Course Listings

View Online Course Listings at registrar.okstate.edu

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 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 *OSU Center for Health Sciences 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 to receive graduate credit in 3000- or 4000-level courses that are labeled with an asterisk.

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 or B or C
A or B or C is acceptable

Prerequisites: A or B, C
A or B is acceptable, and C is required

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.

Course Abbreviations

A&S	Arts and Sciences
ACCT	Accounting
AERO	Aerospace Studies--Air Force
AG	Agriculture
AGCM	Agricultural Communications
AGEC	Agricultural Economics
AGED	Agricultural Education
AGLE	Agricultural Leadership
AMST	American Studies
ANSI	Animal Science
ANTH	Anthropology
ARCH	Architecture
ART	Art
ASL	American Sign Language
ASTR	Astronomy
AVED	Aviation Education
BADM	Business Administration
BAE	Biosystems and Agricultural Engineering
BCOM	Business Communications
BHON	Business Honors
BIOC	Biochemistry
BIOL	Biological Science
BIOM	Biomedical Sciences
BOT	Botany
BSPR	Business Professions
CDIS	Communication Sciences and Disorders
CHE	Chemical Engineering
CHEM	Chemistry
CIED	Curriculum and Instruction Education
CIVE	Civil Engineering
CMT	Construction Management Technology
CPSY	Counseling Psychology
CS	Computer Science
CTED	Career and Technical Education
DHM	Design, Housing and Merchandising
ECEN	Electrical and Computer Engineering
ECON	Economics
EDLE	Educational Leadership
EDTC	Educational Technology
EDUC	Education
EET	Electrical Engineering Technology
ENGL	English
ENGR	Engineering
ENSC	Engineering Science
ENTO	Entomology
ENVR	Environmental Science
EPSY	Educational Psychology
ETM	Engineering and Technology Management
FDSC	Food Science
FIN	Finance
FLL	Foreign Languages and Literatures
FPST	Fire Protection and Safety Technology
FREN	French
FRNS	Forensic Sciences
GENE	Genetics
GENG	General Engineering
GENT	General Technology
GEOG	Geography
GEOL	Geology
GRAD	Graduate
GREK	Greek
GRMN	German
HDFS	Human Development and Family Science
HES	Human Environmental Sciences
HHP	Health and Human Performance
HIST	History
HONR	Honors College
HORT	Horticulture
HRAD	Hotel and Restaurant Administration
HRAE	Human Resources and Adult Education
IEM	Industrial Engineering and Management
INTL	International Studies
JAPN	Japanese
JB	Journalism and Broadcasting
LA	Landscape Architecture
LATN	Latin
LBSC	Library Science
LEIS	Leisure
LSB	Legal Studies in Business
MAE	Mechanical and Aerospace Engineering
MATH	Mathematics
MBA	Master of Business Administration
MC	Mass Communications
MCAG	Mechanized Agriculture
MET	Mechanical Engineering Technology
MGMT	Management
MICR	Microbiology
MKTG	Marketing
MLSC	Military Science
MSIS	Management Science and Information Systems
MUSI	Music
NATS	Natural Science
NREM	Natural Resource Ecology and Management
NSCI	Nutritional Sciences
OCED	Occupational Education
PHIL	Philosophy
PHYS	Physics
PLNT	Plant Science
PLP	Plant Pathology
POLS	Political Science
PSYC	Psychology
REL	Religious Studies
REMS	Research, Evaluation, Measurement, and Statistics
RUSS	Russian
SCFD	Social Foundations
SDEV	Student Development
SOC	Sociology
SOIL	Soil Science
SPAN	Spanish
SPCH	Speech Communication
SPED	Special Education
STAT	Statistics
TCOM	Telecommunications Management
TH	Theater
UNIV	University
VBSC	Veterinary Biomedical Sciences
VCS	Veterinary Clinical Sciences
VMED	Veterinary Medicine
WMST	Women's Studies
ZOOL	Zoology

Accounting (ACCT)

ACCT 2103
Financial Accounting
Prerequisite(s): 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.

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

ACCT 3013
Federal Income Taxation
Prerequisite(s): 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.

ACCT 3103
Financial Accounting and Reporting Concepts
Prerequisite(s): 2203 with grade of "C" or better. Theory and concepts underlying financial accounting and reporting.

ACCT 3113
Financial Accounting and Reporting Applications and Research
Prerequisite(s): 3103 with a grade of "C" or better. Developing financial research skills and applying them to accounting and reporting issues.

ACCT 3183
Agribusiness Accounting and Taxation
Prerequisite(s): 60 semester credit hours, including ENGL 1113 and MATH 1483 or equivalent. Development of the ability to read, analyze and use accounting information to improve decision-making and tax planning. ***(Same course as AGEC 3183)***

ACCT 3203
Cost Accounting
Prerequisite(s): 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.

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

ACCT 3990
Undergraduate Internship in Accounting
1-3 credits, max 3. Prerequisite(s): 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.*

ACCT 4033
Advanced Federal Income Taxation
Prerequisite(s): 3013. Federal income tax law applicable to individuals, corporations, partnerships, trusts and estates, and other specialized topics.

ACCT 4133
Financial Accounting III
Prerequisite(s): 3113 with grade of "C" or better. Accounting for complex business transactions, emerging issues in financial accounting and reporting, accounting for consolidations and business combinations, accounting for governmental and not-for-profit entities.

ACCT 4233
Internal Auditing
Prerequisite(s): 3103 and 3603. Examination of theory and practices utilized by internal auditors in performing operational audits to assure an organization's operational effectiveness, efficiency, and control over resources.

ACCT 4503*
Operational Auditing and Controls
Prerequisite(s): 3103 and 3603. Examination of theory and practices utilized by internal auditors in performing operational audits to assure an organization's operational effectiveness, efficiency, and control over resources.

ACCT 4553
Ethical Issues in Accounting
Prerequisite(s): Admission to the MS/PPA or permission of department. Basic theories of ethics, including moral reasoning, moral values, relativity and objectivity, freedom and responsibility. Lecture and case approach for examination of issues such as independence, integrity, objectivity, client relationships, employee-employer relations, advertising, preferential treatment, core values and the corporation, and corporate governance, such as Sarbanes-Oxley Act, Foreign Corrupt Practices Act, and SEC regulations.

ACCT 4653
Contemporary Integrated Accounting and Business Systems
Prerequisite(s): 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.

ACCT 4733
International Accounting
Prerequisite(s): 2103 and 2203. Diversity in financial reporting across countries and its effect on global capital flows. Using corporate financial information across borders. Accounting in emerging markets.

ACCT 4763
International Accounting Abroad
Prerequisite(s): 2103 or consent of instructor. A four-week visit to a European country or countries. An integrated approach to the cultural, economic, political, historical, and technological effects of the region on international accounting. Comparison of the accounting issues of the region to that of the US.

ACCT 4930
Accounting Projects
1-9 credits, max 9. Prerequisite(s): 3113, 3203, and consent of instructor. Special topics, projects and independent study in accounting.

ACCT 5013*
Tax Research
Prerequisite(s): Admission to MS in accounting. Development and administration of federal tax law with emphasis on the development of tax research skills.

ACCT 5023*
Estate and Trust Taxation
Prerequisite(s): Admission to MS in accounting. Federal and Oklahoma wealth transfer tax systems, including estate, gift, and generation-skipping transfer taxation. Also, treatment of income taxation of estates and trusts and estate planning vehicles.

ACCT 5033*
Natural Resource Taxation
Prerequisite(s): Admission to MS in accounting. Federal income tax laws applicable to the acquisition, operation, and disposal of natural resource properties.

ACCT 5043*
Partnership Taxation
Prerequisite(s): Admission to MS in accounting. Federal income tax laws applicable to partners and partnerships.

ACCT 5053*
Corporate Taxation
Prerequisite(s): Admission to MS in accounting. Federal income tax law applicable to corporations and shareholders.

ACCT 5083*
MBA Tax Management
Prerequisite(s): Admission to MBA program or consent of MBA director. An introduction to the basic framework of the federal income tax system with an emphasis on recognition of the tax implications of business transactions and how taxes affect managerial decision-making. An exploration of the social and economic policy ramifications of the tax system.

ACCT 5103*
Seminar in Contemporary Accounting Theory I
Prerequisite(s): Admission to the MS in accounting. Origin and development of accounting and a critical study of modern accounting theory.

ACCT 5113*
Financial Accounting Research
Prerequisite(s): 3113 and admission to master's program. Research and presentation of solutions for complex issues in accounting practice using databases, SEC, FASB, AICPA, FARS, as well as other publicly available information.

ACCT 5123*
Enterprise Resource Planning
Prerequisite(s): Graduate standing, ACCT 5103 and 5113. 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.

ACCT 5133*
International Oil and Gas Accounting
Prerequisite(s): Admission to MS in accounting and 15 hours of accounting. Financial accounting and reporting for US and international oil and gas operations. Domestic and international joint venture accounting. Accounting for international concession and profit sharing agreements.

ACCT 5153*
Financial Modeling and Statement Analysis
Prerequisite(s): Admission to the MS in accounting. 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.

ACCT 5183*
MBA Financial Accounting and Analysis
Prerequisite(s): Admission to a SSB graduate 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.

ACCT 5203*
Seminar in Contemporary Accounting Theory I
Prerequisite(s): Permission of SSB Graduate Programs office. Origin and development of accounting and a critical study of modern accounting theory.

ACCT 5233*
Valuation and Business Risk Management
Prerequisite(s): Admission to MS in accounting. Valuation of assets using a variety of interdisciplinary business methods. Presentation of asset valuations in formats suitable for different audiences, attuned to different purposes. Application and understanding of the meaning of risk and its impact on valuation issues.

ACCT 5283*
MBA Managerial Accounting
Prerequisite(s): 5183 and admission to MBA program or consent of MBA director. Interpretation of accounting data in planning, controlling and decision-making.

ACCT 5503*
Auditing and Assurance Services
Prerequisite(s): Admission to professional program in accounting (PPA)/MS in accounting program. Auditing theory, procedures and practices.

ACCT 5513*
Advanced Auditing and Assurance Services
Prerequisite(s): 5503 or equivalent. Introduction to fraud examination and legal issues involved in investigative process. Advanced topics in statutory auditing, operational auditing and investigative services.

ACCT 5543*
Fraud Examination
Prerequisite(s): Permission of SSB Graduate Programs office. Schemes used in the commission of white-collar fraud, as well as causes, symptoms and prevention methods related to these crimes.

ACCT 5553*
Forensic Accounting Tools
Prerequisite(s): Permission of SSB Graduate Programs office. Provides in-depth study and practice with tools that are most critical in conducting proactive fraud detection and fraud investigations.

ACCT 5603*
Accounting-based Information Systems
Prerequisite(s): Permission of SSB Graduate Programs office. Concepts underlying the design and use of an effective accounting information system.

ACCT 5613*
Business Systems Control and Risk Analysis
Prerequisite(s): Permission of SSB Graduate Programs office. Controlling and auditing business information systems, including management and applications controls, electronic commerce and internet-related controls and evaluation of system.

ACCT 5753*
Seminar in International Accounting
Prerequisite(s): 3113 and admission to MS in accounting. Not available for students who have credit in 4733. Accounting issues faced by multinational enterprises and internationally listed companies, including diversity in financial reporting and harmonization.

ACCT 5783*
MBA International Accounting
Prerequisite(s): 5183 and admission to MBA program or consent of MBA director. Diversity in financial reporting across countries and its effect on global capital flows. Corporate financial information across borders. Accounting in emerging markets.

ACCT 5830*
Graduate Internship in Accounting
1-3 credits, max 3. Prerequisite(s): Admission to MS/PPA in accounting; consent of graduate coordinator and either 5503 or 5013. Supervised internship in public accounting, industry, or not-for-profit organizations. *May be counted as elective hours only.*

ACCT 5840*
Special Topics and Individual Work in Accounting
1-10 credits, max 10. Prerequisite(s): Consent of instructor. Individual work on special topics, projects or readings selected to acquaint students with significant accounting literature.

ACCT 5850*
Practicum in Professional Accounting
1-6 credits, max 6. Prerequisite(s): Admission to MS/PPA in accounting program. Study of accounting policies, retirement policies, tax issues, and other relevant business issues associated with mergers, acquisitions, and divestures.

ACCT 5880*
MBA Special Topics in Accounting
1-3 credits, max 3. Prerequisite(s): 5183 and admission to MBA program or consent of MBA director. Individual work on special topics, projects or readings to acquaint students with accounting literature.

ACCT 5932*
Research Report
Prerequisite(s): Consent of supervising professor and admission to MS in accounting. Restricted to candidates seeking the MS in accounting degree and not available to students who have credit in 5940. 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.

ACCT 5940*
Thesis
1-6 credits, max 6. Prerequisite(s): Admission to MS in accounting. For students writing reports and theses in accounting.

ACCT 6000*
Research and Thesis
1-18 credits, max 36. Prerequisite(s): Approval of advisory committee. For students working on the doctoral degree.

ACCT 6110*
Graduate Readings and Special Topics in Accounting
1-3 credits, max 20. Prerequisite(s): Consent of supervising professor and coordinator of graduate programs in accounting. Supervised reading of significant literature and study of special topics not covered in regularly scheduled accounting courses.

ACCT 6703*
Seminar in Accounting Research
Prerequisite(s): Doctoral student status and consent of coordinator of graduate programs in accounting. The theoretical literature and research methodology in accounting.

Aerospace Studies - Air Force (AERO)

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

AERO 1211
Foundations of the US Air Force II
Lab 1. Continuation of the doctrine, mission and organization of the United States Air Force; review of Army, Navy, and Marine general purpose forces.

AERO 2111
Evolution of US 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.

AERO 2211
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.

AERO 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.

AERO 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.

AERO 3504
Field Training Encampment Program
Prerequisite(s): 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.

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

AERO 4203
National Security Affairs II
Lab 1. Strategy and management of conflict; implementation of national security and regional world issues. Review of societal issues in the military profession and the military justice system.

AERO 4402
Summer Professional Development Training Program
Prerequisite(s): Consent of professor of aerospace studies. Students spend from two to three weeks on an Air Force base working in their intended specialty under supervision of experienced officer. Leadership and management principles applied to day-to-day experiences.

AERO 4554
Introductory Flight Training Program
Prerequisite(s): Consent of professor of aerospace studies. Academic and flying phase. Flight characteristics, meteorology, navigation, FAA regulations, and radio procedures.

Agricultural Communications (AGCM)

AGCM 2113
Communications in Agriculture
Lab 2. Prerequisite(s): ENGL 1113 and major in AGCM or consent of instructor. Fundamentals of agricultural news writing and other communication methods. Careers in and the role of the media in agriculture and related fields.

AGCM 3101
Exploring Agricultural Communications
An exploration of career expectations and opportunities in agricultural communications.

AGCM 3103
Communicating Agriculture to the Public
Prerequisite(s): Junior standing in the College of Agricultural Sciences and Natural Resources or consent of the instructor. Understanding and application of writing principles and communications 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.

AGCM 3113
Writing and Editing for Agricultural Publications
Lab 2. Prerequisite(s): 3113 with a grade of "C" or better; major in agricultural communications; score of 3 or better on writing assessment; or consent of instructor. Interviewing, reporting, writing, and editing for agricultural publications.

AGCM 3123
Agricultural Broadcasting
Lab 2. Prerequisite(s): 3113 or JB 3263; major in agricultural communications or consent of instructor. Interviewing, reporting, writing and editing agricultural broadcast programs. Exploration of new technologies in broadcast equipment. Opportunity for service-learning experiences.

AGCM 3213
Layout and Design for Agricultural Publications
Lab 4. Prerequisite(s): 2113 or JB 2003; major in agricultural communications or consent of instructor. Fundamentals of layout and design as applied to agricultural publications. Practical application of design principles, typography, desktop-publishing software and printing practices. Opportunity for service-learning experiences.

AGCM 3223
Web Design for Agricultural Organizations
Lab 4. Prerequisite(s): 2113 or JB 2003; major in agricultural communications or consent of instructor. Development of World Wide Web sites for agricultural organizations. Practical application of theory and skills related to graphic design, computer software, writing, editing and project management. Opportunities for service-learning experiences.

AGCM 3233
Basic Photography and Photo Editing for Agriculture
Lab 4. Prerequisite(s): 2113 or JB 2003; major in agricultural communications or consent of instructor. Beginning course focusing on photographic equipment, related software and photo composition in an agricultural setting.

