management of individual and group behavior; affective education in a wide range of instructional settings.

Diversity in Special Education. Examination of the influence of ethnic, socioeconomic class, and gender factors on students with disabilities. "Ethnographic inquiry" through Service-Learning Field Placements for understanding cultural diversity and special education. Applied educational approaches.


Research Topics in Special Education. Prerequisites: REMS 6003, 6013. Classic and current significant research topics; review and reinforcement of professional inquiry skills in reading, utilizing, planning, conducting and reporting research in special education.

Legal Aspects in Special Education. Familiarization and analysis of legal rights and responsibilities of students, educators, and administrators in special education; federal and state mandates, case law and recent legal developments affecting special education.

Program Development in Special Education. Physical, social and psychological factors in communities such as power structure, economics, prejudice, religion, as well as national activities influential in establishing programs for the exceptional student.

Current Trends and Issues in Special Education. Current research and literature regarding the education of exceptional children.

Directed Reading. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Directed reading for students with advanced graduate standing.

Internship in Education. 1-8 credits, maximum 8. Lab 3-24. Directed off-campus experiences designed to relate ideas and concepts to problems encountered in the management of the school program.
4720 Practicum I. 1-2 credits, maximum 2. Prerequisite: speech communication major. Communication facilitation for the speech communication major, with student’s initial role as interventionist.


4733 (S)Elements of Persuasion. Principles and concepts of interpersonal and public persuasive encounters. The instrumental and interactive nature of persuasion. Designing and participating in actual persuasive campaigns.

4743 Advanced Public Speaking. The preparation and delivery of various types of public speeches.

4793* Communication in Interviews. General principles of interviewing. Specific guidelines for the interviewer in survey, journalistic, counseling, selection, appraisal, legal, medical, and sales interviews.

4010 Independent Study in Speech Communication. 1-3 credits, maximum 3. Prerequisite: consent of instructor. Supervised research projects in speech communication.

4703 Communication Theory. Survey of current theories and models dealing with symbolic and communicative behavior.

4710 Topics in Speech Communication. 1-3 credits, maximum 6. Selected current topics in speech communication.

4720 Practicum II. 1-3 credits, maximum 3. Prerequisite: consent of instructor. Individual research projects providing practical experience for advanced undergraduate students on and off campus.

4723* (H)History of Public Address. Analysis of speeches of selected American orators as artifacts and rhetorical responses. Content, structure and style of the speeches and the historical situations in which they were given.

4733 Legal Communication. Analysis and applications of oral communication and analytical skills required for effective performance in trial courts. Course culminates in a day-long mock trial.

4743* Problems of Interpersonal Speech Communication. Application of communication theory to interactions in person-to-person settings. Identification and management of barriers related to the concepts of perception, attraction, self-disclosure, listening and conflict.

4753* (I)Intercultural Communication. Social and cultural differences between individuals from diverse backgrounds as possible barriers to effective communication.

4763 Organizational Communication. The interface between communication theory and organizational structure. Nature of communication problems in organizations, strategies for overcoming such problems and the design of effective communication systems in organizational settings.
5320* Seminar in Student Development. 3-6 credits, maximum 6. Prerequisite: consent of instructor. In-depth exploration of contemporary problems of applied behavioral studies.

5333* Effective Leadership in Student Services. Prerequisite: 6173 or consent of instructor. The organization and management of student services operations in postsecondary institutions. Models for policy and decision making as well as leadership and supervision issues.

6000* Doctoral Dissertation. 1-25 credits, maximum 25. Prerequisite: consent of instructor. Required of all candidates for doctorate in applied behavioral studies. Credit given upon completion and acceptance of dissertation.

6173* Higher Education Student Personnel Administration. Develops an understanding of the history, philosophy, student life, critical issues and administration of student personnel work in higher education.

6213* Higher Education Student Personnel Services. Prerequisite: 6173 or consent of instructor. Higher education student personnel services such as: admissions, orientation, student activities, financial aids, housing and counseling.

6220* Internship in Higher Education Student Personnel. 2-6 credits, maximum 6. Prerequisite: 6213 or consent of instructor. Work and study opportunities under supervision in areas of student housing, student activities, financial aid, foreign student advisement, student personnel administration, student union, group facilitation and other appropriate work situations.

6850* Directed Reading. 1-6 credits, maximum 6. Prerequisite: consent of instructor. Directed reading for students with advanced graduate standing.

Technical and Industrial Education (TIED)

2000 Field Experience in Industrial Practice. 2-6 credits, maximum 16. Supervised work experience in student's proposed teaching area with special emphasis on occupational skill development. Written agreement between student, employer and department must be made prior to beginning of field experience program. Graded on a pass-fail basis.

3000 Trade and Industrial Occupational Experience. 1-24 credits, maximum 24. Credit to be determined by a special skill competency examination.

3203 Foundations and Services of Technical and Industrial Education. Opportunities provided by technical and industrial education, with special emphasis on trade and industrial education and its relationship to other elements of the educational system. Legislative aspects of technical and industrial education, general education, student guidance, and programs for students with special needs.

3900 Seminar in Professional Education. 1-3 credits, maximum 3. Procedures for completing certification and portfolio requirements, and gaining admission to Professional Education and student teaching. Documentation of field experiences, professional development opportunities and observations of at least 45 clock hours of master teachers in various school settings. Graded on a pass-fail basis.

4010* Technical and Industrial Education Workshop. 1-3 credits, maximum 6. Professional work in small groups on various topics and lengths. Focus on a particular topic from such areas as the development, use and evaluation of instructional methods and materials.

4103* Instructional Procedures in Technical and Industrial Education. Methods and techniques for effective teaching and learning in the technical and industrial classroom and laboratory. The use of instructional aids and competency development.

4110* Trade Technical Information. 1-6 credits, maximum 6. New developments in scientific and technical information and knowledge that are relevant to current trade practices.