AGCM 4113*
Features Writing and Editing for Agricultural Publications
Prerequisite(s): 3113 with a grade of "C" or better; major in agricultural communications or consent of instructor. Brainstorming, researching, interviewing, developing, writing and editing feature stories for agricultural publications.

AGCM 4203*
Professional Development in Agricultural Communications
Prerequisite(s): 2113 or JB 2003; major in agricultural communications or consent of instructor. Professional preparation and development for careers in agricultural communications. Professional communications, resume and portfolio development, presentations, networking and job interviews. Introduction to event planning.

AGCM 4300
Internships in Agricultural Communications
1-6 credits, max 6. Prerequisite(s): Consent of internship coordinator and adviser. Supervised work experience with approved employers in agricultural communications. Presentation required following the internship experience.

AGCM 4403*
Planning Campaigns for Agriculture and Natural Resources
Lab 4. Prerequisite(s): 3113 or JB 3263; AGCM 3213; major in agricultural communications or consent of instructor. Communications campaign development for agriculture and natural resources activities and issues, including development of materials, budgets and contracts.

AGCM 4413*
Agricultural Communications Capstone
Lab 4. Prerequisite(s): 3213, 3233; JB 3263 or AGCM 4113; 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.

AGCM 4990
Problems in Agricultural Communications
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Small group and individual study and research in problems relating to communications within the agricultural sector and from the agricultural sector to other constituencies.

AGCM 5000*
Research and Thesis
1-6 credits, max 6. Prerequisite(s): Graduate standing. Independent research and thesis under the direction and supervision of a major professor.

AGCM 5100*
Issues in Agricultural Communications
1-3 credits, max 6. Prerequisite(s): Graduate standing. Discussion of issues, problems and trends in agricultural communications.

AGCM 5103*
History and Philosophical Foundations of Agricultural Communications
Prerequisite(s): Graduate standing. Discussion of the history, philosophical foundations and current issues regarding agricultural communications and the land-grant system.

AGCM 5203*
Theory and Practice in Agricultural Communications
Prerequisite(s): Graduate standing. The study of major communication theories and theorists in the context of agricultural communications.

AGCM 5303*
Communicating Ethical Issues in Agriculture
Prerequisite(s): Graduate standing. An introduction to communicating ethical theories in the context of agriculture. Ethical theory and current research are used to critique contemporary issues in agriculture.

AGCM 5990*
Advanced Studies in Agricultural Communications
Prerequisite(s): Consent of supervising professor. Individual and small group study or research in agricultural communications topics and issues.

Agricultural Economics (AGEC)

AGEC 1114
(S)Introduction to Agricultural Economics
Prerequisite(s): 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.*

AGEC 3010
Internship in Agricultural Economics
1-3 credits, max 3. Prerequisite(s): 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 a pass-fail basis.*

AGEC 3101
Professional Career Development
Prerequisite(s): Junior standing and agricultural economics or agribusiness major status. 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.

AGEC 3183
Agribusiness Accounting and Taxation
Prerequisite(s): 60 semester credit hours, including ENGL 1113 and MATH 1513 or equivalent. Development of the ability to read, analyze, and use accounting information to improve decision-making and tax planning. (*Same course as ACCT 3183*)

AGEC 3213
Quantitative Methods in Agricultural Economics
Lab 2. Prerequisite(s): 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.

AGEC 3323
Agricultural Product Marketing and Sales
Prerequisite(s): 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.*

AGEC 3333*
Agricultural Marketing and Price Analysis
Prerequisite(s): 3213 or concurrent enrollment. 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.

AGEC 3403
Agricultural Small Business Management
Prerequisite(s): 1114. The essentials of operating an agricultural small business. An introduction to the planning, organizing, marketing, managing, financing, controlling and operating an agricultural small business. *Not recommended for agricultural economics or agribusiness majors.*

AGEC 3423
Farm and Agribusiness Management
Prerequisite(s): 1114, ACCT 2103 or ACCT 3183 or AGEC 3183. 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.

AGEC 3463
Agricultural Cooperatives
Prerequisite(s): 3423. An evaluation of the fundamental principles, objectives, structure, finance, and management associated with the cooperative organization. An analysis of the cooperative business organization within the modern economy: history, legislation and evolution. An examination of careers related to cooperatives.

AGEC 3503
Natural Resource Economics
Prerequisite(s): 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 special emphasis on the institutions having an impact on management opportunities. Supply of and demand for natural resources, resource allocation over time, rights of ownership, public issues of taxation, police power and eminent domain.

AGEC 3603
Agricultural Finance
Prerequisite(s): 3213 and 3423. Analyze farm and agribusiness financial statements. Understand the relationship between firm growth and financial leverage. Time value of money concepts and their application to capital budgeting. Discuss how agricultural lenders acquire and use funds.

AGEC 3703
Issues in Agricultural Policy
Prerequisite(s): 1114. Emerging issues related to agricultural policy in the United States.

AGEC 3713
Agricultural Law
Prerequisite(s): 1114. Survey of law with emphasis on agricultural problems, applications, and strategies for managing legal risk in the agribusiness setting. Contract law, tort law, property law, real estate transactions, business organization, estate planning, debtor/creditor law, environmental law, and water/resources law.

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

AGEC 4101
Agricultural Economics Seminar
Prerequisite(s): Senior standing and agricultural economics or agribusiness major status. Contemporary problems in agricultural economics.

AGEC 4213*
Advanced Quantitative Methods in Agricultural Economics
Prerequisite(s): 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.

AGEC 4333*
Commodity Futures Markets
Prerequisite(s): 3213 and 3333. The economics of commodity futures markets. The vocabulary of futures markets and the mechanics of trading and hedging. Basis and producer marketing strategies. Fundamental analysis and statistical analysis of data. Technical analysis, behavioral finance, efficient market hypothesis, and basics of option pricing.

AGEC 4343
(I)International Agricultural Markets, Trade and Development
Prerequisite(s): 1114 or ECON 2103. Contemporary international agricultural trade theory and applications. Tools to identify, evaluate critically, and seek solutions to complex international trade and development problems, such as gains from trade, impacts of trade barriers on social welfare, export promotion effectiveness, trade impacts on environment and land degradation, social benefits and costs of free trade areas, and impacts of genetically modified crops on trade.

AGEC 4403*
Advanced Farm and Ranch Management
Prerequisite(s): 3213, 3333, 3603, MATH 2103, and ECON 3023 or 3113. The development of problem solving and risk management skills needed on the modern farm or ranch. Use of spreadsheets to perform production planning and analysis of farm and ranch problems with linear programming, simulations, and other tools. Analysis of the acquisition of resources and the use of information systems in managing the individual farm or ranch business.

AGEC 4423*
Advanced Agribusiness Management
Prerequisite(s): 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.

AGEC 4503*
Environmental Economics and Resource Development
Prerequisite(s): 3503 or ECON 3113 or consent of instructor. Economic, social, and political factors relating to conservation, 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.

AGEC 4513*
Farm Appraisal
Lab 2. Prerequisite(s): 3423. Estimating the market value of agricultural real estate using the three approaches to value - sales comparison, cost, and income approaches. Analysis of sales to value the different characteristics of the farm.

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

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

AGEC 4803
(I)International Agricultural Economics Tour
Prerequisite(s): Consent of instructor. A two-three week international travel component. 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 US.

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

AGEC 5000*
Thesis or Report in Agricultural Economics
1-6 credits, max 6. For students working on an MS degree in agricultural economics. Independent research and thesis under the direction and supervision of a major professor.

AGEC 5010*
Professional Experience in Agricultural Economics
1-6 credits, max 6. Prerequisite(s): 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. Graded on pass-fail basis.*

AGEC 5101*
Research Methodology
Prerequisite(s): Selection of a thesis adviser and a thesis topic. Using the scientific method to solve problems related to agriculture. Preparation of a thesis proposal required.

AGEC 5103*
Mathematical Economics
Prerequisite(s): Differential calculus and ECON 3113. Mathematical tools necessary for formulation and application of economic theory and economic models.

AGEC 5113*
Applications of Mathematical Programming
The application of concepts and principles of existing linear and nonlinear programming techniques to agricultural problems.

AGEC 5203*
Advanced Agricultural Prices
Prerequisite(s): 5103, STAT 4043. Demand and price structures, price discovery, time series and agricultural price research methods.

AGEC 5213*
Econometric Methods
Prerequisite(s): 5103 and ECON 4213 or STAT 4043. Application of econometric techniques to agricultural economic problems, theory and estimation of structural economic parameters.

AGEC 5233*
Primary Data Analysis in Economic Research
Prerequisite(s): 5213 or ECON 5243 or concurrent enrollment. Development and analysis of surveys and experiments designed to collect primary data for economic research. Basics of survey and experimental design, survey delivery, and sampling. Methods, economics, and econometrics of valuation methods including contingent valuation, experimental auctions, factor analysis, cluster analysis, and structural equations modeling, including limited dependent variable models such as the logit, probit, ordered probit, multinomial logit, tobit and intervalcensored regression.

AGEC 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.

AGEC 5343*
International Agricultural Markets and Trade
Contemporary international agricultural trade theory and applications. Broaden students' understanding of contemporary cultural and economic issues outside the US that affect global demand. Gains from trade and the theory of comparative advantage. *No credit for students with credit in AGEC 4343. Not recommended for graduate students in Agricultural Economics.*

AGEC 5403*
Production Economics
Prerequisite(s): 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.

AGEC 5423*
Agribusiness Management
Prerequisite(s): Consent of instructor. Application of quantitative analysis to the evaluation of business plans for agribusiness firms. Preparation of business plans, including mission statements, financial analyses, marketing plans, personnel, and organization requirements of the firm, production and operations plans as well as a contingency plan. Analysis of risk factors associated with agriculturally-based companies. *No credit for students with credit in AGEC 4423.*

AGEC 5503*
Economics of Natural and Environmental Resource Policy
Prerequisite(s): 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 prices. Cost benefits analysis of long term natural resource use and environmental policy. Elementary computer simulation of long term resource use and environmental policy.

AGEC 5603*
Advanced Agricultural Finance
Prerequisite(s): 3603 or FIN 3113, ECON 3023 or 3113 and ECON 4213 or STAT 4043. Financial management concepts applied to agricultural firms. Financial models that incorporate uncertainty and risk via stochastic simulation. Risk/return tradeoff for stocks and portfolio management.

AGEC 5703*
Economics of Agriculture and Food Policy
Prerequisite(s): 4703 and 5103. Application of welfare criteria and economic analysis to agricultural, food, and rural development problems and policies.

AGEC 5713*
Rural Regional Analysis
Prerequisite(s): 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.

AGEC 5723*
Planning and Policy for Development
Prerequisite(s): Master's-level microeconomics, macroeconomics, and regression analysis. Economics of market-based planning and policy analysis for developing countries, topics and tools in macro- and microeconomics of development, and social cost-benefit and project analysis with emphasis on agricultural and public policy. Hands-on application of econometrics, input-output analysis, and cost-benefit analysis using econometric software.

AGEC 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.

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

AGEC 6000*
Research Problems
1-15 credits, max 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.

AGEC 6102*
Teaching Practicum in Agricultural Economics
Lab 4. Prerequisite(s): 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.

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

AGEC 6213*
Advanced Econometrics
Prerequisite(s): 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; misspecification testing. Extensive use of SAS statistical software package.

AGEC 6300*
Agricultural Marketing Seminar
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Current developments in theory, techniques for evaluating marketing behavior, market legislation and market development.

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

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

AGEC 6403*
Advanced Production Economics
Prerequisite(s): 5403. Formulating and solving applied economic optimization problems in agricultural production economics. Expected profit maximization; analyzing data from agronomic experiments; credit scoring; risk models such as stochastic dominance and expected utility.

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

Agricultural Education (AGED)

AGED 3101
Laboratory and Clinical Experiences in Agricultural Education
Preprofessional clinical experiences in agricultural education teaching and related careers. Requirement for admission to professional education, student teaching, and internships. *Graded on a pass-fail basis.*

AGED 3103
Foundations and Philosophies of Teaching Agricultural Education
Lab 2. Prerequisite(s): 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.

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

AGED 4103*
Methods and Skills of Teaching and Management in Agricultural Education
Lab 2. Prerequisite(s): 3203, junior standing in the College of Agricultural Sciences and Natural Resources, full admission to the University Professional Education program, and concurrent enrollment in 4200. 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.

AGED 4113
Laboratory Instruction in Agricultural Education
Prerequisite(s): 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.

AGED 4200
Student Teaching in Agricultural Education
1-12 credits, max 12, Lab 12. Prerequisite(s): 3203, junior standing in the College of Agricultural Sciences and Natural Resources, full admission to the University Professional 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, and evaluating curriculum materials and experiences to meet educational goals and facilitate learning for individual students. Roles, responsibilities, and interactions of school personnel and parents. Study of professional education groups and organization and operation of school systems. *Graded on a pass-fail basis.*

AGED 4713
(I)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.

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

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

AGED 5100*
Organizing Curriculum and Programs of Agricultural Education
1-3 credits, max 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.

AGED 5102*
Creative Component in Agricultural Education
Prerequisite(s): 5983 or equivalent; consent of instructor. Independent research or project management under the direction and supervision of a major adviser.

AGED 5123*
Adult Programs in Agricultural and 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.

AGED 5202*
Grant Seeking
Prerequisite(s): Graduate 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 working narrative that follows the RFP guidelines, developing boiler-plate information, conducting a review of literature to demonstrate a need for the project and developing timelines and budgets.

AGED 5500*
Directing Programs of Supervised Experience
1-3 credits, max 6. Prerequisite(s): 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.

AGED 5823*
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 use of various advanced methodologies, technologies and concepts.

AGED 5863*
Methods of Technological Change
Processes by which professional change 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.

AGED 5900*
Graduate Internship in Agriculture
1-6 credits, max 6. Prerequisite(s): 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.

AGED 5983*
Research Methods in Agricultural Education
Prerequisite(s): Graduate standing. Research methods presented in support of decision-making in a scientifically literate world. Literature, logic, and research methodologies for quantitative and qualitative paradigms. Studies in the social sciences. Preparation of a proposal for their thesis, dissertation, or creative component.

AGED 5990*
Problems in Agricultural and Extension Education
1-3 credits, max 8. Securing and analyzing data related to special problems or investigation in designated areas of agricultural education.

AGED 5993*
Data Analysis and Interpretation in Agricultural Education
Prerequisite(s): Graduate standing; 5983 or equivalent; REMS 5953 or equivalent. A course designed for Agricultural Education students, who have gathered or are gathering data for a research study, to analyze and interpret that data. Both quantitative and qualitative data analysis techniques will be studied. The discovery method will allow the students and instructor to work together to identify resources to analyze and interpret the data sets.

AGED 6000*
Research in Agricultural Education
1-16 credits, max 16. Prerequisite(s): Approval of major adviser. 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.

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

AGED 6103*
History and Philosophical Foundations of Agricultural and Extension Education
Prerequisite(s): 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.

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

AGED 6200*
County Extension Program Development
1-3 credits, max 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 lay people and the various groups of extension workers. Uses of committees, step-by-step procedures, coordinated county and state plans and characteristics of effective programs.

AGED 6223*
Program Evaluation in Agriculture and Extension
Prerequisite(s): 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.

AGED 6252*
Seminar in Advanced Qualitative Research Methods
Prerequisite(s): AGED 5983 or other graduate level social science research methods. Survey of interpretative data collection and analysis techniques, including participant observation, interviewing, and document analysis. Students will participate in collecting, analyzing, and reporting qualitative data.

Agricultural Leadership (AGLE)

AGLE 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.

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

AGLE 2403
Agricultural Leadership in a Multicultural Society
The study of leadership as it relates to a multicultural society. Cultural changes in the agricultural workplace and future impact on the industry. Personal barriers to fulfilling leadership roles in the agricultural sciences and natural resources. Skills related to managing teams in a diverse workplace specifically related to differences in gender, race and ethnicity.

AGLE 3101
Introduction to Agricultural Leadership
Prerequisite(s): Major in AGLE or consent of instructor. Exploring leadership in the context of agriculture. Specific topics will include authentic leadership, independent thinking, commitment to agriculture, open minds and professionalism. *Graded on pass-fail basis.*

AGLE 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.

AGLE 3333
Contemporary Issues in Leadership
Prerequisite(s): 2303, 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.

AGLE 3403
Facilitating Social and Technological Change in Agriculture
Examination of processes by which professional agriculturists influence the introduction, adoption, and diffusion of technological change.

AGLE 4101*
Seminar in Leadership Education
Prerequisite(s): 2303, 3303. In depth exploration of leadership topics related to agricultural sciences and natural resources.

AGLE 4203
Professional Development in Agriculture
Prerequisite(s): 3101; 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.

AGLE 4300
Agricultural Leadership Internship
3-6 credits, max 6. Prerequisite(s): 3101 and 4203; consent of adviser/internship coordinator. Supervised full-time internships in approved county extension offices, agribusinesses, or governmental agencies for students preparing career paths in agriculture. *Maximum credit requires a 10-week internship in addition to a report and final seminar. Graded on a pass-fail basis.*

AGLE 4303*
Facilitating Leadership Education Programs
Prerequisite(s): 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.

AGLE 4990
Problems in Agricultural Leadership
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Small group and/or individual study and research in problems related to agricultural leadership.

AGLE 5303*
Foundations of Leadership Theory
Study of leadership theory including definitions of leadership, a history of modern leadership theory, and current trends in leadership practice and research. Models of leadership including contingency models, situational leadership and transformational leadership.

AGLE 5353*
Leadership in Agriculture
Prerequisite(s): 5303 or consent of instructor. Concepts, principles, and philosophies of leadership applied to agricultural contexts. Importance of traits, perceptions, and behaviors to success of agricultural professionals in leadership roles. Dimensions and style of leadership for varying situations.

Agriculture (AG)

AG 1011
Orientation
Required of all freshmen 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.

AG 1111
Career Exploration in Agricultural Sciences and Natural Resources
Application of the career planning cycle and detailed exploration of career opportunities in the agricultural industry and natural resources field.

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

AG 3010
Internships in Agriculture
1-3 credits, max 12. Prerequisite(s): Junior standing or consent of instructor. Supervised internships with business, industry or governmental agencies, including cooperating veterinarians. *Graded on pass-fail basis.*

AG 3080
(I)International Experience
1-18 credits, max 36. Prerequisite(s): Consent of the associate dean of the college. Participation in a formal or informal educational experience outside of the USA.

AG 3090
(I)Study Abroad
1-18 credits, max 36. Prerequisite(s): Consent of the Study Abroad office and associate dean of the college. Participation in an OSU reciprocal exchange program.

AG 3111
Career Planning and Skill Development
In-depth application of career research and literature to the internship search, full-time job search, and graduate school application and decision-making processes, as related to the agricultural industry and natural resources field.

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

American Sign Language (ASL)

ASL 1115
American Sign Language I
Learners will use fingerspelling, signing, eye gazing, classifiers, mime, and facial expressions presented in context and through meaningful and experimental activities.

ASL 1225
American Sign Language II
Prerequisite(s): 1115. Continuation of 1115.

ASL 2113
American Sign Language III
Prerequisite(s): 1225 or equivalent. Intermediate level study of American Sign Language.

ASL 2233
American Sign Language IV
Prerequisite(s): 2113 or equivalent. Continuation of 2213.

American Studies (AMST)

AMST 2103
(D,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.

AMST 3223
(H)Theory and Method of American Studies
Introduction to assumptions, methods, and theory of cultural analysis in American studies scholarship.

AMST 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.

AMST 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.

AMST 3333
(S)Crime, Law and American Culture
Study of crime, law and the legal system from a cultural perspective. Examine how race, gender, and social class play different roles in issues related to crime, law and the legal system.

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

AMST 3430
Topics in Television Studies
3 credits, max 6. Examination of the study of television in the US, including narrative and visual practices, genres, political economy and social effects, and comparison with television in other national settings and other forms of media. No credit for students with credit in ENGL 3430.
(Same course as ENGL 3430)

AMST 3443
(H)Studies in Film Genre
Lab 2. A comparative study of types of films both inside the Hollywood system and in other national cinemas. Genres may include the western, film noir and the musical, as well as genres from such countries as France, Germany and Japan. Focused knowledge of selected genres, a sense of the economic imperatives that necessitate generic "contracts" between film producers and viewers, and knowledge of the history of specific genres.
(Same course as ENGL 3443)

AMST 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.
(Same course as ENGL 3813)

AMST 3950
Special Topics in American Studies
3 credits, max 12. Particular topics (popular culture, regionalism, myth, subcultures, race, ethnicity) to illustrate the use of interdisciplinary methods in American studies.

AMST 4633
(H)The Frontier and American Visual Culture
The frontier and its impact on American culture examined through a survey of paintings, sculpture, photography, film, television, and other forms of popular imagery. The frontier as a zone of cultural interaction that is seldom tied to a single culture. ***(Same course as ART 4633)***

AMST 4910
American Period Seminar
3 credits, max 12. In-depth study of a particular period or era in American historical experience. Examples include The Ragtime Era, The Jazz Age, The Great Depression, The Season of 1954-1955, The Sixties, Contemporary America, The Romantic Revolutionaries (1905-1914), The Postwar Era, American Avant Garde, The South and 30's Expression, The Civil Rights Movement, The American Twenties, The Fifties, America Between the Wars, The Colonial Period, The Aspirin Age, and Post Modern America. Topics vary by semester.

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

AMST 4990
Internship
1-3 credits, max 6. An internship opportunity which combines independent study and practical fieldwork experience focusing on a particular problem or topic related to America culture and experience. (Examples: Internship in Archival Fieldwork, Material Culture Fieldwork, Museum Management, Sound Recordings and Native American Heritage Site).

Animal Science (ANSI)

ANSI 1111
Animal & Food Science Experience
Student development through connections among the student's major curriculum, career goals specific to animal or food science, and eventual careers and career development through resume building and networking.

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.

ANSI 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.*

ANSI 2112
Live Animal Evaluation
Lab 4. Prerequisite(s): 1124. Using tools for selection including performance records, pedigree information and visual appraisal, in the evaluation of cattle, swine, sheep, horses and poultry.

ANSI 2123
Livestock Feeding
Lab 2. Nutrients and their functions, nutrient requirements of the various classes of livestock; composition and classification of feed stuffs and ration formulation. *Not required of animal science majors.*

ANSI 2253
Meat Animal and Carcass Evaluation
Lab 2. Prerequisite(s): 1124. Evaluation of carcasses and wholesale cuts of beef, pork, and lamb. Factors influencing grades, yields and values in cattle, swine and sheep. ***(Same course as FDSC 2253)***

ANSI 3182
Meat Grading and Selection
Lab 4. Prerequisite(s): 2253. Classifying and grading carcasses and wholesale cuts of beef, pork and lamb; factors influencing quality and value.
(Same course as FDSC 3182)

ANSI 3202
Equine Training Methods
Basic techniques of equine training. Performance of various maneuvers including halter breaking, saddling, longing, driving, and riding.

ANSI 3210
Animal and Product Evaluation
1-2 credits, max 4, Lab 3. Prerequisite(s): Consent of instructor. Advanced instruction in evaluating slaughter and breeding animals and grading and evaluating meat, poultry, and dairy products. ***(Same course as FDSC 3210)***

ANSI 3242
Advanced Live Animal Evaluation
Lab 4. Prerequisite(s): 2112. Visual and objective appraisal of beef cattle, sheep, swine and horses.

ANSI 3333*
Meat Science
Lab 3. Prerequisite(s): 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 economical utilization of meat animals, as well as in the manufacture of meat products emphasized in the laboratory. ***(Same course as FDSC 3333)***

ANSI 3422
Horse Management and Production
Nutrition, feeding, reproduction, and physical conditioning of horses. Current management concepts as they apply to the health and well being of horses.

ANSI 3423*
Animal Genetics
Prerequisite(s): Introductory biology. The basic principles of heredity including: kinds of gene action, random segregation, independent assortment, physical and chemical basis of heredity, mutations, sex-linkage, chromosome mapping, multiple alleles and chromosomal abnormalities. Also a brief introduction to quantitative inheritance and population genetics.

ANSI 3433*
Animal Breeding
Lab 2. Prerequisite(s): 3423. The application of genetic principles to livestock improvement; study of the genetic basis of selection and systems of mating; development of breeding programs based on principles of population genetics.

ANSI 3443*
Animal Reproduction
Lab 2. Prerequisite(s): Introductory biology. Physiological processes of reproduction in farm animals, gonad function, endocrine relationships, fertility, and factors affecting reproduction efficiency. Emphasis on principles of artificial insemination in the laboratory.

ANSI 3523
Pet and Companion Animal Management
Current concepts and management principles related to pet and companion animal species and their roles in society. Discussion of the human-animal bond, service animals, kennel and cattery management, anatomy, internal and external parasites, toxins, restraint and handling, training, reproduction, nutrition, genetics, and breeding.

ANSI 3543
Principles of Animal Nutrition
Prerequisite(s): CHEM 1215 or equivalent. Basic principles of animal nutrition including digestion, absorption, and metabolism of the various food nutrients; characteristics of the nutrients; measure of body needs; ration formulation.

ANSI 3653*
Applied Animal Nutrition
Lab 2. Prerequisite(s): 3543. Composition, characteristics and nutritive value of feeds and ration additives; qualitative and quantitative nutrient requirements of each of the classes of livestock; formulation of rations for each of the classes of livestock.

ANSI 3753
Basic Nutrition for Pets
Nutrients, nutrient requirements, feeding practices, food sources, and diet management for pets and companion animals as well as exotic animals and birds.

ANSI 3903
(I)Agricultural Animals of the World
The production and utilization of agricultural animals by human societies.

ANSI 4023
Poultry Science
Lab 2. Prerequisite(s): 1124 and 2123 or 3543. The relationship of the biological concepts and functions of poultry to management practices, incubation procedures, and economic factors utilized by poultry men in the commercial production of table and hatching eggs, broilers, turkeys, and other poultry meat.

ANSI 4203*
Rangeland and Pasture Utilization
Lab 2. Prerequisite(s): RLEM 3913 or 4613. Investigation of livestock and forage interactions that impact productivity in the utilization of rangeland and improved pastures.

ANSI 4333*
Processed Meat
Lab 3. Prerequisite(s): 3033 or 3333. Meat and meat product composition. Techniques in the molding and forming of meat; sausage formulation; curing; quality control; and cost analysis. ***(Same course as FDSC 4333*)***

ANSI 4423
Horse Science
Lab 2. Prerequisite(s): 3433, 3443 and 3653. Current concepts and production principles related to the horse industry including nutrition, reproduction, herd health, functional anatomy and implications, social behavior, and applying principles of psychology in horse management and training.

ANSI 4543*
Dairy Cattle Science
Lab 2. Prerequisite(s): 3433, 3443 and 3653. Current concepts and production principles of the dairy cattle industry including value of milk products, milk marketing, physiology of lactation, reproduction, nutrition, mastitis, and housing. Analysis and active learning of dairy production systems using farm visits and field techniques laboratories.

ANSI 4553*
Sheep Science
Lab 2. Prerequisite(s): 3433, 3443 and 3653. Breeding, feeding, management, and marketing of commercial and purebred sheep.

ANSI 4613*
Cow-Calf and Purebred Beef Cattle Management
Lab 2. Prerequisite(s): 3433, 3443, and 3653. Application of scientific knowledge, management principles, and research advances to modern commercial cow-calf and purebred beef cattle production.

ANSI 4633*
Stocker and Feedlot Cattle Management
Lab 2. Prerequisite(s): 3612, 3653. Application of scientific knowledge, management principles, and research advances to modern stocker and feedlot cattle operations.

ANSI 4643*
Swine Science
Lab 2. Prerequisite(s): 3433, 3443 and 3653. Application of genetic, physiological, microbiological, nutritional, and engineering principles to the efficient production of swine.

ANSI 4712
Livestock Sales Management
Lab 2. Prerequisite(s): 3433. Advertising of purebred livestock; performance data and breeding values in the merchandising of purebred livestock; photography and ad copy layout; conduct of an actual livestock auction, including animal selection, advertising, catalog and animal preparation, clerking, receipt of payments, sales budgets, and transfer of registration papers.

ANSI 4803*
Animal Growth and Performance
Prerequisite(s): An upper-division course in animal science. Physiological and endocrine factors affecting growth and performance of domestic animals.

ANSI 4843
Applications of Biotechnology in Animal Science
Lab 3. Prerequisite(s): 3423 and BIOC 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.

ANSI 4863
Capstone for Animal Agriculture
Lab 2. Prerequisite(s): Senior standing. Examination of the role of animal agriculture in society and the importance of research and current issues. *Oral and written reports.*

ANSI 4900
Special Problems
1-6 credits, max 6. Prerequisite(s): Consent of instructor. A detailed study of an assigned problem by a student wishing additional information on a special topic.

ANSI 4910*
Animal or Food Industry Internship
3-12 credits, max 12. Prerequisite(s): 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.*

ANSI 4973
Rangeland Resources Planning
Lab 3. Prerequisite(s): 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 RLEM 4973 & 5973)***

ANSI 5000*
Research and Thesis
1-6 credits, max 6. Independent research planned, conducted, and reported in consultation with a major professor.

ANSI 5010*
Special Problems
1-3 credits, max 6. Special problems in areas of animal science other than those covered by the individual graduate student as a part of his/her research and thesis program.

ANSI 5110*
Seminar
1 credit, max 3. A critical review and study of the literature; written and oral reports and discussion on select subjects. ***(Same course as 6110*)***

ANSI 5113*
Basic Reproductive Physiology
Prerequisite(s): 3443 or equivalent. Female and male reproductive processes, endocrine control of reproductive functions, and the application of reproductive physiology to animal production.

ANSI 5213*
Advances in Meat Science
Prerequisite(s): BIOC 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. ***(Same course as FDSC 5213)***

ANSI 5303*
Advanced Animal Breeding
Prerequisite(s): 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.

ANSI 5333*
Carcass Value Estimation Systems
- Effective Spring '09 - Prerequisite(s): Graduate classification. Analysis of scientific literature regarding carcass composition, quality and palatability. Overview of technology used to evaluate carcass quality factors. ***(Same course as FDSC 5333*)***

ANSI 5553*
Interpreting Animal and Food Science Research
Prerequisite(s): STAT 5013 or concurrent enrollment. Critical evaluation and knowledgeable communication on the design, analyses, and reporting of animal science and food science research. ***(Same course as FDSC 5553)***

ANSI 5573*
Techniques in Animal Molecular Biology
- Effective Summer '09 - **Lab 4.** Prerequisite(s): BIOC 4113. Principles of major basic animal molecular biology techniques in gene cloning and expression. Hands-on experience with basic molecular biology techniques, including DNA cloning and quantitative measurement of mRNA and protein expression in eukaryotic cells.

ANSI 5733*
Advanced Ruminant Nutrition
Lab 2. Prerequisite(s): 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.

ANSI 5743*
Rumenology
Prerequisite(s): 3653 or equivalent. Physiology of development of the ruminant digestive tract; the nature of, and factors controlling digestion and absorption from the tract to include the relative nature and roles of the rumen bacteria and protozoa.

ANSI 5753*
Animal Nutrition Techniques and Laboratory Methods
Lab 2. Prerequisite(s): 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.

ANSI 5763*
Advanced Nonruminant Nutrition
Prerequisite(s): BIOC 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.

ANSI 5773*
Protein Nutrition
Prerequisite(s): BIOC 3653. Nutritional, biochemical and clinical aspects of protein metabolism as it relates to nutritional status.

ANSI 5782*
Vitamin and Mineral Nutrition
Prerequisite(s): BIOC 5753. 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.

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

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

ANSI 6110*
Seminar
1 credit, max 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. ***(Same course as 5110*)***

Anthropology (ANTH)

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

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

ANTH 3443
(I,S)Peoples of Mesoamerica
Modern indigenous peoples of Mexico and Central America. Examination of contemporary communities and modern social and cultural practices understood from a historical perspective, leading to an appreciation of regional similarities and diversity.

ANTH 3990
Fieldwork in Anthropology
1-8 credits, max 8. Prerequisite(s): Consent of instructor. Instruction through ethnographic or archaeological field techniques by participation in a field program. Topics subject to change from year to year depending upon the type of field program offered or available.

ANTH 4223
(S)The Aztec Empire
Society and Culture of the Aztecs of Mesoamerica. Overview of preceding civilizations, analysis of imperial strategies, social organization, religion, and other topics culminating in the Spanish conquest.

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

ANTH 4990*
Special Topics in Anthropology
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Directed readings or research on significant topics in anthropology.

ANTH 5243*
Globalization and Culture
Prerequisite(s): Admission to Graduate College and International Studies. Critical assessment of 20th century social scientific theories of development culminating in current theories of globalization. Exploration of capitalism's antecedents, origin, and proliferation. Evaluation of global inequality from a cross-culture perspective. Utility of anthropological theories of culture, ideology and hegemony in assessing local responses to globalization. *No credit for students with credit in INTL 5243.* ***(Same course as INTL 5243)***

ANTH 5990*
Advanced Problems and Issues in Anthropology
1-9 credits, max 9. Prerequisite(s): Consent of instructor. Group enrollment or individual research enrollment as needed. Graduate level analysis of special problems and issues in Anthropology not covered in other department offerings.