4113 Technical and Industrial Education in American Society. Characteristics of technical and industrial education and its development; role and function in a changing American society. Economic and sociological considerations of technical and industrial-oriented programs. Exploration of the interaction of technical and industrial and academic subject strategies for teaching multicultural and special needs in technical and industrial, and adult education.

4123* Coordinating Career and Technical Student Organizations and Activities. Student organizations and activities in career and technical education at local, state and national levels. Procedures for planning programs of work, incorporation of student organization activities into curriculum, adviser characteristics and responsibilities, fund-raising activities, and techniques for recognizing outstanding members and community supporters.

4213* Safety, Organization and Management of Learning Facilities. Techniques and procedures for organizing and managing shop and laboratory facilities and learner activities to enhance the quality of instruction and improve efficiency of equipment and space utilization including all safety rules and procedures.

4223 Program Planning and Development in Career and Technical Education. Planning and designing programs for the development of human resources. Program goals and objectives, curriculum, facilities, teaching-learning theories, materials development, program resources and program and instructional evaluation.

4313 Computers and Multimedia for Workplace Education. Lab 2. Overview of micro-computer applications in technical and industrial education and its relationship to other elements of the educational system. Legislative aspects of technical and industrial education, general education, student guidance, and programs for students with special needs.

4333 International Technical Education. Comparison and analysis of international occupational education.

4343* Occupational Analysis and Curriculum Development. Analysis of occupational job analysis and development of course objectives; course outlines, and specific instructional materials for occupational and technical courses.

4470 Teaching Practicum in Technical and Industrial Education. 1-12 credits, maximum 12. Prerequisite: full admission to Professional Education. Organized teaching experiences under the guidance and direction of a local school cooperating teacher and university teacher educator. Participant assigned to a cooperating teacher with responsibility for planning, implementing and evaluating the classroom, laboratory or shop. Graded on a pass-fail basis.

4773 Practices and Problems of School-to-Work Transition Programs. Problems of school-to-work transition and examination of practices designed to improve it. Planning, organizing and developing strategies to implement and evaluate school related work-based learning.

4883* Practices and Problems in Integrating Academic and Vocational Education. Prerequisite: 4103* development of course objectives. Experiences in learning, designing, and practicing strategies that technical and industrial teachers can use to integrate academic competencies into their particular curricula. Design and presentation of cognitive psycho-motor and affective occupational lessons that integrate math, social studies, science and/or English-related competencies.

5122* Evaluation of Programs and Instruction in OCED. Philosophes, principles and techniques of evaluation and strategies for applying them in planning, managing and improving occupational education programs. Designing, conducting, and reporting evaluations of OCED programs and instruction.

Telecommunications Management (TCOM)

3203 Telecommunications Industry Foundations. Prerequisite: consent of instructor. Emerging trends in the telecommunications industry. Past events, regulatory and legal implications, strategic direction of organizations with respect to telecommunications.

3223 Network Design Principles. Prerequisite: MSIS 3223. Management science principles applied to telecommunications network design. Specific topics will include mathematical programming, network models, simulation, and queueing theory.
5012* Telecommunications Laboratory. Prerequisite: ECEN 5553, TCOM 5123 or co-requisite. Familiarization with the hardware used to move voice, data and video traffic. Data network experiments include set up and operation of a small LAN, interconnection of these LANs via bridges or routers, overview of voice and video modules to the LANs. Telephone network experiments include installation of small PBXs and interconnection of them to the campus phone system, and interconnection of the PBXs with crosspoint switches and fiber. Video experiments include interconnection and operation of a small two-camera studio, and digitizing and transferring the video over the laboratory telephone system. Practical operating aspects and standards of distance transmission devices, switching equipment for transmitting data, voice and video signals. Handling problems within selected environments.

5113* Industry Overview and Telecommunications Applications. Prerequisites: graduate standing and consent of program director. Overview of telecommunications industry, technology, regulatory environment, and current topics in telephone services (wireless and wireline), business data services, CATV, and Internet services and providers (including JAVA and HTML). Managerial and strategic aspects of telecommunications technologies. Guest speakers from the telecommunications industry.

5123* Telecommunications Systems II. Prerequisites: ECEN 5553 and consent of program director. Applied technical coverage of selected topics from the upper layers of the OSI model. Network and Transport layers using, TCP/IP, IPX/SPX, and Netbeui as well as security issues and other multi-layer protocol suites. Flow control, RSVP, encryption, compression, and LAN/WAN applications.

5143* Telecommunications Systems Analysis, Planning and Design I. Prerequisites: ECEN 5553 and consent of program director. The fundamentals behind systems analysis and design of telecommunication systems from a managerial perspective. Financial analysis of telecommunication projects, fundamentals of mathematical modeling and queuing theory, and other management tools that are key to the design and analysis of telecommunication networks.

5153* International Telecommunications Management. Prerequisites: graduate standing and consent of program director. Investigation of the institutions that affect the use of telecommunications. The various parts of the federal government involved, such as the Department of Commerce, the FCC and the Department of State. The role of international institutions, including the ITU, UNESCO, and the various satellite organizations such as INTELSAT.

5163* Telecommunications Practicum. Lab 3. Prerequisites: graduate standing and consent of program director. Application of knowledge and skills developed in core courses in an organizational environment to solve telecommunications management problems. Integration of concepts and adaptation of theory to fit organizational reality.

5173* Global Telecommunications Regulation. Historical review of the classical “FTT (Post, Telephone and Telegraph) Model”, and the development of new competitive environments. Overview of international telecommunications networks and how they are regulated nationally and internationally. Review of the World Trade Organization (WTO) and the telecommunications commitments made by members. Emphasis on the European Union as the largest single telecommunications market, along with analyses of regional emerging markets. Review of challenges for the future for both regulatory agencies and telecommunications operators and providers.

5213* Telecommunications Systems Analysis, Planning and Design II. Prerequisites: 5143, ECEN 5553, and consent of program director. The fundamentals behind systems analysis and design of telecommunications systems from an engineering perspective. Advanced mathematical modeling and queuing theory, graph theory, network design algorithms and other tools that are key to the design and analysis of telecommunication networks. An in-depth, technical and quantitative follow-up to TCOM 5143.