Architecture (ARCH)

ARCH 1112
Introduction to Architecture
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.

ARCH 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.

ARCH 2003
(H,I)Architecture and Society
Design, planning, and building considered in their social and aesthetic contexts. *Some sections may be restricted to Architecture and Architectural Engineering majors, see course offerings.*

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

ARCH 2116
Architectural Design Studio II
Lab 16. Prerequisite(s): Grade of "C" or better in 1216. 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.

ARCH 2216
Architectural Design Studio III
Lab 16. Prerequisite(s): Grade of "C" or better in 1216 and 2116. Problems in architectural design. 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.

ARCH 2263
Building Systems
- Effective Spring '09 - Prerequisite(s): Grade of "C" or better in 1215 and 2115. Architectural, structural, and environmental control systems.

ARCH 3073
History and Theory of Greek and Roman Architecture
Prerequisite(s): 2003. History and theory of the ancient Greek and Roman periods of architecture.

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

ARCH 3100
Special Topics in Architecture
1-6 credits, max 12. Subjects to be selected by the faculty in architecture from advances in state-of-the-art areas.

ARCH 3116
Architectural Design Studio IV
Lab 16. Prerequisite(s): Grade of "C" or better in 2216 and admission to third year. Problems in architectural design.

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

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

ARCH 3143
Structures: Analysis I
Lab 2. Prerequisite(s): Grade of "C" or better in ENSC 2143. Structural theory for applications in architecture.

ARCH 3216
Architectural Design Studio V
- Effective Spring '09 - **Lab 16.** Prerequisite(s): Grade of "C" or better in 3116, 3252. Problems in architectural design.

ARCH 3223
Structures: Timbers
Lab 2. Prerequisite(s): Grade of "C" or better in 3323. Analysis and design of timber structures used in architecture.

ARCH 3224
Structures: Steel II
- Effective Spring '09 - **Lab 2.** Prerequisite(s): Grades of "C" or better in 3323 and 3143. Design and analysis of multi-story steel frames, trusses, arches, and other architectural structure components.

ARCH 3253
Computer Applications in Architecture
Lab 3. Prerequisite(s): Grade of "C" or better in 3116. Introduction to 2-D and 3-D computer CAD topics and their application in the design process.

ARCH 3263
Materials in Architecture
Prerequisite(s): Grade of "C" or better in 2263 and admission to third year. Introduction to the basic materials used in the construction of architecture and how such materials affect both the design and implementation of the systems that incorporate these materials.

ARCH 3323
Structures: Steel I
Prerequisite(s): Grade of "C" or better in ENSC 2113 and admission to the professional program, or permission of school head and adviser. Analysis and design of steel structures used in architecture.

ARCH 3433*
Environmental Control: Acoustics and Lighting
Lab 2. Prerequisite(s): MATH 1513 or 1715. A survey of architectural acoustics, electrical, and lighting systems for buildings.

ARCH 3462
Computer Applications in Architectural Engineering
Prerequisite(s): Admission to the professional program. Co-requisite(s): Enrollment with 3252 required. Computer applications in architectural engineering introducing AUTOCAD, computer programming, and the use of commercial analytical software.

ARCH 4053*
Computer Applications in Architecture
Lab 3. Prerequisite(s): 3253 or 3454. State-of-the-art applications of computers to the practice of architecture and architectural engineering.

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

ARCH 4083
History and Theory of English and Early American Architecture
Prerequisite(s): 2003. English renaissance architecture from 1483 to 1837 and its importance to developments in early American architecture.

ARCH 4100
Special Topics in Architecture
1-6 credits, max 12. Prerequisite(s): Consent of instructor and head of the school. Subjects to be selected by the faculty in architecture from advances in state-of-the-art areas.

ARCH 4116
Architectural Design Studio V
Lab 6. Prerequisite(s): Grades of "C" or better in 3116 and 3253. Problems in architectural design.

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

ARCH 4143*
Structures: Foundations for Buildings
Lab 2. Prerequisite(s): Grade of "C" or better in 3126. Interaction of frames and supports for structures used in architecture. Subsurface conditions and design of foundation systems and retaining walls for buildings.

ARCH 4183*
History and Theory of Architecture: Cities
Prerequisite(s): 2003. The development of cities as an aspect of architecture from ancient times to the twentieth century.

ARCH 4216
Architectural Design Studio VI
Lab 16. Prerequisite(s): Grades of "C" or better in 3126, 3134, 3433, 4116. Enrollment in appropriate architectural seminar required. Problems in architectural design.

ARCH 4225*
Structures: Concrete II
Lab 4. Prerequisite(s): Grades of "C" or better in 3126, 3454, and 4143. Design and analysis of multi-story reinforced concrete frames and prestressed and post-stressed concrete structural components used in architecture applications.

ARCH 4233*
Sustainability Issues in Architecture
Prerequisite(s): Grade of "C" or better in 3134. Sustainability topics and their application to architecture.

ARCH 4263
Architecture Seminar
Prerequisite(s): Concurrent enrollment in 4226 or 5226. Topics in architecture and architectural engineering.

ARCH 4273
History and Theory of Islamic Architecture
Prerequisite(s): 2003. Architecture of the Islamic World.

ARCH 4293
(H)The Ethics of the Built Environment
Prerequisite(s): Admission to the professional program or consent of instructor. Analysis of basic values that determine the form of the built environment.

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

ARCH 4443*
Structures: Analysis II
Lab 2. Prerequisite(s): 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.

ARCH 5023*
Masonry Design and Analysis
Prerequisite(s): Grade of "C" or better in 4123. 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.

ARCH 5083*
History and Theory of Japanese Architecture
Prerequisite(s): Admission to the professional school or consent of instructor. Historical Japanese architecture from 200 BC to 1980; Shinto, Buddhist, Zen Sukiya, Zukuri, Minka and contemporary subjects.

ARCH 5100*
Special Topics in Architecture
1-6 credits, max 12. Prerequisite(s): Consent of instructor and head of the school. Subjects to be selected by the faculty in architecture from advances in state-of-the-art areas.

ARCH 5116*
Architectural Design Studio VII
Lab 6. Prerequisite(s): Grade of "C" or better in 4216. Problems in architectural design.

ARCH 5143*
Structures: Special Loadings
Lab 2. Prerequisite(s): Grade of "C" or better in ARCH 4443. Mathematical formulations and modeling in architectural structures. Human response to vibrations. Seismic design in building. Design for extreme winds on buildings. Approximate methods for preliminary design of architectural structures.

ARCH 5193*
Management of Architectural Practice
Prerequisite(s): 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.

ARCH 5217*
Architectural Design Studio VIII
Lab 16. Prerequisite(s): Grade of "C" or better in 5116 or consent of instructor. Problems in architectural design.

ARCH 5226*
Architectural Engineering Comprehensive Design Studio
Lab 6. Prerequisite(s): Grade of "C" or better in 3116, 3224, 3454, 4143, 4225, 4443. Problems in architectural and architectural engineering design.

ARCH 5293*
Architectural Project Management
Prerequisite(s): Concurrent enrollment in 4226 or 5226 or consent of instructor. Principles of management as applied to architectural and architectural engineering projects.

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

ARCH 6000*
Special Problems
1-15 credits, max 15, Lab 3-18. Prerequisite(s): 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.

ARCH 6073*
History and Theory of Non-Western Architecture
Prerequisite(s): Graduate standing or consent of instructor. Architecture in the non-Western and pre-Columbian world.

ARCH 6083*
History and Theory of Contemporary Architecture
Prerequisite(s): Graduate standing or consent of instructor. American architecture beginning in the 16th century through the 20th century.

ARCH 6113*
Creative Component Research
Prerequisite(s): Admission to graduate program. Data gathering, analysis and program formulation related to creative component.

ARCH 6117*
Graduate Design Studio I
Lab 20. Prerequisite(s): Admission to graduate program. Problems in architectural design.

ARCH 6193*
Financial Management for Architects and Engineers
Prerequisite(s): 3116. Financial aspects of design firm management, including fundamentals of finance, profit planning and control, cash management, and analysis of financial statements.

ARCH 6203*
Creative Component in Architectural Engineering
Lab 6. 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.

ARCH 6207*
Creative Component in Architecture
Lab 20. Prerequisite(s): 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.

ARCH 6243*
Structures: Analysis III
- Effective Spring '09 - Prerequisite(s): Grade of "C" or better in 4443 and admission to the graduate program. Analysis techniques for architectural structures including stability, space frames, computer applications, guyed towers and project research.

ARCH 6244*
Structures: Analysis III
- Effective through Fall '08 - Prerequisite(s): Grade of "C" or better in 4443. Analysis techniques for architectural structures including stability, space frames, computer applications, guyed towers and project research.

ARCH 6343*
Structures: Steel III
Prerequisite(s): Grade of "C" or better in 4144. Plastic analysis and design of structural steel frames utilizing load and resistance factor design.

ARCH 6543*
Structures: Concrete III
Prerequisite(s): Grade of "C" or better in 5244. Design of prestressed concrete structures, including pre- and post-tensioning.

Art (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.

ART 1113
Drawing II
Lab 6. Prerequisite(s): 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.

ART 1203
Two-dimensional Foundations
Lab 6. Introduction to visual problem solving and two-dimensional media. Organization to the two-dimensional plane; line, shape, value and texture. Color theory including hue, value and saturation.

ART 1303
Three-dimensional Foundations
Lab 6. Prerequisite(s): 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.

ART 1603
(H)Introduction to Art
Introductory survey of art history from ancient times to the present. *No credit for those with prior credit in 2603 or 2613.*

ART 2003
Studio Methods and Preparation
Lab 6. Portfolio concept development including idea generation, sketchbook, analyzing and evaluating art criticism and select contemporary artists. Professional portfolio presentation, including matting, slide documentation, labeling and resume as a precursor to the sophomore review.

ART 2113
Life Drawing
Lab 6. Prerequisite(s): 1113. Introduction to 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.

ART 2213
Color Theory
Lab 6. Prerequisite(s): 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.

ART 2223
Oil Painting I
Lab 6. Prerequisite(s): 1113, 1203, 1303, 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.

ART 2233
Watercolor I
Lab 6. Prerequisite(s): 1103, 1203, 1303, or consent of instructor. The development of technical skills stressing color, form, and content. Assignments cover paper preparation and support, brush handling, pigment characteristics and mixing, and all basic dry surface and wet surface painting techniques.

ART 2243
Jewelry and Metals I
Lab 6. Prerequisite(s): 1113, 1303, 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.

ART 2253
Ceramics I
Lab 6. Prerequisite(s): 1113, 1303, or consent of instructor. Introduction to basic building techniques including wheel throwing, coiling, and slab construction, as well as slip and glaze application and a variety of firing processes. Exposure to historical and contemporary references. Emphasis on personal growth through technique and concept.

ART 2263
Sculpture I
Lab 6. Prerequisite(s): 1113, 1303. Studies in clay and plaster. Subtractive and additive processes. Emphasis on sculptural ideas, methods, and materials.

ART 2273
Introduction to Printmaking
Lab 6. Prerequisite(s): 1113, 1203, 1303 or consent of instructor. Varied print processes, including monotypes, relief printmaking, and intaglio. Fundamental techniques of each medium that include inking, printing, editioning multiples, and both additive and subtractive approaches.

ART 2403
Illustration I
Lab 6. Prerequisite(s): 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.

ART 2413
Typography I
Lab 6. Prerequisite(s): 1113 and 2.5 graduation/retention GPA. An investigation of letter forms and 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.

ART 2423
Graphic Design I
Lab 6. Prerequisite(s): 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 and presentation skills.

ART 2603
(H)Art History Survey I
The arts, artists, and their cultures from prehistoric times through the Early Renaissance. *No credit for those with prior credit in 1603.*

ART 2613
(H)Art History Survey II
The arts, artists, and their cultures from the Early Renaissance to the present. *No credit for those with prior credit in 1603.*

ART 3110
Life Drawing Studio
3 credits, max 9, Lab 6. Prerequisite(s): 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. ***(Same course as 4100)***

ART 3223
Oil Painting II
Lab 6. Prerequisite(s): 2223 and proficiency review or consent of instructor. Oil Painting with emphasis on personal development of visual ideas and techniques.

ART 3233
Watercolor II
Lab 6. Prerequisite(s): 2233 and proficiency review or consent of instructor. Stresses continued growth of technical skills with an emphasis on the individual development of ideas and imagery.

ART 3243
Jewelry and Metals II
Lab 6. Prerequisite(s): 2243 and proficiency review or consent of instructor. Development of technical skills and ideas through assigned projects. Metalworking processes include casting, advanced stone setting, hinge making, and forming of metal.

ART 3253
Ceramics II
Lab 6. Prerequisite(s): 2253 and proficiency review or consent of instructor. Focus on either hand building or throwing techniques. Development of personal expression and technical proficiency with the material and advanced firing and glazing processes. Emphasizing contemporary ceramic issues as well as broader art concepts.

ART 3263
Sculpture II
Lab 6. Prerequisite(s): 2263 and proficiency review. Non-ferrous metal casting. Basic welding techniques using oxy-acetylene, electric arc, and T.I.G. methods. Emphasis on concepts, form, methods and materials.

ART 3270
Printmaking: Relief
3 credits, max 9, Lab 6. Prerequisite(s): 2273 and proficiency review 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.

ART 3280
Printmaking: Intaglio
3 credits, max 9, Lab 6. Prerequisite(s): 2273 and proficiency review 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.

ART 3290
Printmaking: Lithography
3 credits, max 9, Lab 6. Prerequisite(s): 2273 and proficiency review 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.

ART 3403
Illustration II
Lab 6. Prerequisite(s): 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. ***(Same course as 4430)***

ART 3413
Typography II
Lab 6. Prerequisite(s): 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.

ART 3423
Graphic Design II
Lab 6. Prerequisite(s): 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 comprehensive. 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.

ART 3443
Computer Graphics I
Lab 6. Prerequisite(s): 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.

ART 3600
Writing Methods in Art History
1 credit, max 3. Prerequisite(s): 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.

ART 3603
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.

ART 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.

ART 3623
(H)History of Italian Renaissance Art
Architecture, sculpture, and painting in Italy, c.1300-1580. Major artists in their local contexts (e.g. Leonardo in Milan, Michelangelo in Florence, and Titian in Venice).

ART 3633
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).

ART 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.

ART 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.

ART 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.

ART 3673
History of Northern Renaissance Art
Art in Northern Europe, c. 1200-1550. Emphasis on panel painting in the Netherlands (e.g. Van Eyck, Bosch), and book illustration in Germany (Dürer).

ART 3683
(H,I)History of 20th Century Art
Beginning with the birth of "modernism" in the late 19th century, exploration of the fast-changing artistic styles of the 20th century: abstraction, expressionism, fantasy, realism, surrealism, and social protest. Emphasis on the relationship of art and 20th century society.

ART 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.

ART 4100
Advanced Drawing
3 credits, max 9, Lab 6. Prerequisite(s): 3110. Investigation of drawing stressing thematic development, abstract ideas, and individual imagery. ***(Same course as 3110)***

ART 4213
Studio Capstone
Prerequisite(s): Concurrent enrollment in upper-division studio course and consent of instructor. Final presentation of the professional BFA portfolio in a gallery space, including support materials, exhibition advertising professionally prepared and presented, and the defense of exhibition.

ART 4220
Oil Painting Studio
3 credits, max 9, Lab 6. Prerequisite(s): 3223. Oil painting with emphasis on continuing personal development of visual ideas and techniques.

ART 4230
Watercolor Studio
3 credits, max 9, Lab 6. Prerequisite(s): 3233. Stresses continued growth of personal imagery with an emphasis on the development of a consistent body of work and professional portfolio.

ART 4240
Jewelry and Metals Studio
3 credits, max 9, Lab 6. Prerequisite(s): 3243. Emphasis on further development of personal concepts and technical skills through assigned and individual oriented projects. Broad-based exploration of advanced metalworking processes with emphasis on individual students' direction and technical needs.

ART 4250
Ceramics Studio
3 credits, max 9, Lab 6. Prerequisite(s): 3253. Intended for students who want to specialize in the ceramic field of art. Will include sophisticated techniques of clay, glaze and firing methods. Emphasis on creation of a unique, well researched, aesthetically concise, and technically successful body of work.

ART 4260
Sculpture Studio
3 credits, max 9, Lab 6. Prerequisite(s): 3263. 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.

ART 4420
Graphic Design Studio
3 credits, max 9, Lab 6. Prerequisite(s): 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.

ART 4430
Illustration Studio
3 credits, max 9, Lab 6. Prerequisite(s): 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. ***(Same course as 3403)***

ART 4450
Computer Graphics Studio
3 credits, max 9, Lab 6. Prerequisite(s): 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.

ART 4493
Portfolio Capstone
Lab 6. Prerequisite(s): 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.

ART 4603
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.

ART 4613
Art Since 1960
Art and art theory from 1960 to the present. Major trends of Minimalism, Pop Art, Photorealism, Performance, and Conceptual Art. Theories and intellectual bases of each movement as well as major critical responses.

ART 4633
(H)The Frontier & American Visual Culture
The frontier and its impact on American culture examined through a survey of paintings, sculpture, photography, film, television, and other forms of popular imagery. The frontier as a zone of cultural interaction that is seldom tied to a single culture. ***(Same course as AMST 4633)***

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

ART 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.

ART 4673
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.

ART 4683
(I)History of Contemporary South Asian Art
Continuation of 4653. History and culture of South Asia (India and Pakistan) explored through its art from 1800 to the present. The effects of colonialism and the nature of modernism in the art of South Asia.

ART 4800
(H,I)Special Studies in Art
1-3 credits, max 9. Prerequisite(s): Junior standing and consent of instructor. Courses in media exploration, special subjects and current issues. Offered on campus or through extension workshops.

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

ART 4820
Graphic Design Internship
1-6 credits, max 6. Prerequisite(s): 3403 or 3423 and consent of instructor. An on-site graphic design work experience that provides professional practice under the supervision of a design professional.

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

ART 4900*
Directed Study in Art
1-3 credits, max 9, Lab 1-6. Prerequisite(s): Junior standing and written permission of department head. Self-designed special topics in studio art or graphic design. By contract only.

ART 4910*
Directed Study in Art History
1-3 credits, max 9, Lab 1-6. Prerequisite(s): Junior standing and written consent of department head. Self-designed special topics in art history. By contract only.

ART 4933
Art in Context
Prerequisite(s): 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.

ART 4993
Senior Honors Project
Lab 3. Prerequisite(s): 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.*

ART 5900*
Graduate Studies in Art
1-6 credits, max 12. Prerequisite(s): BA, BFA or 15 upper-division hours in a discipline; consent of instructor. Projects in art with emphasis on portfolio preparation.

ART 5910*
Graduate Studies in Art History
1-6 credits, max 12. Prerequisite(s): BA, BFA or 15 upper-division hours in art history; consent of instructor. Advanced research in art history.

Arts and Sciences (A&S)

A&S 1111
Freshman Orientation
Orientation for freshmen. Study techniques, evaluation of one's abilities and the making of proper educational and vocational choices.

A&S 1221
Honors Freshman Orientation
Prerequisite(s): 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.*

A&S 2000
Special Topics
1-3 credits, max 6. Selected interdisciplinary topics presented in lecture or seminar format.

A&S 2001
Introduction to European Studies
Overview of the history, languages, and cultures of the nations currently constituting the European Union.

A&S 3080
International Experience
1-18 credits, max 36. Prerequisite(s): Consent of the associate dean of the college. Participation in a formal or informal educational experience outside of the USA.

A&S 3090
(I)Study Abroad
1-18 credits, max 36. Prerequisite(s): Consent of the Study Abroad office and associate dean of the college. Participation in an OSU reciprocal exchange program.

A&S 3111
New Student Seminar
Orientation to OSU for new transfer students. Topics include advanced study and writing skills, financial management, career development and the transition from college to work.

A&S 3710
Arts and Sciences Internship
1-3 credits, max 6. Prerequisite(s): 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.

A&S 4000
Special Topics
1-3 credits, max 6. Selected interdisciplinary topics presented in lecture or seminar format.

A&S 4013
Liberal Studies Senior Project
Prerequisite(s): Consent of instructor. Research report or other creative activity undertaken to satisfy capstone requirement for liberal studies degree.

A&S 4111
Job Search Strategies for Arts and Sciences Majors
Prerequisite(s): Junior standing. Identification of individual goals and transferable skills, exploration of career options, job market research, and development of employment search tools.

Astronomy (ASTR)

ASTR 1014
(N)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.*

ASTR 1024
(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 tachyons. *Offered in the spring semester. No credit for those with credit in 1104.*

ASTR 4010
Observatory Research
1-2 credits, max 8. Prerequisite(s): PHYS 2114 and consent of instructor; ASTR 1014 or ASTR 1024 recommended. Team execution of multi-semester observing programs with electronic detectors at OSU's off-campus observatory. Introduction to digital image processing and analysis.

Aviation Education (AVED)

AVED 1114
Theory of Flight
Private pilot ground school. Theory of flight, principles of navigation, meteorology and Federal Aviation Regulations. Preparation for FAA private pilot computer-based knowledge exam. *Special fee required.*

AVED 1222
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.*

AVED 1403
Advanced Theory of Flight
Prerequisite(s): 1114 and passed FAA Private Pilot Examination. Advanced navigation, aircraft performance and meteorology, and introduction to crew resource management.

AVED 2113
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.

AVED 2122
Commercial Flight Laboratory I
Lab 4. Prerequisite(s): 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.*

AVED 2132
Commercial Flight Laboratory II
Lab 4. Prerequisite(s): 2122. Dual instrument flight instruction to meet requirements for FAA instrument rating. Flight instruction conducted under FAR Part 141. *Special fee required.*

AVED 2142
Commercial Flight Laboratory III
Lab 4. Prerequisite(s): 2132. Final flight lab to meet requirements for the FAA commercial pilot certificate. Flight instruction conducted under FAR Part 141. *Special fee required.*

AVED 2213
Theory of Instrument Flight
Prerequisite(s): 1403. Instrument flight rules, the air traffic system and procedures, the elements of forecasting weather trends. Preparation for FAA instrument computer-based knowledge exam.

AVED 2313
Theory of Commercial Flight
Prerequisite(s): 2213. Advanced aircraft systems, aerodynamics, federal aviation regulations, airports and airspace, navigation, and performance. Preparation for FAA Commercial Pilot Written Examination. *Special fee required.*

AVED 2513
Aviation Career Planning and Development
Assessment of career interests and aviation job opportunities that match those interests. Development of an academic and career learning and development plan consistent with identified interests.

AVED 3231
Theory of Multi-engine Flight
Prerequisite(s): Private Pilot Certificate. Aeronautical theory and information required for operating the multi-engine airplane safely, efficiently and within its specified limitations. Emphasis on aerodynamics and multi-engine emergencies.

AVED 3243
Human Factors in Aviation
Prerequisite(s): PSYC 1113, PHIL 1213. The study of people interacting with the aviation environment. Individual and group performance, equipment design, physical environment and procedure development.

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

AVED 3341
Multi-engine Flight Laboratory
Lab 2. Prerequisite(s): 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.*

AVED 3433
Aviation/Aerospace Ethics
Prerequisite(s): PHIL 1213. Ethical decision-making as applied to the aviation and aerospace industry, an industry with narrow tolerance for error in terms of human life and economic impact. Awareness of aviation ethical issues and associated decision-making skills.

AVED 3443
Aviation Legal and Regulatory Issues
Prerequisite(s): PHIL 1213. 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.

AVED 3453
Aviation/Aerospace Security Issues
Analysis of the legal and regulatory responses to changing threats to aerospace security. Review of technological solutions for airports and aircraft.

AVED 3463
Aerospace Maintenance and Safety
Identification and management of the human errors encountered in all aspects of aircraft maintenance operations. Case studies of maintenance-related accidents: line, hangar, and overhaul maintenance. The role of quality control and quality assurance are also examined as tools in reducing maintenance error.

AVED 3473
OSHA for Aerospace Managers
Occupational safety and health requirements within the aerospace industry. History of OSHA, OSHA regulations relative to aerospace organizations along with recent inspection results and published violations.

AVED 3513
Aviation/Aerospace Management Principles
Prerequisite(s): 50 credit hours. Managing the major elements of the aviation/aerospace industry, including aircraft manufacturing and air transportation system.

AVED 3523
Airport Planning and Management
Prerequisite(s): 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.

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

AVED 3543
Aerospace Organizational Communications
Aerospace communication to aid aviation students in proper use of written and verbal skills needed in various aerospace leadership roles.

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

AVED 3573
Aviation/Aerospace Finance
Prerequisite(s): 50 credit hours. Financing the major elements of the aerospace industry, including general aviation, aircraft manufacturing and airports.

AVED 3663
Aerospace and Air Carrier Industry
Prerequisite(s): 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.

AVED 4100*
Specialized Studies in Aviation
1-3 credits, max 6. Prerequisite(s): 55 credit hours. Independent studies, seminars, and training within selected areas of aviation.

AVED 4103
Aerospace Distribution, Warehousing and Transportation
Aerospace logistics concepts and the management of aerospace distribution activities ranging from top management planning to warehousing and shipping.

AVED 4113*
Aviation Safety
Prerequisite(s): 50 credit hours. Flight safety including studies in human factors, weather, aircraft crashworthiness, accident investigation, and aviation safety programs. Elements of aviation safety and flight operations (private flying, flight instruction, and business flying) and commercial aviation.

AVED 4123
Aerospace Depot Maintenance
Aerospace depot maintenance operational and budget issues related to Economic Order Quality, Materials Requirement Planning, Benefit Cost Analysis, repair expenditures, fleet flight hours, transport modules, handling, shipping and other activities.

AVED 4133
Principles of Flight Instruction
Prerequisite(s): 2142, 2313. Development of flight training lesson plans and syllabi. Application of learning theory and teaching fundamentals to flight maneuvers and performance evaluation. Preparation for the FAA Fundamentals of Instructing and Flight Instructor-Airplane Written Examinations.

AVED 4143
Government Operations and Interfaces in Aerospace Management
Government and its impact on aerospace management decisions related to logistics, inventory management, production, and operations.

AVED 4153
Aerospace Sustainment
Prerequisite(s): Senior standing. A capstone course requiring application of all elements of the supply-chain management process to an aerospace organizational problem or project.

AVED 4163
FAA and Aerospace Logistics Regulations and Requirements
Government regulations and requirements and the impact of those requirements on the aerospace supply chain management processes using case scenarios related to logistics, aviation, operations, procurement and the environment.

AVED 4173
Aerospace Logistics Quality Programs
Logistics quality programs, including TQM, Kaizen, Lean, Six Sigma, and ISO 9000 in aerospace organizations.

AVED 4193
Aerospace Human Resource Management and Aerospace Workforce Acquisition
Workforce planning techniques to strengthen knowledge retention practices within the aerospace industry.

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

AVED 4232
Flight Instructor: Airplane Flight Laboratory
Lab 4. Prerequisite(s): 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.*

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

AVED 4331
Flight Instructor: Instrument Flight Laboratory
Lab 2. Prerequisite(s): 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.*

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

AVED 4353*
Cockpit Automation
Prerequisite(s): 2213, 2132, 3333. A study of aircraft "glass cockpits", including performance management, navigation and guidance, automatic flight control, flight instrument displays, and crew advisory and warning.

AVED 4413*
Aviation Terrorism and Asymmetrical Warfare
Origins of modern terrorism and asymmetrical warfare as it related to current aviation security issues. A historical perspective to the headlines of today providing an understanding needed in making future security decisions.

AVED 4423*
Aviation Security Organizations and Law
Understanding how security systems and law are organized and managed. Problems facing security management, including recruiting, screening, and hiring of security personnel. Problems associated with 24/7 operations.

AVED 4433
Airport Safety Inspections
Safety requirements of US general aviation airports. Elements of the 5010 airport inspection program, FAA advisory circulars, and other pertinent documents.

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

AVED 4653
(I)International Aerospace Issues
Prerequisite(s): 50 credit hours. Fundamental knowledge, comprehension and abilities to apply, analyze, synthesize and evaluate international aerospace issues, including trends in security, safety, technology, and organizations.

AVED 4663
Aerospace Leadership
Leadership theories and practices applicable to the aerospace environment and the types of leadership skills required for 21st Century aerospace organizational leaders.

AVED 4703
Crew Resource Management
Prerequisite(s): 2142, 3243, PHIL 1213. Discovering how resource management applies to crew behavior in aviation. Special emphasis on decision-making, judgment, teamwork, stress management, situation awareness, leadership, and workload management. Ten hours in a dual flight control multi-engine simulator. *Special fee required.*

AVED 4771
Flight Instructor: Multi-engine Flight Laboratory
Lab 2. Prerequisite(s): 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.*

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

AVED 4953*
Corporate and General Aviation Management
Prerequisite(s): 2142 and 3341. Study of management principles and practices of corporate and general aviation. Equipment acquisition, legal requirements, government regulations, flight operations, aircraft maintenance, management and investment decision-making.

AVED 4963*
Airport Design
Overview of airport planning and development parameters, airport design considerations, economic impact of airport development, and a global examination of airport expansion projects.

AVED 4973
Aerospace Industry Hazardous Materials or Dangerous Goods
Regulatory requirements and compliance issues in managing aerospace industry hazardous materials and dangerous goods.

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

AVED 4993
Aviation Labor Relations
Aviation industry laws, regulations, and procedures for management and organized labor from historical through current perspectives. Focus on economic, legal, political, and public policy factors in aviation.

AVED 5000*
Master's Report or Thesis
1-6 credits, max 6. Prerequisite(s): Consent of adviser. Students studying for a master's degree enroll in this course for a total of 3 credit hours if writing a report or 6 hours if writing a thesis.

AVED 5020*
Seminar in Aerospace Education
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Individual research problems in aerospace education.

AVED 5053*
Guided Reading and Research
Prerequisite(s): Consent of instructor. Guidance in reading and research required for the MS in aviation and space program.

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

AVED 5113*
Aviation Safety Program Development
Prerequisite(s): 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.

AVED 5200*
Graduate Internship in Aviation and Space
1-6 credits, max 6. Directed field experiences in aerospace education for master's students.

AVED 5203*
Aeromedical Factors
Prerequisite(s): 3243. The study of aeromedical factors that influence pilot performance. The study of life support equipment designed to increase aviation safety.

AVED 5303*
Aviation and Space Quality Issues
A study of the practice and research involved in implementing aviation and space quality issues.

AVED 5333*
Aircraft Performance
Operational flight performance issues, especially transition from propeller-driven to jet aircraft. Use of flight simulation software to determine optimal speeds for climb, descent, range and maximum endurance of a specific aircraft model.

AVED 5363*
Aircraft Systems
Flight management systems, data exchange busses, computerized flight control systems, airframe environmental systems, electrical, pressurization, fuel and icing. Earlier generation aircraft systems contrasted with modern aircraft systems.

AVED 5403*
Passenger Screening Technology
Understanding of the technologies currently in use or being tested in airports. Passenger screening technologies and their role in establishing a layered security program.

AVED 5413*
Landside Security Technologies
Technologies available for protecting the landside of the airport. Access control systems, blast protection and mitigation planning, perimeter security technologies and biometric technologies.

AVED 5423*
Security Planning Audits and NIMS
The management of a security program. Written security plans, security audits, emergency management, and the National Incident Management System.

AVED 5433*
General Aviation and Cargo Security
Overview of airport operations: regulatory history of air transportation, aviation forecasting, capacity and delay issues at airports, environmental issues, airport emergency procedures and aircraft rescue and fire-fighting, and airport system and master planning.

AVED 5443*
International Aviation Security
Civil aviation security structure required of all airports and airlines engaged in international civil aviation operations. Focuses on the requirements of the International Civil Aviation Organization, specifically ICAO Annex 17.

AVED 5453*
Advanced Aviation Security
Prerequisite(s): Graduate standing. In-depth look at aviation security. Development of a greater understanding of problems associated with maintaining a secure aviation transportation industry. Familiarity with the history of attacks against aircraft, airports and other aviation facilities.

AVED 5543*
Advanced Aerospace Communications
Interdisciplinary area of study drawing from previous knowledge and experience in effective management and leadership communication to meet the unique demands of the field of aviation. A broad range of academic disciplines and technical experience guiding aviation professionals in the refinement of personal, team and organizational communications.

AVED 5553*
Aerospace Financial and Business Inventory Management
Aerospace logistics inventory planning and management and the methods for managing revenues and costs by selection of best carriers, setting logistics performance goals and planning logistics strategies for streamlining shipping and receiving.