5223* Information Assurance Management. A broad investigation of the elements of information assurance and security with an emphasis on the management impact to corporations and businesses engaged in information services and electronic commerce. Students should come away from the course with the ability to advise management on the risks and mitigation for all types of threats to information and privacy.

5233* Applied Information Systems Security. Prerequisite 5123. An investigation into the various technical aspects of attacking, and of guarding against attacks and failures in various types of information systems. Course content may vary but will generally include computer, network, and data protection technologies (e.g., firewalls, packet filters, proxy servers, user authentication and validation techniques, encryption, backup methodologies, system and component redundancies, etc.). Various threats and attack methods will be examined.

5310* Advanced Topics in Telecommunications Management. 3 credits, maximum 3. Prerequisites: graduate standing and consent of program director. Advanced topics in the interdisciplinary field of telecommunications management, such as legal and regulatory issues, electronic commerce, internet and intranet development.

5350* Advanced Telecommunications Management Lab. 2-3 credits, maximum 3. Lab 2-3. Prerequisites: 5012 and consent of program director. Advanced state-of-the-art topics in voice, data and video. Hands-on network experiments beyond coverage in the required TCOM 5012 lab.

5990* Directed Studies in Telecommunications Management. 1-6 credits, maximum 5. Prerequisites: graduate standing and consent of program director. Special advanced topics, projects and independent study in telecommunications management.

1322 Acting I. Lab 3. Ensemble techniques and creative improvisation; vocal and physical development for the actor: theories and techniques of acting; fundamental scene and character analysis; scene performance workshops.

1332 Voice and Movement I. Techniques and exercises to build the actor’s awareness and ability to use the vocal and physical instruments on stage. Alignment, breathing, centers essence, tempo-rhythm, and movement patterns. Freeing and natural voice, resonance and range, and articulation.

1500 Theater Practicum. 1 credit, maximum 6. Lab 2. Laboratory experience in theater production, acting and crew assignments. Graded on a pass-fail basis.


2322 Acting II. Lab 4. Prerequisite: 1322. Continuation and refinement of 1322. Textual and character analyses, characterization and inner techniques. Audition techniques and realistic comedy through scene work with contemporary plays.


2413 [H]Introduction to the Theater. Character, plot, thematic, historical and production analyses of various types of play scripts: understanding the work of various theater artists; developing appreciative audiences.

2533 Oral Interpretation. Reading aloud effectively; training in voice improvement, platform techniques, selection criteria and audience analysis.

2553 Introduction to Stage Design. Lab 2. Prerequisites: 2663, 2673 or consent of instructor. An integrated overview of the theory and practice of design for the stage.

3223 [H]Theater History III. Aesthetic and social relationships of theater and western civilization from 1900 to the present.

3373 Acting III. Prerequisites: 3222. Continuation and refinement of 2322. Performance techniques in classic to modern styles. Shakespeare to Miller.

3383 BFA Acting Studio I. Lab 2. Prerequisites: 3373 and admission to Bachelor of Fine Arts program. In-depth acting study for BFA candidates. Special emphasis on performing classic and poetic realism.
Theatrical Dance: Jazz I
Lab 4. Jazz dance techniques for theatrical performance emphasizing body alignment, coordination, flexibility, rhythm and jazz dance vocabulary in simple dance combinations. Artistic development of dance performers.

Teatrical Dance: Jazz II
Lab 4. Required, or consent of instructor. Techniques for theatrical performance at the intermediate level emphasizing stamina, control, speed, and dynamics. Artistic development of dance performers.

Teatrical Dance: Tap I

Teatrical Dance: Tap II
Lab 4. Tap dance techniques for theatrical performance at the intermediate level emphasizing stamina, control, speed, and dynamics. Artistic development of dance performers.

Stage Movement for Actors
Techniques and exercises to build the actor’s awareness and abilities for use of the bodily instrument on stage; preparation and readiness routines; rhythms, postures, and movement patterns appropriate to various styles of theater and to specific character roles.

(H)History of Costume and Decor for the Stage
Comprehensive history of theatrical costume and interior decor from ancient Egypt to the present.

Dramatic Literature and Analysis
Survey of critical approaches to dramatic literature focusing on the transfer of literature to live theatrical production and performance.

(H)Theater History I
Aesthetic and social relationships of theater and western civilization from Ancient Greece to the Italian Renaissance.

(H)Theater History II
Aesthetic and social relationships of theater and western civilization from the Italian Renaissance through the 20th century.

Stage Makeup
Lab 2. Techniques of basic stage makeup. Application of makeup including a study of facial anatomy and character development. Laboratory work in preparation for departmental productions.

Scene Design for Theater and Television
The designer’s approach to the script; execution of sketches, models and working drawings.

Sound Design and Technology
Prerequisites: 2553, 2663. Use and design of sound in theatrical productions, including voice reinforcement, scoring, script analysis and effects.

BFA Acting Studio II
Lab 2. Prerequisites: 3383 and admission to Bachelor of Fine Arts program. In-depth acting study for BFA candidates. Special emphasis on performing physical comedy and related styles.

BFA Acting Studio III
Lab 2. Prerequisites: 4363 and admission to Bachelor of Fine Arts program. In-depth acting study for BFA candidates. Special emphasis on performing restoration, comedy of manners and other dramatic literature which requires heightened performance style.

Stage Combat
Lab 3. Prerequisites: 2332, 3373. Safe and effective techniques for portraying theatrical representations of stage violence; melding technical aspects of stage combat with developing use of the actor’s craft.

Stage Dialects
Lab 4. Prerequisites: 1332, 2332. Development of techniques for learning and speaking dialects commonly required in theatrical productions, as well as an application of these dialects.

Senior Honors Project
Prerequisites: departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors thesis or performance under the direction of a faculty member, with second faculty committee member. Required for graduation with departmental honors in theater.