AVED 5563*
Aerospace Leadership and Management
Introductory course on leadership and management issues in the highly volatile aerospace environment. Introduction to management and leadership theory of the past, and exploration of the aviation environment of the future.

AVED 5663*
Issues in the Airline/Aerospace Industry
The components, participants, activities, characteristics, scope and economic significance of the air carrier industry and its major segments. The effects of regulation, competition, marketing, manufacturing and environmental control.

AVED 5720*
Current Issues in Aerospace Education
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Current issues in aerospace education.

AVED 5813*
Earth Observation Systems
Prerequisite(s): GEOG 4333. A study of systems orbiting earth that collect data on the land and atmosphere.

AVED 5823*
Space Science
A study of the sun, inner and outer planets, asteroid belt, space probe exploration, orbital mechanics and missions.

AVED 5850*
Directed Readings in Aerospace Education
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Directed studies in aerospace education.

AVED 5883*
Aviation Economics
The economic significance of the air carrier industry and its major segments. The effects of regulation, competition, schedules, marketing and environmental control.

AVED 5910*
Practicum in Aerospace Education
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Directed observation and supervised clinical experiences in aerospace education.

AVED 5963*
Airport Operations
Prerequisite(s): Graduate standing. Extensive overview of airport operations. Familiarity with the regulatory history of air transportation, airports, the Federal Aviation Administration, and the Transportation Security Agency. Introduction to a wide variety of organizational structures found at US airports.

AVED 5973*
Aerospace Law
Study of the legal system as it relates to aerospace law and governance of the aviation industry.

AVED 6000*
Doctoral Thesis
1-15 credits, max 15. Required of all candidates for the EdD in applied educational studies. Credit awarded upon completion of the thesis.

AVED 6303*
Aviation and Space Safety Data Analysis
A doctoral seminar in the practical application and research of aerospace databases. Qualitative and mixed method tools common to research in the fields of aviation and aerospace are emphasized.

AVED 6313*
Administration of Aviation Institutions
A study of the organization and administration of public and private aviation institutions. Study of the impact of economic and governmental system on these institutions.

AVED 6413*
Development of Air and Space Flight
Specific air and space missions with emphasis on contributions to humankind.

AVED 6423*
Certification of Airplanes
A study of the practices and research involved in the certification of airplanes.

AVED 6443*
Certification of Rotorcraft
A study of the practices and research involved in the certification of rotorcraft.

AVED 6613*
Aviation Executive Development
A study of the styles of aviation executives in private and public aviation organizations.

AVED 6773*
Applied Aviation and Space Research
Prerequisite(s): Consent of instructor and approval of student's advisory committee. Action research topics in aviation and space identified by the aerospace industry with emphasis upon publications in aviation and space refereed journals and trade publications.

AVED 6883*
Doctoral Internship in Aviation and Space
Prerequisite(s): Consent and approval of student's advisory committee. Directed field experiences in aerospace education for doctoral students.

AVED 6943*
Aviation Regulatory Law
A study of the practical application and research of the FAA regulatory process and associated case law.

AVED 6963*
Advanced Aircraft Accident Investigation
Prerequisite(s): 4943. Application and practice of the different statutes, regulations, and regulatory agency requirements that influence aircraft accident investigations.

Biochemistry (BIOC)

BIOC 1990
Freshman Research in Biochemistry
1-2 credits, max 2, Lab 3. An introduction to biochemical research through guided work on a relevant experimental problem.

BIOC 2101
The Experiments Behind the Facts of Real Science
Prerequisite(s): BIOL 1114 and CHEM 1515. Introduction to research though the study of primary research papers.

BIOC 2344
Chemistry and Applications of Biomolecules
Lab 3. Prerequisite(s): CHEM 1225. A descriptive survey of organic functional groups and biomolecules. Mode of formation and function of these molecules in microorganisms, plants and animals as they relate to biotechnology, environmental sciences and health related issues. A terminal course for students in applied biological science education. *Not recommended for preprofessional students or students planning graduate study in biological sciences.*

BIOC 3653*
Survey of Biochemistry
Prerequisite(s): CHEM 3015 or 3053. An introduction to the chemistry of living systems. Chemical properties of the constituents of living organisms. Modes of formation, reactions and function of these compounds in microorganisms, plants and animals.

BIOC 3723
Biochemical Laboratory
Lab 6. Prerequisite(s): 3653 or concurrent enrollment. Qualitative and quantitative examination of biochemical and molecular biology materials and reactions. Hands-on experience with contemporary aspects of biochemical and molecular biology techniques. *Designed for biochemistry majors and others desiring an extensive biochemical laboratory experience.*

BIOC 4113*
Biochemistry
Prerequisite(s): 3653 and BIOL 3023 (or ANSI 3423 or PLNT 3554). An extension and expansion of 3653 emphasizing applications of biochemistry, molecular biology and genetic engineering to studies on protein structure and function, regulation of cell function, metabolism and disease processes.

BIOC 4224*
Physical Chemistry for Biologists
Prerequisite(s): CHEM 1515, MATH 2133, PHYS 1214 or consent of instructor. Classical and statistical thermodynamics with applications to pure systems, solutions and electrochemistry; transport; chemical and enzyme kinetics, quantum chemistry of structure and chemical bond; and spectroscopy all with emphasis on biological applications.

BIOC 4990*
Special Problems
1-6 credits, max 10. Training in independent work, study of relevant literature and experimental investigation of an assigned problem.

BIOC 5000*
Research
1-6 credits, max 6. For MS thesis.

BIOC 5753*
Biochemical Principles
Prerequisite(s): 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.

BIOC 5824*
Biochemical Laboratory Methods
Lab 6. Prerequisite(s): 4113 or 5753. 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.

BIOC 5853*
Metabolism
Prerequisite(s): 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.

BIOC 5930*
Advanced Biochemical Techniques
1-4 credits, max 10. Prerequisite(s): 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.

BIOC 6000*
Research
1-15 credits, max 60. For PhD dissertation.

BIOC 6110*
Seminar
1-2 credits, max 2 for PhD or 1 for MS candidates.

BIOC 6740*
Physical Biochemistry
1-2 credits, max 2. Prerequisite(s): 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.*

BIOC 6763*
Nucleic Acids and Protein Synthesis
Prerequisite(s): 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.

BIOC 6773*
Protein Structure and Enzyme Function
Prerequisite(s): 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.

BIOC 6783*
Biomembranes and Bioenergetics
Prerequisite(s): 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.

BIOC 6792*
Plant Biochemistry
Prerequisite(s): 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.

BIOC 6820*
Selected Topics in Biochemistry
1-3 credits, max 15. Prerequisite(s): 5853. Recent developments in biochemistry. Subject matter varies from semester to semester; students should inquire at the department office before enrolling.

Biological Science (BIOL)

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.*

BIOL 3023
General Genetics
Prerequisite(s): BOT 1404, or ZOOL 1604, or equivalent. Inheritance in plants, animals, and microorganisms; molecular and classical aspects.

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

BIOL 3223
(N)Survey of Human Diseases
Prerequisite(s): 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.

BIOL 3232
Human Reproduction
Prerequisite(s): 1114. Overview of human reproduction, including anatomy, physiology, embryology, genetics, evolution, birth control, teratogenic substances, pregnancy and childbirth. For the nonbiology major. *No credit for students with credit in MICR 2123 and 2132 combined or ZOOL 3204.*

BIOL 3243
(N)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.

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

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

Biomedical Sciences (BIOM)

BIOM 5000*
Research and Thesis
1-6 credits, max 6, Lab 1-6. Prerequisite(s): Consent of major adviser. Research in biomedical sciences for MS degree.

BIOM 5013*
Biomedical Statistics
Prerequisite(s): Graduate standing. Fundamentals of biostatistics, including parametric and non-parametric statistical methods with applications to biomedical research, clinical epidemiology and clinical medicine.

BIOM 5020*
Biomedical Sciences Seminar
1-4 credits, max 4. Prerequisite(s): Graduate standing. Literature and research problems in biomedical sciences.

BIOM 5117*
Gross and Developmental Anatomy
Lab 3. Prerequisite(s): 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.

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

BIOM 5134*
Neuroanatomy
Lab 2. Prerequisite(s): Graduate standing in the biomedical sciences program. The study of structure and integrative function of the central nervous system. Lectures and laboratory demonstrations emphasizing the role of the brain and spinal cord in sensory perception and motor responses. Neuroanatomy presentations enhancing the students' understanding of the normal anatomy of the central nervous system.

BIOM 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.

BIOM 5316*
Medical Microbiology and Immunology
Lab 2. Prerequisite(s): 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.

BIOM 5415*
General Pathology I
Prerequisite(s): 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, and diseases of development and aging. Basic disease processes and ability to recognize and describe basic disease processes from gross and microscopic specimens.

BIOM 5425*
General Pathology II
Prerequisite(s): Graduate standing. Continuation of General Pathology I.

BIOM 5513*
Pharmacology I
Prerequisite(s): 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, physiologic effects, therapeutic indications, and adverse reactions to these drugs.

BIOM 5523*
Pharmacology II
Prerequisite(s): 5513. Continuation of Pharmacology I.

BIOM 5616*
Medical Physiology
Prerequisite(s): 5215. The integration of structure and function of the human body with a functional analysis of the organ systems. Comprehension of the physiologic principles and control mechanisms that maintain homeostasis. Discussion of all systems of the body and analysis of various interrelationships. The fundamental dynamic view of physiology upon which subsequent clinical learning is dependent. Problem solving techniques utilized to develop and examine student understanding.

BIOM 6000*
Research and Dissertation
1-15 credits, max 15, Lab 1-15. Prerequisite(s): Consent of major adviser. Research in biomedical sciences for PhD degree.

BIOM 6010*
Topics in Biomedical Sciences
1-3 credits, max 3. Prerequisite(s): Consent of instructor. Tutorials in areas of biomedical sciences not addressed in other courses.

BIOM 6013*
Educational Methods in the Biomedical Sciences
Prerequisite(s): Graduate standing. Introduces graduate students to a full range of faculty roles and responsibilities related to instructional methods used at the health sciences center.

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

BIOM 6113*
Human Embryology
Lab 2. Prerequisite(s): 5117 or consent of instructor. Formation of the fetus from conception through development of the organs and organ systems with discussions of congenital malformations.

BIOM 6124*
Advanced Histology
Lab 4. Prerequisite(s): 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.

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

BIOM 6163*
Cellular and Molecular Neurobiology
Prerequisite(s): 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.

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

BIOM 6183*
Cellular and Molecular Biology of Pain
Prerequisite(s): 5133 or 5616. An understanding of the cellular and molecular events that occur in the initiation and transmission of nociceptive (painful) sensory signaling.

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

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

BIOM 6243*
Human Nutrition
Lab 2. Prerequisite(s): 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.

BIOM 6263*
Techniques in Molecular Biology
Lab 4. Prerequisite(s): 5215, 5316, consent of instructor. Transformation of bacterial 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.

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

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

BIOM 6333*
Immunology
Prerequisite(s): 5215, 5316. The experimental basis of immunology and immunopathology.

BIOM 6343*
Microbial Physiology
Lab 2. Prerequisite(s): 5215, 5316. The chemical composition, growth and metabolism of prokaryotic organisms including regulation and control of metabolic pathways with emphasis on metabolism unique to microbes.

BIOM 6353*
Molecular Virology
Lab 2. Prerequisite(s): 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.

BIOM 6413*
Graduate General Pathology
Prerequisite(s): Graduate standing and 5215; permission of the instructor is required; 5616 and 5316 are recommended. An introduction for biomedical researchers to disease processes, from etiologies to cell and tissue responses that manifest as diseases.

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

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

BIOM 6533*
Principles of Drug Action
Prerequisite(s): 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.

BIOM 6543*
Neurochemical Toxicology
Prerequisite(s): 5215, 5616. The fundamental aspects of neurochemistry and neurotoxicology using both cellular and molecular approaches in neurotoxicology will be emphasized using the effects of exogenous toxins such as heavy metals, pesticides, solvents, and drugs of abuse and their role in the pathogenesis of neurological toxicity.

BIOM 6583*
Neuroinflammation
Prerequisite(s): Graduate standing. Provides an understanding of inflammation in the central nervous system through discussion of current and experimental pharmacologic strategies designed to modulate neuroinflammation.

BIOM 6613*
Environmental Physiology
Prerequisite(s): 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.

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

BIOM 6662*
Research Ethics and Survival Skills for the Biomedical Sciences
Prerequisite(s): Graduate standing. Provides a basic framework for scientific conduct and practice and the skills needed for a career in the biomedical sciences.

BIOM 6663*
Neuroethology
Prerequisite(s): Permission of instructor. This course is designed to provide an analysis of the neuroendocrine basis of behavior. Lectures will serve as the format of presentation to provide a sound understanding of the neuroethological concepts discussed.

BIOM 6673*
Genomics
- Effective Spring '09 - Prerequisite(s): 6175. The course begins with a review of molecular biology and then proceeds to the structure and organization of eukaryotic, prokaryotic, and organelle genomes. Techniques in dividing, sequencing, annotating, and mapping genomes are studied as well as those of global gene expression profiling. The course finishes with a look at the many applications of genomics in biomedical science and disease.

Biosystems and Agricultural Engineering (BAE)

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

BAE 1022
Experimental Methods in Biosystems Engineering
Lab 2. Prerequisite(s): 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.

BAE 2012
Introduction to Engineering in Biological Systems
Prerequisite(s): BIOL 1114, MATH 2144. 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.

BAE 2023
Physical Properties of Biological Materials
Lab 2. Prerequisite(s): 1022, BIOL 1114, PHYS 2014. Basic engineering fundamentals applied to characterization and determination of physical properties of biological materials, including water relations, rheological, thermal, and electromagnetic properties, materials drying concepts, fans, psychrometrics and refrigeration.

BAE 3013
Heat and Mass Transfer in Biological Systems
Prerequisite(s): ENSC 3233. Mechanisms of heat and mass transfer, with specific applications in transport processes of biological systems. Introduction to steady state and transient heat conduction and convection, radiation, diffusion, simultaneous heat and mass transfer, and generation and depletion of heat and mass in biological systems.

BAE 3023
Instruments and Controls
Lab 2. Prerequisite(s): 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.*

BAE 3113
Microbial Technologies in Biosystems Engineering
Prerequisite(s): 2012, ENSC 2213, 3233, MATH 2233. Introduction to engineering applications of industrial microbiology. Technologies covered include fermentation systems, enzyme kinetics, wastewater treatment and bioremediation.

BAE 3213
Energy and Power in Biosystems Engineering
Lab 2. Prerequisite(s): 1022, ENSC 2123, 2143, 2213, 2613. Analysis and design of energy generation, transmission, and utilization in the production and processing of biological materials.

BAE 3313
Natural Resources Engineering
Lab 3. Prerequisite(s): 2022, ENSC 3233. Principles and practices of engineering analysis and design applied to hydrology, water quality, erosion and sedimentation, air quality, irrigation and animal waste management.

BAE 4001
Professional Practice in Biosystems Engineering
Prerequisite(s): Concurrent enrollment in 4012. Preparation for professional practice through case studies about ethics, legal liability, safety, and societal issues. Practical professional communications experience.

BAE 4012
Senior Engineering Design Project I
Lab 2. Prerequisite(s): Completion or concurrent enrollment in 3013, 3023, 3113, 3213, 3313, 4001 and ENSC 2413; admission to professional school. 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.

BAE 4023
Senior Engineering Design Project II
Lab 4. Prerequisite(s): 4012. Second of two-semester sequence of senior design courses.

BAE 4213*
Precision Agriculture
Lab 2. Prerequisite(s): 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 SOIL 4213)

BAE 4224*
Machinery for Production and Processing
Prerequisite(s): 3213. Analysis and design of machine components 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.

BAE 4283*
Bioprocess Engineering
Prerequisite(s): 3113 or consent of instructor, ENSC 3233. 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 CHE 4283)***

BAE 4313*
Hydrology
Prerequisite(s): 3313, ENSC 3233. Basic principles of surface and groundwater hydrology and their application in engineering problems. The hydrologic cycle, weather and hydrology, precipitation, evaporation, transpiration, subsurface waters, stream flow hydrographs, hydrologic and hydraulic stream routing, probability of hydrologic events and application of hydrologic models.

BAE 4353*
Mechanical Design II
Prerequisite(s): ENSC 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)

BAE 4400
Special Problems
1-4 credits, max 8. Investigations in specialized areas of biosystems engineering.

BAE 4413*
Food Engineering
Prerequisite(s): 3013, 3413; ENSC 3233, 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.

BAE 5000*
Thesis and Research
1-6 credits, max 6. Prerequisite(s): Consent of major professor.

BAE 5030*
Engineering Practice
1-12 credits, max 12. Prerequisite(s): BS degree in biosystems and agricultural 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.

BAE 5213*
Renewable Energy Engineering
Prerequisite(s): ENSC 2213, ENSC 3233 or consent of instructor. Renewable technologies such as solar, wind, geothermal, hydroelectric, and biomass to generate energy for electricity, heating, transportation, and other uses.

BAE 5283*
Advanced Bioprocess Engineering
Prerequisite(s): 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.
(Same course as CHE 5283)

BAE 5313*
Watershed Modeling and Water Quality
Lab 6. Prerequisite(s): 4313 or equivalent. A computer modeling course with an emphasis on chemical and physical processes governing nonpoint source pollution (nitrogen, phosphorus, sediment) at the basin scale. 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. For students with advanced personal computer skills.

BAE 5324*
Modeling and Design in Storm Water and Sediment Control
Lab 3. Prerequisite(s): 4313 or equivalent. Analysis and design of storm water, 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 kinematics, diffusion and dynamic modeling of flow; soil erosion, sediment transport and sediment control; storm water 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.

BAE 5333*
Applied Water Resources Statistics
Lab 3. Prerequisite(s): STAT 5013 or equivalent. Applied statistical methods for hydrologists, engineers, and environmental scientists for analysis of environmental data. Parametric and nonparametric methods and exploratory data analysis applied to observed environmental data sets. Laboratory exercises emphasize hands-on application of statistical problems to reinforce concepts.

BAE 5343*
Environmental Contaminant Transport
Prerequisite(s): 4313. Conceptual and mathematical models for the transport of contaminants in natural systems with an emphasis on agricultural pollutants. Basic transport processes relevant to the three environmental media - air, water, and soil. Common features underlying pollutant transport.

BAE 5413*
Instrumentation in Biological Process Control System
Prerequisite(s): 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.

BAE 5423*
Food Rheology
Lab 2. Prerequisite(s): 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.

BAE 5433*
Biosensors
Prerequisite(s): PHYS 2114 and CHEM 3053 or equivalent. Principles and applications of biosensors in food analysis, disease diagnostics, and environmental monitoring. Emphasis on conceptual design and characterization of biosensors. Introduction to recent advances in biodetection using nanotechnology.

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

BAE 6000*
Research and Thesis
1-10 credits, max 30. Prerequisite(s): 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.

BAE 6100*
Teaching Practicum in Biosystems Engineering
1-3 credits, max 3, Lab 2-6. Prerequisite(s): 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.

BAE 6313*
Stochastic Methods in Hydrology
Prerequisite(s): CIVE 5843, STAT 4033. Stochastic and statistical hydrologic analyses of surface water and groundwater systems. Analysis of urban and rural drainage and detention systems. ***(Same course as CIVE 6843)***

BAE 6333*
Fluvial Hydraulics
Prerequisite(s): 3013 or equivalent. Principles of sediment detachment and transport in fluvial systems. Design of stable channels and flow resistance relationships for sediment-laden flows.

BAE 6343*
Ground Water Contaminant Transport
Prerequisite(s): SOIL 5583 or CIVE 5913 or GEOL 5453. Principles of solute and multiphase transport in soils and ground water. Effects of advection, diffusion, dispersion, degradation, volatilization and adsorption. Relationships between laboratory and field scale transport. Contamination by nonaqueous phase liquids.

BAE 6520*
Problems in Soil and Water Engineering
2-6 credits, max 6. Prerequisite(s): Consent of instructor. Problems associated with erosion control, drainage, flood protection and irrigation.

BAE 6540*
Problems in Farm Power and Machinery
2-6 credits, max 6. Prerequisite(s): consent of instructor. Literature review and analytical studies of selected farm power and machinery problems. *Written report required.*

BAE 6580*
Problems in Transport Processes
2-6 credits, max 6. Prerequisite(s): Consent of instructor. Literature review and analysis of heat and mass transport and interval diffusion in biological materials. Transport phenomena at interfaces, thermal and cryogenic processing, drying, packed and fluidized bed systems. Thermal and moisture control processing affecting quality of food products. *Written report required.*

BAE 6610*
Advanced Research and Study
1-10 credits, max 20. Prerequisite(s): Approval by the student's advisory committee. Research and study at the doctoral level on the topic related to the student's doctoral program and field of interest.

Botany (BOT)

BOT 1404
(N)Plant Biology
Lab 2. Prerequisite(s): BIOL 1114. Morphology and anatomy of plants. Plant functioning: photosynthesis, water relations, translocation, hormonal regulation, and photoperiodism. Survey of the plant divisions, algae and fungi.

BOT 3005
Field Botany
Lab 6. Prerequisite(s): BIOL 1114 or equivalent. Botanical field techniques, the vegetation of North America, and the flora of Oklahoma. Terminology of description, use of taxonomic keys, techniques of specimen preservation, field recognition of plant taxa and communities and controlling ecological factors, economic and wildlife significance of dominant taxa, principles of classification + and nomenclature. *Four weekend field trips required.*

BOT 3013*
Biological Microtechnique
Lab 3. Prerequisite(s): 1404 or ZOOL 1604. Techniques for preparation of biological materials for microscopic examination.

BOT 3024*
Plant Diversity
Lab 4. Prerequisite(s): 1404. Forms and life histories of selected plants with emphasis on some of the less familiar forms. The diversity of plant forms as well as basic similarities in life histories; importance of each form to man and his environment. *Field trips required.*

BOT 3114*
Plant Taxonomy
Lab 4. Prerequisite(s): 1404 or equivalent. Vocabulary and concepts of plant taxonomy: terminology, keys, nomenclature, documentation, classification, and biosystematics. Emphasis on angiosperm flora of Oklahoma. *Field trips required.*

BOT 3233*
Plant Anatomy
Lab 3. Prerequisite(s): 1404. Structure of cells, tissues and organs of plants. Consideration of structure as related to ontogeny, phylogeny and function.

BOT 3253
(N)Environment and Society
Prerequisite(s): BIOL 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.*

BOT 3263
(N)Plants and People
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.*

BOT 3273
Plants and Human Health
Study of plants as a source of medicines, psychoactive compounds and poisons. These topics will be explored in the context of modern western medicine as well as traditional health systems and complementary alternative medicine.

BOT 3462
Plant Physiology Laboratory
Lab 4. Prerequisite(s): 3463 or concurrent enrollment. Skills in techniques for working with plants, experiments involving nutrition, respiration, photosynthesis, water relations, translocation, hormones, growth and development.

BOT 3463*
Plant Physiology
Prerequisite(s): 1404. Plant subcellular structure, water relations, water absorption and ascent of sap, translocation, gaseous exchange, nutrition, enzymes, respiration, photosynthesis, growth, development, reproduction, tropisms, hormones, dormancy and seed germination.

BOT 3553
Fungi: Myths and More
Lab 2. Prerequisite(s): BIOL 1114. Explores the impact of fungi on beliefs, culture and society via the colorful folklore and myths on fungi and their role in the environment and human affairs, including diseases of plants, animals and humans exemplified by the Great Bengal famine of 1943, The Irish potato famine, 1840's and the Salem witch trials 1692. Laboratory instruction on use of microscopes, mushroom identification, mechanisms of dispersal, and genetic recombination. ***(Same course as PLP 3553)***

BOT 4023
Community Ecology
Prerequisite(s): 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. *No credit for students in 5023.*

BOT 4123*
Ethnobotany
Prerequisite(s): One course from 1404 or ZOOL 1604, HORT 1013, 3024, PLNT 1213, or consent of instructor. Uses of plants by past and present cultures for food, fiber, and medicinal purposes. The role of plants in traditional rituals and religious practices.

BOT 4214
Botanical Limnology
Lab 3. Prerequisite(s): 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 5214.*

BOT 4400
Undergraduate Research
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Undergraduate research problems in botany.

BOT 4993
Senior Honors Thesis
Prerequisite(s): 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 made at a departmental seminar. *Required for graduation with departmental honors in botany.*

BOT 5000*
Research
1-6 credits, max 6. Research for the MS degree.

BOT 5023*
Community Ecology
Prerequisite(s): 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. *No credit for students with credit in 4023.*

BOT 5104*
Mycology
Lab 4. Prerequisite(s): 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)***

BOT 5110*
Problems in Botany
1-5 credits, max 12. Prerequisite(s): Consent of instructor. Special studies in any area of botany.

BOT 5214*
Botanical Limnology
Lab 3. Prerequisite(s): 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 4214.*

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

BOT 5533*
Multivariate Methods in Community Ecology
Prerequisite(s): 5023 or BIOL 3034 or other equivalent course work in ecology recommended. Basic knowledge of statistics desirable. Methods used by ecologists to analyze community data and community patterns, including ordination and modern regression techniques. *One weekend field trip required.*

BOT 5753*
Physiology of Plant Growth and Development
Prerequisite(s): 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.

BOT 5813*
Plant Developmental Genetics
Prerequisite(s): BIOL 3023 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.

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

BOT 6000*
Research
1-15 credits, max 60. Independent research for the doctoral dissertation.

Business Administration (BADM)

BADM 1111
Business Freshman Orientation
Prerequisite(s): Freshman standing only. Required of all first semester freshmen in the William S. Spears School of Business. An orientation to the SSB and OSU, survival skills, and a study of the career opportunities and curriculum in the various business departments.

BADM 2010
Special Topics
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Special topics and independent study in business.

BADM 3090
(I)Study Abroad
1-18 credits, max 36. Prerequisite(s): Consent of the Study Abroad office and associate dean of the college. Participation in an OSU reciprocal exchange program.

BADM 3713
(I)International Business
Prerequisite(s): MGMT 3123. Development of international business strategy based on the integration of economic, accounting, financial, management and marketing concepts.

BADM 4010
Business Projects
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Special advanced topics, projects and independent study in business.

BADM 4050*
Business Colloquium
3-9 credits, max 9. Prerequisite(s): 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 challenge for the able student with a strong interest in scholarship.

BADM 4513*
Strategy and Integration in Organizations
Prerequisite(s): Senior standing or business core classes. Integration of concepts from the business core courses using tools such as simulation and case analysis. Planning models, policy models and strategy development.

BADM 5013*
Research Methods for Business
Prerequisite(s): 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.

BADM 5113*
Entrepreneurship and Venture Management
Prerequisite(s): Admission to MBA program or consent of MBA director. Enterprise 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 growing concerns.

BADM 5200*
Selected Master of Business Administration Topics
3-6 credits, max 6. Prerequisite(s): Admission to the MBA program. Selected topics dealing with business decision-making and contemporary business issues.

BADM 5613*
The External Environment of Business
Prerequisite(s): 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.

BADM 5713*
Analysis of the Multinational Firm
Prerequisite(s): 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.

BADM 6000*
Research and Thesis
1-9 credits, max 30. Prerequisite(s): Approval of advisory committee.

BADM 6100*
Seminar in Business Administration
3-6 credits, max 6. Prerequisite(s): Consent of instructor. Interdisciplinary in nature; focused on research methodology.

BADM 6713*
Theory Building and Scientific Research in Business
Prerequisite(s): Doctoral student status and consent of instructor. Examination of theory building and research methods from a business perspective. Understanding of theory and methods relevant to research in the business disciplines.

Business Communications (BCOM)

BCOM 3113
Written Communication
Prerequisite(s): 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.

BCOM 3223
Organizational Communication
Prerequisite(s): 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.

BCOM 3333
Business Report Writing
Prerequisite(s): 6 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.

BCOM 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.

BCOM 5210*
Business Communication Applications
1-3 credits, max 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)

BHON 4053
Critical Issues in Global Business
Prerequisite(s): Junior standing, admission to the Honors Program. Current critical issues facing business in a global environment. Social, political, economic, and technological sectors of the environment. Framework of study on geographical and political regions.

BHON 4063
Topics in Contemporary Business
Prerequisite(s): Junior standing, admission to the Honors Program. Topics of interest in the contemporary business and economic environment. The social role of the corporation; US competitiveness and business and environmental issues.

BHON 4073
Literature in Business
Prerequisite(s): Junior standing, admission to the Honors Program. Foundations of American business through selected literary masterpieces.

BHON 4990
Business Honors Thesis
1-5 credits, max 5. Prerequisite(s): Honors Program participation, senior standing, college approval. 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 college honors in business.*

Business Professions (BSPR)

BSPR 3523
Office Problems in Keyboarding
Lab 2. Prerequisite(s): 2313 or equivalent. Problems in office situations requiring application of keyboarding knowledge and skills. Emphasis on quality work at high speeds.

Career and Technical Education (CTED)

CTED 2000
Field Experience
2-6 credits, max 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.*

CTED 3000
Occupational Experience
1-24 credits, max 24. Credit to be determined by a special skill competency examination.

CTED 3203
Foundations of Career and Technical Education
Opportunities provided by career and technical education through the programmatic areas of trade and industrial, marketing, business and information technology, health occupations, and technology education. The relationship of CTED to other elements of the educational system, including legislative aspects, student guidance, and programs for students with special needs.

CTED 3903
Seminar in Professional Education
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.*

CTED 4010*
Career and Technical Education Workshop
1-3 credits, max 6. Professional workshops of various topics and lengths. Focus on a particular topic from such areas as the development, use, and evaluation of instructional methods and materials.

CTED 4103*
Instructional Procedures in Career and Technical Education
Methods and techniques for effective teaching and learning in career and technical classroom, laboratories, and technology-based environments.

CTED 4110*
Career and Technical Information
1-6 credits, max 6. New developments in scientific and technical information and knowledge that are relevant to current career, technical and trade practices.

CTED 4113
Career and Technical Education in American Society
Characteristics of career and technical education and its development, role and function in a changing American society. Economic and sociological considerations of career and technical programs. Exploration of the interrelationship of career and technical and academic subject strategies for teaching multicultural and special needs in career and technical and adult education.

CTED 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.

CTED 4213*
Safety, Organization and Management of Learning Facilities
Techniques and procedures for organizing and managing career and technical 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.

CTED 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.

CTED 4313
Computers and Multimedia in Career and Technology Education
Lab 2. Review of current hardware systems and software applications and their uses in career and technology education. Current and emerging issues facing career and technology instructors using technology in the classroom. A wide range of Internet and multimedia tools and techniques and their functions in career and technical teaching and learning. Instructional technology usage issues and computer-based materials suitable in professional settings.

CTED 4333
(I)International Career and Technical Education
Comparison and analysis of international career and technical education.

CTED 4343*
Occupational Analysis and Curriculum Development
Analysis of occupational job activities; development of course objectives, course outlines, and specific instructional materials for occupational and technical courses.

CTED 4470
Teaching Practicum in Career and Technical Education
1-12 credits, max 12. Prerequisite(s): Full admission to Professional Education. Organized teaching experiences under the guidance and direction of a local school cooperating professional and university professional 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.*

CTED 4673
Current Issues in Career and Technical Education
Defining current issues, conducting action research and proposing possible solutions to current issues in CTED. Debating opposing views and giving logic and reasoning for each view.

CTED 4683
Legal Issues in Career and Technical Education
Overview of the law and the legal system, including how to perform legal research using library and Internet resources, issues involving student organizations, intellectual property, and distance education.

Chemical Engineering (CHE)

CHE 2033
Introduction to Chemical Process Engineering
Prerequisite(s): CHEM 1515, ENSC 2213. Co-requisite(s): 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.

CHE 3013
Rate Operations I
Prerequisite(s): 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.

CHE 3113
Rate Operations II
Prerequisite(s): 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.

CHE 3123
Chemical Reaction Engineering
Prerequisite(s): 3333, 3473, and admission to CHE Professional School. Principles of chemical kinetics rate concepts and data treatment. Elements of reactor design principles for homogeneous systems; introduction to heterogeneous systems.

CHE 3333
Introduction to Transport Phenomena
Prerequisite(s): Admission to CHE Professional School. Molecular concepts of mass, momentum, and thermal energy diffusion. Theories and correlations for transport properties of viscosity, thermal conductivity, and diffusivity. Shell balance techniques to derive differential equations of change. Application of ODEs to simple transport phenomena problems. Turbulent flow analysis. Use of CFD software for analysis.

CHE 3473
Chemical Engineering Thermodynamics
Prerequisite(s): 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.

CHE 4002*
Chemical Engineering Laboratory I
Lab 6. Prerequisite(s): 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 decisions. Interpretation of experimental data and presentation of results.