Lighting for Theater and Television
Lab 2. Stage lighting design, elementary electricity, design of lighting instruments. Practical experience in lighting in preparing and running departmental productions.

Advanced Stage Mechanics
Lab 2. Prerequisite: 1664. Advanced study in theatrical stage mechanics and production techniques including special steel fabrication, automated scenery, and structural support systems.

Scenographic Techniques
Lab 2. Prerequisites: 2553, 2663, 2673. Development of computer and hand drafting techniques specific to the design, planning, and execution of stage scenery, lighting, and sound. Emphasis will be placed on USITT graphic standards.

Seminar in Advanced Costume Construction
Lab 2. Prerequisites: 2673 and 4123. Sewing and craft techniques for the construction of period costumes. Boned garments, fabric manipulation and millinery.

Costume and Prop Crafts
Lab 2. Prerequisites: 2663, 2673. Use of advanced materials and techniques in the fabrication of specialized stage and costume props.

Stage Management
Prerequisite: consent of instructor. Procedures and skills of effective stage management. Authoritative coordination of performers and technicians during rehearsal and performance periods. Maintenance and use of the production prompt book, notation of ground plan and blocking; scenic changes; cues for lighting, sound, special effects, and performers; opening and calling the show; post-show wrap-up. Practical experience in stage managing student directed scenes.

Directing
Prerequisite: 2543. Play analysis for production, problems in staging, and the role of the director. Planning and direction of scenes in laboratory situations.

Theater Graphic Techniques
Fundamental theater graphic techniques to communicate theatrical design ideas.

Stage Costume Design
Lab 4. Approaches to basic costume design including research, conceptual analysis, figure drawing, and executions of sketches and renderings.

Scene Painting
Lab 3. Elementary techniques of scene painting. Individual projects in large scale in representing marble, rock to landscape, interiors. Color theory, forced perspective, ability to paint different styles. Practical experience preparing for departmental productions.

BFA Jury
Lab 1. Prerequisite: consent of the department. Portfolio and audition technique development and review. Required for all BFA candidates.

Masters Thesis and Research
1-6 credits, maximum 6. Prerequisite: consent of department head. Masters level research in theater for thesis option graduate students.

Theater Research Methods
Diverse methods of theater research appropriate to performance, design and technology, and history and theory. Developing familiarity with standard references and journals of the field, and introduction to professional organizations.

Scenography
Prerequisites: proven experience in scenery, lighting or costume design and consent of instructor. Scenographic design processes for the advanced theatrical design student. Investigation of design styles and theories and the designers whose works advanced these theories; practical application of designing scenery, lighting and costumes.

Script Analysis
Analytical and interpretive techniques in studying play scripts for theatrical production. Emphasis on writing skills appropriate to script analysis.

Problems in Advanced Acting
Prerequisites: 4143 and graduate standing or consent of instructor. Experimentation in psychological realism. Concentration on analysis, technical skills, and contacting the emotions. Special preparations for professional interviews and auditions.

Problems in Advanced Acting II
Lab 3. Prerequisite: 5243. In-depth exploration of three theatrical acting styles. Scene study, monologue study, lecture, discussion, reading and various in-class exercises. Utilizing language in these plays and creating a physical life reflective of the character’s social customs and values.
Veterinary Biomedical Sciences (VBSC)

5000* 
Masters Research and Thesis. 1-6 credits, maximum 6. Prerequisite: graduate standing. Research problem for meeting requirements of the Masters degree.

5101* 
Current Topics in Veterinary Biomedical Sciences. 1-3 credits, maximum 3. Prerequisite: graduate standing in Veterinary Biomedical Sciences program. Overview of the biomedic- research enterprise. Fundamentals of research administration, obtaining grant fund- ing, publication, and ethics in biomedical re- search. Understanding the basics of a successful career in biomedical research. Development of writing, speaking and critical thinking skills. Professional development.

5110* 
Special Problems. 1-6 credits, maximum 20. Prerequisites: graduate standing and consent of instructor. Special research problems in the various fields of veterinary biomedical sciences.

5120* 
Current Topics in Veterinary and Biomedical Sciences. 1-3 credits, maximum 4. Prerequisite: a minimum of one undergraduate in- troductory course in microbiology. Development of oral presentation skills, critical thinking and deductive reasoning through the use of dis- cussion of current literature from the field of veterinary and biomedical science as it per- tains to the study of infectious disease in hu- mans and animals.

5210* 
Diseases and Parasites of Wild Animals. Lab 1. Prerequisite: consent of instructor. A system- atic approach to bacterial, viral and parasitic disease of wild animals. Principles of disease transmission as it relates to individuals and populations of wild animals. Principles applicable to all areas of zoology, veterinary medi- cine and wildlife management.

5401* 
Techniques in Parasitology. Lab 1. Prerequi- site: graduate standing and general parasitol- ogy; helminthology or concurrent enrollment. Experimental application of basic research and teaching techniques in helminthology and par- tozoology. Individual participation and analysis of experimental situations and techniques ap- plicable to all areas of zoology.

5500* 
Bacterial Pathogenesis. Prerequisites: under- graduate course in microbiology and consent of instructor. Survey of pathogenic mechanisms of bacteria and host response covering historic prospective; genetic organization of virulence; regulation of virulence factors; attachment, adhesion, an invasion; capsules and outer membrane proteins; intracellular parasitism; endotoxin; exotoxins; iron acquisition and host sequestration; antibiotic resistance mechanisms; innate immunity; acquired immunity; and eva- nation of host immunity. Lecture and discussion of directed reading of classic and current litera- ture.

5610* 
Biological Parasites. Prerequisites: gradu- ate standing, general parasitology, or consent of instructor. A systematic and eco- logical approach to the study of parasitology. Host-paras- ite relationships, physiology, ecology and be- havioral aspects of parasitic organisms.

5723* 
Parasitic Protozoa. Lab 3. Prerequisite: gradu- ate standing in zoology or entomology or con- sent of instructor. Structure, life cycle, physiol- ogy, host-parasite relationships, and diagnosis concerned with protozoan parasites.

6000* 
PhD Research and Thesis. 1-15 credits, maximum 45. Prerequisite: graduate standing. Re- search problem for meeting requirements of the Ph.D. degree.

6110* 
Seminar. 1-6 credits, maximum 6. Prerequisite: graduate standing. Literature and research prob- lems pertaining to veterinary biomedical sci- ences.

6120* 
Advanced Physiology of Selected Sys- tems. 2-10 credits, maximum 10. Prerequisite: graduate standing or consent of instructor. Advanced studies in gastrointestinal, cardio- vascular, respiratory, excretory and neuroen- docrine physiology. Each part of this sequen- tial course may be taken for two hours credit. Student should ascertain the topics before reg- istering for this course a second time.

6200* 
Topics in Advanced Pharmacology and Toxicology. 1-4 credits, maximum 4. Prerequi- site: consent of instructor. Selected topics in advanced pharmacology, including xenobiotic kinetics and dynamics.

6203* 
Advanced Concepts in Veterinary Immunol- ogy. Prerequisite: 5113 or BIOG 3653 or MIRC 3254. Induction of immune responses, host defense mechanisms, immunoregulation, anti- gen presentation and immune recognition by B and T lymphocytes, using contemporary re- search publications.

6210* 
Advanced Toxicology. 1-3 credits, maximum 3. Prerequisites: graduate standing, consent of instructor. An integrated systems-based ap- proach to toxicology from molecular, cellular, organ, organismal and ecological perspectives.

6233* 
Laboratory in Electron Microscopy. Lab 12. Prerequisite: consent of instructor. Student learns to prepare specimens for, and to oper- ate, the electron microscope, and techniques for printing and preparation of electron micro- graphs for publication.

6410* 
Endocrine Control of Fuel Metabolism. 1-5 cred- its, maximum 5. Lab 0-2. Prerequisite: consent of instructor. Emphasis on cellular and molecular aspects of hormone action in target tissues as basis for understanding endocrine regul- ation of organ and whole body metabolism. Spec- ial reference to endocrine pancreas regula- tion of ketone, carbohydrate (glucose) and lipid (FFA) metabolism in pregnancy, lactation, fasting, obesity and diabetes. Content ap- plicable to health and disease in humans and domestic animals. Course offered in spring sem- ester of alternate years.

6550* 
Problems in Functional Morphology. 1-3 credits, maximum 12. Lab 3-9. Prerequisite: consent of instructor. Investigations in compar- ative, gross, developmental or histologic mor- phology for graduate students.

6560* 
Advanced Pathology Techniques and Special Problems. 1-6 credits, maximum 20. Prerequisites: graduate standing in biological sciences and consent of instructor. Investiga- tions of contemporary techniques and meth- ods used in diagnosis, technical work and re- search in pathology.
Required to choose four electives. Two of those electives on-campus. Two electives may be off-campus.

Elective II. Prerequisite: fourth-year standing in the College of Veterinary Medicine. Students required to choose four electives. Two of those electives on-campus. Two electives may be off-campus.

Elective III. Prerequisite: fourth-year standing in the College of Veterinary Medicine. Students required to choose four electives. Two of those electives on-campus. Two electives may be off-campus.

Elective IV. Prerequisite: fourth-year standing in the College of Veterinary Medicine. Students required to choose four electives. Two of those electives on-campus. Two electives may be off-campus.

Food Animal Medicine Clinic. Prerequisite: fourth-year standing in the College of Veterinary Medicine. Diagnosis, prognosis, treatment and prevention of diseases of food animal medical and surgical diseases.

Equine Surgery Clinic. Prerequisite: fourth-year standing in the College of Veterinary Medicine. Diagnosis, prognosis, treatment and prevention of equine surgical diseases.

Clinical Pool. Prerequisite: fourth-year standing in the College of Veterinary Medicine. Semi-elective clinical assignment. Graded on a pass-fail basis.

Veterinary Medicine (VMED)

Animal Disease Control and Prevention. Prerequisite: junior standing in the College of Agriculture. Principles of sanitation and of prevention and control of common diseases of livestock and other animals.

Veterinary Physiology I 3-6 credits, maximum 6. Lab 15. Prerequisite: first-year standing in the College of Veterinary Medicine or consent of instructor. Molecular, cellular and organ system physiology. Establishing a base of knowledge and understanding requisite to subsequent courses.

Veterinary Physiology II 3-6 credits, maximum 6. Lab 15. Prerequisite: first-year standing in the College of Veterinary Medicine or consent of instructor. Molecular, cellular and organ system physiology. Establishing a base of knowledge and understanding requisite to subsequent courses.

Veterinary Histology. Lab 45. Prerequisite: first-year standing in the College of Veterinary Medicine or consent of instructor. Organization and structure of cells and tissues of domestic animals.

Gross and Developmental Anatomy. Prerequisite: first-year standing in the College of Veterinary Medicine or consent of instructor. Introduction to veterinary jurisprudence, ethics, licensing, government regulations, human-animal bond, and evolving issues in animal law and animal welfare.
7652*  Avian and Exotic Pet Medicine. Lab 6. Prerequisite: second or third-year standing in the College of Veterinary Medicine. Clinical diagnosis, management and treatment, prognosis, and prevention of diseases in avian and exotic pets. Introductory material provided to familiarize students with the species discussed and where clinically important; however, student understanding of the basic sciences required and assumed.

7563*  Musculoskeletal System. Lab 9. Prerequisite: third-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, pathology, medical and surgical treatment, and prevention of diseases related primarily to the musculoskeletal system.

7564*  Alimentary System. Lab 12. Prerequisite: third-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, pathology, medical and surgical treatment, and prevention of diseases related primarily to the alimentary system.

7571*  Introduction to Behavioral Medicine. Prerequisite: third-year standing in the College of Veterinary Medicine. Introduction to behavioral veterinary medicine. Normal behaviors of the dog and cat, basic procedures and methods for diagnosing and treating behavioral problems.

7583*  Dermatology and Endocrinology. Prerequisite: third-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, pathology, medical and surgical treatment, and prevention of diseases related primarily to skin and the endocrine system (nine-week module).

7610*  Basic Science Elective. 1-8 credits, maximum 8. Prerequisite: second or third-year standing in the College of Veterinary Medicine. Problems in the basic sciences taught as lecture or lab.

7611*  Applied Pharmacology. Lab 7. Prerequisite: second- or third-year standing in College of Veterinary Medicine. Criteria applicable to the rational selection of pharmacological agents used in the diagnosis and treatment of diseases. Adverse reactions and interactions that may complicate therapy, and issues relevant to the ethical use of drugs and avoidance of residues in food products.

7614*  Cardiothoracic System. Lab 24. Prerequisite: third-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, pathology, medical and surgical treatment, and prevention of diseases related primarily to the cardiovascular and respiratory systems.

7620*  Clinical Science Elective. 1-8 credits, maximum 8. Prerequisite: second- or third-year standing in the College of Veterinary Medicine. Problems in the clinical sciences taught as lecture or lab.

7622*  Problem Solving in Internal Medicine. Prerequisite: second-or-third-year standing in the College of Veterinary Medicine. History of the veterinary medical profession, especially in North America.

7632*  Exercise Physiology. Prerequisite: second-or-third-year standing in the College of Veterinary Medicine. Current knowledge base pertaining to the acute and chronic adaptations to exercise in domestic animals and current techniques for the evaluation and correction of poor performance.

7652*  Clinical Techniques II. Lab 120. Prerequisite: third-year standing in the College of Veterinary Medicine. Rotations through instructional and service areas including the Veterinary Teaching Hospital of the College of Veterinary Medicine. Graded on a pass-fail basis.

7653*  Neurology and Ophthalmology. Lab 11. Prerequisite: third-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, pathology, medical and surgical treatment, and prevention of diseases related primarily to the nervous system and the eye, (4 week module).

7661*  Infectious and Parasitic Diseases of Wild Animals. Lab 11. Prerequisite: second- or third-year standing in the College of Veterinary Medicine. Infectious and parasitic diseases affecting wild animals. Capture, restraint, and disease recognition in wild species, population management implications of disease diagnosis.

7662*  Urinary System. Prerequisite: third-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, pathology, medical and surgical treatment, and prevention of diseases related primarily to the urinary system (2.5 week module).

7672*  Swine Production and Diseases. Prerequisite: second or third-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, pathology, medical and surgical treatment, and prevention of diseases related primarily to swine production systems.

7674*  Theriogenology. Prerequisite: third-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, pathology, medical and surgical treatment, and prevention of diseases related primarily to the reproductive system.

7682*  Small Ruminant Production, Management, Medicine and Surgery. Prerequisite: second or third-year standing in the College of Veterinary Medicine. Production, management, medical and surgical diseases of sheep, goats, and llamas used for production and companion animals.

7701*  Small Animal Diagnostic Ultrasound. Lab 10. Prerequisite: second- or third-year standing in the College of Veterinary Medicine. An introduction to diagnostic ultrasonography, basic physics of ultrasound production, transmission in tissues, image formation and common artifacts. Recognition of normal organs, organ dysfunction, and common diseases that can be diagnosed sonographically in small animals.

7731*  Advanced Small Animal Medicine I: Problem-based Learning. Prerequisite: third-year standing in the College of Veterinary Medicine. Case-based problem-oriented clinical diagnosis, management, treatment, and prevention of internal medicine diseases common to small animals. Small group format will meet one hour per week at a time determined by the individual groups.

7732*  Advanced Medical and Surgical Oncology. Lab 7. Prerequisite: third-year standing in the College of Veterinary Medicine. Investigates cancer as the leading cause of death among dogs and cats. Diagnosis, staging and treatment of common malignancies in veterinary medicine. A systematic approach to the cancer patient, while dispelling common misconceptions about cancer treatment and prognosis. Emphasis on fundamental skills, such as diagnostic evaluation of the cancer patient, principles of oncologic surgery, and critical evaluation of journal articles. Safe chemotherapy drug handling and biopsy techniques will be learned in a laboratory setting.

7741*  Bovine Palpation Laboratory. Lab 27. Prerequisite: third-year standing in the College of Veterinary Medicine. Palpation techniques in cows. An elective restricted to students entering food animal practice.

7751*  Poultry Medicine and Diseases. Prerequisite: third-year standing in the College of Veterinary Medicine. Poultry medicine and common diseases of poultry. Skills and background will be based on clinical signs and lesions. Disease prevention and treatment. Application of diagnostic techniques through problem oriented case studies.

7752*  Applied Bovine Nutrition. Lab 14. Prerequisite: third-year standing in the College of Veterinary Medicine. Applied nutrition of beef and dairy cows. Restricted to students that wish to enter food animal practice.

7771*  Advanced Equine Medicine I. Lab 3. Prerequisite: third-year standing in the College of Veterinary Medicine. An in-depth study of topics pertinent to equine practice. Supplemental information presented in core sources and critical analysis of current literature, pathophysiological concepts and case management issues.

7801*  Business Management for Veterinary Practice. Prerequisite: third-year standing in the College of Veterinary Medicine. VME 5521 recommended. Skills and background are essential in the business of veterinary practice. Business and financial management of private veterinary practices.

7811*  Advanced Equine Medicine II. Lab 3. Prerequisite: third-year standing in the College of Veterinary Medicine. A continuation of 7771 presenting in-depth study of topics pertinent to equine practice. Supplemental information presented in core sources and critical analysis of current literature, pathophysiological concepts and case management issues.

7821*  Equine Radiology. Lab 12. Prerequisite: third-year standing in the College of Veterinary Medicine. Diagnostic imaging (radiology, nuclear scintigraphy and ultrasound) of horses.

7822*  Food Animal Production Medicine. Prerequisite: third-year standing in the College of Veterinary Medicine. Production animal agriculture and the veterinarian's present ad future role in these enterprises. Cattle production is emphasized, cycles of production, economics and health programs will be discussed. For students intending to enter mixed animal or exclusive food animal practices.
Zoology (ZOOL)

1011 Professions in Natural Resources. An examination of the professions of the ecology and management of natural resources. Exploration of academic and career options. Graded on a pass-fail basis. Same course as RLEM 1011.

1604 (N) Animal Biology. Lab 2. Prerequisite: BIOL 1114. Morphology, physiology, ecology, embryological development behavior, life histories and importance to man of representatives of major groups. Evolution of systems and mechanisms which have allowed animals to survive and adapt to diverse habitats.

2104 Human Anatomy. Lab 3. Prerequisite: ZOOL 1604. Gross anatomy of the human body and its systems based on comparisons with nonhuman mammals dissected in the laboratory. Minor emphasis on embryology and histology.

3104 Invertebrate Zoology. Lab 4. Prerequisite: ZOOL 1604. Morphology, physiology, reproduction and ecology of major invertebrate groups.

3113 (N) Human Evolution. An evolutionary perspective on human biology. No credit for students with prior credit in 3133.

3115 Vertebrate Morphology. Lab 6. Prerequisite: ZOOL 1604. Comparative gross anatomy of representative vertebrates with consideration given to embryology, histology and evolution.

3123 (N) Human Heredity. The impact of genetics on human endeavor. No credit for students with prior credit in BIOL 3024.

3133 Evolution. Prerequisite: 3123 or BIOL 3024. Development of the evolutionary concept: specialization, evolutionary mechanisms and phylogenetic concepts.

3143 Oceanography. Prerequisite: CHEM 1225. Ocean basins, geology, chemistry, biology, waves, tides, ocean exploration, ocean communities, and resources.

3153 (N) Animal Behavior. Prerequisite: junior standing. Survey of theory and application in basic and applied animal behavior. Interdisciplinary analysis of animal behavior in the field, captive settings and laboratories.

3204 Physiology. Lab 2. Prerequisites: BIOL 1114; CHEM 1215 or 1314. Anatomy and function of the human body. Human and domestic animal physiology considered in laboratories. No credit for students with prior credit in 4215.


3502 Wildlife Law Enforcement. Prerequisite: junior standing and consent of instructor. Survey of state and federal wildlife laws with emphasis on Oklahoma statutory and regulatory laws pertaining to wildlife. Lectures, guest lectures, video- tapes, and field exercises.

3513 Principles of Conservation Biology. Prerequisites: 60 credit hours including BIOL 3034. Application of ecological principles to the maintenance and restoration of biological diversity at genetic, population, and community levels.

3700 Readings and Special Studies in Zoology, 1-3 credits maximum. 6. Prerequisites: ZOOL 1604 and consent of instructor. Discussion of selected readings.
4264* Cell Physiology. Lab 3. Prerequisites: BIOC 3653 or CLML 3014. Cellular activities and fundamental physiological processes. Same course as CLML 4264.

4273 Comparative Physiology. Prerequisite: 3204 or 4215. Comparative, environmental and ecological physiology of nonhuman animals, with emphasis on vertebrates. Thermoregulation, osmoregulation, comparative aspects of respiratory, circulatory, digestive, muscle, and sensory physiology, and adaptations to extreme environments. Same course as 5273.

4283* Endocrinology. Prerequisites: 3204 or 4215, and CHEM 3015 or consent of instructor. Examination of the hormonal control and regulation of physiological processes in vertebrates. Function of the hypothalamus, pituitary, adrenal, thyroid, pancreas, ovary and testes; comparative endocrinology.

4303* Environmental Toxicology. Prerequisites: BIOC 1114 or equivalent; CHEM 1215 or 1314; junior standing. Introduction to the basic theories, principles, and techniques of environmental toxicology; comparative study of the groups of toxicants (e.g., heavy metals, PCB’s, pesticides) and discussion of the environmental problems created by these chemicals and their implications for survival of populations (including humans) on earth.

4403* Wetland Ecology and Management. Lab 3. Prerequisites: 3513 or BIOL 3034, or FOR 3213, or RLEM 4954 or consent of instructor. Ecology, classification, restoration, and management of wetlands. Adaptations of wetland plants and animals, structure and function of wetlands, field identification of wetland plants, restoration techniques, wetland classification systems, management and conservation of wetlands, and regulatory processes.

4414* Fisheries Management. Lab 4. Prerequisites: BIOC 3034. Techniques and principles involved in management of fishes. Field trip fee required.

4434* Limnology. Lab 3. Prerequisite: BIOL 3034. Physical, chemical and biological factors in lakes and streams.

4513* Wildlife Management. Prerequisite: BIOL 3034 or FOR 3213. Biological basis for the management of wildlife populations and habitats, with emphasis on current management problems.

4523 Wildlife Management Techniques. Lab 3. Prerequisite: 4513, ENGL 3323 strongly recommended. Research techniques and methodology in wildlife science. Experimental design, wildlife population and habitat analysis, wildlife and vegetation sampling techniques, aging and sexing techniques, and report preparation and presentation.

4533* Zoo Biology and Management. Prerequisite: hours of zoology or biology. Conservation and propagation of endangered species, animal acquisition and transport, restraint, sanitation and animal health, exhibit planning and design, public relations, administration and research. Lectures by professional zoo staff members. Extension course taught at the Oklahoma City and Tulsa zoos.

4700 Undergraduate Research Problems. 1-4 credits. Prerequisite: consent of instructor. Participation in faculty research or execution of a problem formulated by the student.

4710 Internships in Zoology. Prerequisites: 2.50 GPA and consent of department head. Zoology related experiences in professional work settings. Graded on a pass/fail basis.

4720 Zoo Careers Internship. 1-3 credits, maximum 3. Prerequisite: 4533. Hands-on career experience working under the direction of zoo professionals.

4750 Honors Study in Zoology. 1-5 credits, maximum 5. Prerequisite: Honors Program participation. Individual study in the development of zoological concepts. Extensive reading, literature search and special experimentation. An individual problems course for the gifted student.

5000* Research for Master’s Thesis. 1-6 credits, maximum 6. Independent research for the M.S. thesis under the supervision of graduate faculty member.

5010* Graduate Seminar. 1-3 credits, maximum 10. Discussion of selected topics.

5020* Special Problems. 1-4 credits, maximum 10. Prerequisites: graduate standing and consent of instructor. A report of results obtained is to be placed in department files.

5030* Teaching Zooology. 1-4 credits, maximum 4. Prerequisites: consent of instructor. Supervised teaching in the department laboratories. Attendance at seminar on problems involved in teaching zoology in college.

5112 Advanced Herpetology. Selected advanced aspects of evolution, systematics, biogeography, natural history, physiology, behavior, and population biology of reptiles and amphibians as drawn from the primary literature.

5113* Conservation Genetics. Prerequisite: course in genetics strongly recommended. Theory and principles of population genetics as they pertain to issues in conservation biology. Evolutionary relationships, hybridization, natural selection, factors affecting small populations, gene flow, captive populations, META populations, and data analysis. No credit for students with credit in 4113.

5123* Behavioral Ecology. Prerequisite: course in ecology strongly recommended. Analysis and description of the behavior of animals in their natural environment, especially in terms of natural selection and adaptation. A synthesis of ethology, population genetics, sociobiology, and evolutionary theory. Largely descriptive and generalized with limited emphasis on mathematical theory.

5133* Evolutionary Ecology. Lab 2. Prerequisite: course in ecology strongly recommended. Ecological concepts dealing with contemporary evolutionary processes, not phylogeny. Life history traits, R and K selection, sociality, kin and group selection, speciation, competition, predation, plant-animal coevolution, niche theory, species diversity and biogeography. General models and mechanisms, with examples drawn from all kingdoms.

5153* Ecosystem Analysis. Prerequisite: ecology and organic chemistry strongly recommended. Theory and principles of ecosystem ecology focusing on metabolism and biogeochemical cycles in terrestrial and aquatic systems. Application of principles to current issues of environmental change and management. Same course as BOT 5153.

5163* Population Ecology. Lab 3. Prerequisites: BIOL 3034, MATH 1513. Theory and principles of predicting and analyzing population abundance and dynamics. Life history theory, foraging theory, habitat selection, population genetics, and species interactions.

5173* Systematic Mammalogy. Lab 1. Basic principles of taxonomy; how to apply systematics to study of mammalian biology; biodiversity, biogeography, and systematic relationships. Special emphasis on nonhuman primates, marsupials, and bats.

5200 Lab. 1-3 credits, maximum 10. Introduction to the basic theories, principles, and techniques of environmental toxicology; comparative study of the groups of toxicants (e.g., heavy metals, PCB’s, pesticides) and discussion of the environmental problems created by these chemicals and their implications for survival of populations (including humans) on earth.

5203 Ecotoxicology. Theory and principles of ecosystem ecology focusing on metabolism and biogeochemical cycles in terrestrial and aquatic systems. Application of principles to current issues of environmental change and management. Same course as 4273.

5323* Molecular and Cellular Toxicology. Examination of the physiological basis of toxicokinetics (absorption, distribution, metabolism and excretion) and toxicodynamics (mechanisms of toxic effect). Comparative aspects of toxicology in aquatic and terrestrial organisms.

5413* Ecotoxicology. Integration of the major abiotic and biotic processes involved in transport, exposure and response to environmental toxicants. Focus on aquatic and terrestrial environments.

5424* Techniques in Environmental Toxicology. Lab 2. Prerequisite: course in environmental toxicology strongly recommended. Focus on techniques used to quantify exposure and effects of environmental toxicants. Laboratories include gas chromatography, HPLC, atomic absorption spectroscopy, protein/nucleic acid isolation, immunosay, genetic toxicology, and immunotoxicology.

5433* Fisheries Science. Prerequisite: 4414 or equivalent. Lab 1-3 credits, maximum 10. Principles of fishery science as they relate to fish and aquatic biota, their habitats, and the humans who utilize them.

5453* Stream Ecology. Lab 1. Prerequisite: course in ecology strongly recommended. Focus on techniques used to quantify exposure and effects of environmental toxicants. Laboratories include gas chromatography, HPLC, atomic absorption spectroscopy, protein/nucleic acid isolation, immunosay, genetic toxicology, and immunotoxicology.
**Woodland Wildlife Ecology.** Lab 3. Prerequisite: course in ecology strongly recommended. Vertebrate species diversity in the world's woodland and forested biomes. Changes imposed by land clearing and development and their effects upon wildlife diversity and populations. Options for wildlife conservation, from strict nature reserves to integrating wildlife habitat management into land use practices. Field trip required.

**Grassland and Desert Wildlife Ecology.** Prerequisite: course in ecology strongly recommended. Ecology of grasslands and deserts with emphasis on vertebrate species diversity, adaptations to semi-arid and arid ecosystems, and management problems associated with such habitats.

**Wetland Wildlife Ecology.** Lab 3. Prerequisite: 4513 or consent of instructor. Ecology of various types of wetlands with emphasis on the management problems for waterfowl and fur-bearers.

**Diseases and Parasites of Wild Animals.** Lab 2. A systematic approach to bacterial, viral and parasitic diseases of wild animals. Principles of disease transmission as it relates to individuals and populations of wild animals. Principles are applicable to all areas of zoology, veterinary medicine and wildlife management. Same course as VPARA 5213.

**Research for Ph.D. Dissertation.** 1-15 credits, maximum 30. Independent research for the Ph.D. dissertation under the supervision of a graduate faculty member.