CHE 4112*
Chemical Engineering Laboratory II
Lab 6. Prerequisite(s): 3113, 3123, 4002, admission to CHE Professional School. A continuation of 4002. Primary reaction and mass transfer processes.

CHE 4124*
Chemical Engineering Design I
Lab 2. Prerequisite(s): 3113, 3123, 4002, and 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.

CHE 4224*
Chemical Engineering Design II
Lab 2. Prerequisite(s): 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 plants. Application of computer techniques to chemical engineering design.

CHE 4283*
Bioprocess Engineering
Prerequisite(s): 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)***

CHE 4293
Biomedical Engineering
Prerequisite(s): 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.

CHE 4343
Environmental Engineering
Prerequisite(s): 4123. 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. Consideration of safety, health and environmental issues from a process standpoint.

CHE 4523
Introduction to Colloid Processing
Prerequisite(s): MATH 2153, CHEM 1515. The physics and chemistry governing the behavior of microscopic particles in dilute and concentrated suspensions. Interparticle interaction influence on viscosity, viscoelasticity, yield stress, and shear thinning. Practical application of colloids principles in industrial practice. *No credit for students with credit in 5523.*

CHE 4581*
Chemical Engineering Seminar
Prerequisite(s): 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.

CHE 4843*
Chemical Process Instrumentation and Control
Prerequisite(s): 4124, admission to CHE Professional School. Process instrumentation for measurement and control. Process dynamics and modeling. Linearization. Classical control system analysis and design. Tuning. Communication through block diagrams and P&IDs.

CHE 4990
Special Problems
1-5 credits, max 5, Lab 3-15. Prerequisite(s): Senior standing. Training in independent work, study of relevant literature, and experimental investigation of an assigned problem.

CHE 5000*
Master's Thesis
1-6 credits, max 6. Prerequisite(s): Approval of major professor. Methods used in research and thesis writing.

CHE 5030*
Professional Practice
2-6 credits, max 8. Prerequisite(s): 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.

CHE 5110*
Special Topics In Chemical Engineering
2-3 credits, max 6, Lab 2-6. Prerequisite(s): Consent of instructor. Small group and individual projects in unit operations, unit procedures, 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.

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

CHE 5213*
Selected Diffusional Unit Operations
Mass transfer in fluids. Diffusion in liquids and gases. Equilibrium stage and transfer unit concepts. Mass transfer concepts of diffusional unit operations such as absorption, adsorption, crystallization, drying, humidification and liquid extraction.

CHE 5263*
Advanced Biomaterials Science and Engineering
Prerequisite(s): Graduate standing or consent of instructor. Engineering issue that are implicit in understanding the interactions of living tissue and processed materials will be introduced. Emphasis is on identifying the processes in which cells interact with surfaces and particulate matter and the outcome of these interactions. Highlighted biological responses will include inflammation and coagulation. Also, biomaterial issues related to drug delivery and tissue engineering will be discussed.
(Same course as MAE 5003)

CHE 5273*
Basic Physiology and Physiological System Analysis for Engineers
Prerequisite(s): Graduate standing or consent of instructor. The goals of this class are: 1) to introduce the basic physiology concepts used widely in biomedical engineering research; 2) to introduce and develop engineering concepts and approaches for quantitative analysis of physiological systems. Engineering principles will be applied to study mechanical properties of various tissue and organ systems under normal and diseased conditions. Knowledge obtained from this class can help engineers to apply engineering principles to the design and development of medical devices for disease treatments. ***(Same course as MAE 5013)***

CHE 5283*
Advanced Bioprocess Engineering
Prerequisite(s): 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.
(Same course as BAE 5283)

CHE 5293*
Advanced Biomedical Engineering
Prerequisite(s): 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. ***(Same course as MAE 5033*)***

CHE 5343*
Advanced Environmental Engineering
Prerequisite(s): Consent of instructor. Science and engineering principles to minimize the adverse effects of human activities on the environment. National and state regulations. Predictive movement and fate of chemicals in the geospheres. Multi-media pollution assessment, analysis, and control. Consideration of safety, health, and environment issues from a process standpoint. *Special project required. Credit not allowed if CHE 4343 was taken.*

CHE 5523*
Colloid Processing
Prerequisite(s): Graduate standing in engineering, physics, or chemistry or consent of instructor. The physics and chemistry governing the behavior of microscopic particles in dilute and concentrated suspensions. Interparticle interaction influence on viscosity, viscoelasticity, yield stress, and shear thinning. Practical application of colloids principles in industrial practice.

CHE 5703*
Optimization Applications
Prerequisite(s): 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 ECEN 5703, IEM 5023 & MAE 5703)***

CHE 5733*
Neural Networks
Prerequisite(s): 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 & MAE 5733)***

CHE 5743*
Chemical Engineering Process Modeling
Chemical engineering systems and process models. Analytical and numerical methods of solution of resulting equations with computer methods in a chemical engineering context.

CHE 5843*
Principles of Chemical Engineering Thermodynamics
Principles of thermodynamics. Properties of fluids and prediction of thermodynamic properties. Phase and chemical equilibrium. Thermodynamics in unit operations.

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

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

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

CHE 6000*
Doctoral Thesis
2-15 credits, max 54. Prerequisite(s): 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.

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

CHE 6223*
Advanced Chemical Engineering Thermodynamics
Prerequisite(s): 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.

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

CHE 6703*
Research Methods in Chemical Engineering
Prerequisite(s): MS or PhD 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)

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.*

CHEM 1215
(L,N)General Chemistry
Lab 2. Prerequisite(s): 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.*

CHEM 1225
(L,N)General Chemistry
Lab 2. Prerequisite(s): 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.*

CHEM 1314
(L,N)General Chemistry
Lab 2. Prerequisite(s): 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 pre-medical science and pre-veterinary science), physical sciences and engineering. *No credit for students with credit in 1014, 1215.*

CHEM 1413
(L,N)Inquiry-based Chemistry
Lab 3. Prerequisite(s): 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.

CHEM 1414
(L,N)General Chemistry for Engineers
Lab 2. Prerequisite(s): One year of high school chemistry or one semester of college chemistry and MATH 1513 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.*

CHEM 1515
(L,N)General Chemistry
Lab 2. Prerequisite(s): 1314 or advanced placement. A continuation of general chemistry. *No credit for students with credit in 1225.*

CHEM 2113
Principles of Analytical Chemistry
Prerequisite(s): 1515 and MATH 1513 or 1715. Modern theories of solutions, separation techniques and methods of analysis.

CHEM 2122
Quantitative Analysis Laboratory
Lab 6. Prerequisite(s): 2113 or concurrent enrollment. Laboratory work related to material covered in CHEM 2113.

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

CHEM 3015*
The Chemistry of Organic Compounds
Lab 4. Prerequisite(s): 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.*

CHEM 3053
Organic Chemistry
Prerequisite(s): 1414 or 1515 or equivalent. Hydrocarbons and their derivatives, including specific compounds of theoretical, biological or industrial importance. *No credit for students with credit in 3015.*

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

CHEM 3153*
Organic Chemistry
Prerequisite(s): 3053. A continuation of 3053.

CHEM 3353
Descriptive Inorganic Chemistry
Prerequisite(s): 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.

CHEM 3433*
Physical Chemistry I
Prerequisite(s): 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.*

CHEM 3532*
Physico-Chemical Measurements
Lab 6. Prerequisite(s): 2122 and 3433. Apparatus, experimental methods, and calculations employed in physico-chemical investigations.

CHEM 3553*
Physical Chemistry II
Prerequisite(s): 3433. A continuation of 3433. *Students who are not chemistry majors may receive graduate credit.*

CHEM 4020*
Modern Methods of Chemical Analysis
1-5 credits, max 5. Prerequisite(s): 2122, 3433. Theoretical and laboratory study of modern techniques, reagents and instruments employed in analytical chemistry.

CHEM 4320*
Chemical and Spectrometric Identification of Organic Compounds
1-3 credits, max 3, Lab 1-2. Prerequisite(s): 3112 and 3153. Theory and practice in separating mixtures of organic compounds and some theory and practice in identifying organic compounds by spectroscopic methods.

CHEM 4990*
Special Problems
1-5 credits, max 6, Lab 3-15. Prerequisite(s): Senior standing. Training in independent work, study of relevant literature and experimental investigation of an assigned problem.

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

CHEM 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 MS degree.*

CHEM 5103*
Physical and Chemical Separations
Prerequisite(s): One year of physical chemistry. Principles of bulk and multi-stage separation methods: chromatography, liquid-liquid extraction, and zone melting.

CHEM 5113*
Equilibrium and Kinetics in Analytical Chemistry
Prerequisite(s): One year of physical chemistry. Physical and chemical principles of equilibrium and kinetics as applied to analytical problems.

CHEM 5220*
Modern Topics for Teachers
1-9 credits, max 9. Prerequisite(s): 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.

CHEM 5223*
Chemistry of High Polymers
Prerequisite(s): 3153 and 3433 or equivalent. Preparation and polymerization of organic monomers; properties and uses of resulting high polymers; theories of polymerization; inorganic and natural organic polymers.

CHEM 5260*
Inorganic Chemistry I
1-3 credits, max 3. Prerequisite(s): 3353 or equivalent and 3 hours of physical chemistry. Bonding theory, molecular symmetry and structure, characterization of inorganic compounds, coordination chemistry, crystal field theory, solution chemistry, and mechanisms of inorganic reactions in solution.

CHEM 5283*
Solid-state Chemistry
Prerequisite(s): 5260. Structure, bonding, and properties of cyrstalline and amorphous inorganic solids. Emphasis on the characterization of inorganic solids and phase transitions in inorganic solids.

CHEM 5323*
Reactions of Organic Compounds
Prerequisite(s): 3153. Products and mechanisms of reactions of importance in organic synthesis.

CHEM 5373*
Spectrometric Identification of Organic Compounds
Lab 3. Prerequisite(s): 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.

CHEM 5443*
Mechanism and Structure in Organic Chemistry
Prerequisite(s): 3153 and 3553. Relationship of properties of organic compounds to their structure; mechanisms of organic reactions.

CHEM 5563*
Chemical Thermodynamics I
Prerequisite(s): 3553. Statistical and classical thermodynamics applied to chemical systems.

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

CHEM 5960*
Inorganic Chemistry II
1-3 credits, max 3. Prerequisite(s): 5260. Chemistry of main group and transition metal organometallic compounds, metal clusters, and catalysis by organometallic polymers, bioinorganic chemistry, and materials chemistry. ***(Same course as 6650*)***

CHEM 6000*
Research
1-12 credits, max 60. Prerequisite(s): MS degree in chemistry or consent of instructor. Independent investigation under the direction and supervision of a major professor.

CHEM 6010*
Research Seminar
1 credit, max 8. Prerequisite(s): Consent of instructor. Presentations of current research. *One credit hour per academic year required for MS and PhD candidates.*

CHEM 6011*
Advanced Seminar
Prerequisite(s): 5011 or MS degree. Preparation and oral presentation of critical reviews on chemical subjects. Usually related to the student's research area. *Completion of 1 credit hour required for the PhD degree.*

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

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

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

CHEM 6420*
Special Topics in Organic Chemistry
1-9 credits, max 9. Prerequisite(s): 3153. Deals with topics not covered in other courses.

CHEM 6453*
Chemical Kinetics
Prerequisite(s): 3553. The kinetics of chemical reactions and their theoretical interpretation.

CHEM 6553*
Molecular Spectroscopy
Prerequisite(s): 5623. Spectra and structure of molecules.

CHEM 6650*
Selected Topics in Advanced Physical and Inorganic Chemistry
1-6 credits, max 12. Prerequisite(s): Consent of instructor. Supervised study of selected topics and fields not otherwise covered. ***(Same course as 5960*)***

CHEM 6803*
Photonics I: Advanced Optics
Lab 9. Prerequisite(s): 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. Ultra short laser pulses. ***(Same course as ECEN 6803 & PHYS 6803)***

CHEM 6810*
Photonics II: THz Photonics and THz-TDS
1 credit, max 4, Lab 1. Prerequisite(s): 6803. THz photonics and THz time-domain spectroscopy (THz-TDS). Concepts and techniques of driving electronic circuitry with ultra short laser pulses to generate and detect freely propagating pulses of THz electromagnetic radiation using several operational research systems. ***(Same course as ECEN 6810 & PHYS 6810)***

CHEM 6820*
Photonics II: Spectroscopy II
1 credit, max 4, Lab 1. Prerequisite(s): 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 ECEN 6820 & PHYS 6820)

CHEM 6830*
Photonics II: Spectroscopy III
1 credit, max 4, Lab 1. Prerequisite(s): 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. Multiphotonic excitations. Fast measuring techniques, including subnanosecond detectors, picosecond streak cameras, and ultra fast four-wave mixing and correlation techniques. Time-dependent photoconductivity measurements.
(Same course as ECEN 6830 & PHYS 6830)

CHEM 6840*
Photonics III: Microscopy I
1 credit, max 4, Lab 1. Prerequisite(s): 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 air. ***(Same course as ECEN 6840 & PHYS 6840)***

CHEM 6850*
Photonics III: Microscopy II
1 credit, max 4, Lab 1. Prerequisite(s): 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 & PHYS 6850)***

CHEM 6860*
Photonics III: Microscopy III and Image Processing
1 credit, max 4, Lab 1. Prerequisite(s): 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 & PHYS 6860)***

CHEM 6870*
Photonics IV: Synthesis and Devices I
1 credit, max 4, Lab 1. Prerequisite(s): 6803 and 6840. Preparation of functional nanostructures and related optical and electronic devices. Physical and chemical methods of thin film deposition. Engineering of prototypes of light emitting diodes, sensors, optical limiting coatings, lithographic patterns. ***(Same course as ECEN 6870 & PHYS 6870)***

CHEM 6880*
Photonics IV: Semiconductor Devices, Testing and Characterization
1 credit, max 4, Lab 1. Prerequisite(s): 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 & PHYS 6880)***

CHEM 6890*
Photonics IV: Semiconductor Synthesis and Devices III
1 credit, max 4, Lab 1. Prerequisite(s): 6803. Processing, fabrication and characterization of semiconductor optoelectronic devices in class 100/10000 clean rooms. Clean room 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 ECEN 6890 & PHYS 6890)

Civil Engineering (CIVE)

CIVE 3413
Structural Analysis
Lab 3. Prerequisite(s): ENSC 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.

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

CIVE 3523
Reinforced Concrete Design
Lab 3. Prerequisite(s): 3413. Introduction to the design of reinforced concrete elements in accordance with the strength design requirements of the ACI Building Code.

CIVE 3614
Engineering Surveying
Lab 3. Prerequisite(s): MATH 1613 or 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.

CIVE 3623
Engineering Materials Laboratory
Lab 3. Prerequisite(s): 3713 or concurrent. 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.

CIVE 3633
Transportation Engineering
Prerequisite(s): 3614 or consent of instructor. Planning, design and operations of transportation facilities. 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.

CIVE 3713
Geotechnical Engineering
Prerequisite(s): ENSC 2143. Physical and mechanical properties of soils, including specific gravity, grain size distribution, plasticity, permeability, consolidation, and shear strength. Use of physical and mechanical properties to calculate stresses in a soil mass, lateral earth pressures, bearing capacity, and slope stability. Application of physical and mechanical properties to design of foundations, retaining structures and slopes.

CIVE 3813
Environmental Engineering Science
Prerequisite(s): CHEM 1414 or 1515, MATH 2144. 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.

CIVE 3833
Applied Hydraulics
Prerequisite(s): CHEM 1414 or 1515, ENSC 3233, PHYS 2014. Basic hydraulic principles and their application in civil engineering problems. Analyses of water distribution networks, open channels, storm-water management and wastewater collection systems, water pumps, hydraulic models, hydraulic measurements, treatment plant hydraulics and hydraulic structures.

CIVE 3843
Hydrology I
Prerequisite(s): CHEM 1414 or 1515, ENSC 3233, PHYS 2014. Basic principles of surface groundwater hydrology and their application in engineering problems. The hydrologic cycle, weather and hydrology, precipitation, evaporation, transpiration, subsurface waters, stream flow hydrographs, hydrologic and hydraulic stream routing, probability of hydrologic events, application of hydrologic models.

CIVE 3853
Environmental Engineering Laboratory
Lab 3. Prerequisite(s): 3813. Performance of experiments with benchscale 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.

CIVE 4010*
Civil Engineering Research
1-4 credits, max 12. Prerequisite(s): Senior standing or consent of instructor. Research and investigation of civil engineering problems.

CIVE 4042
Engineering Practice
Prerequisite(s): 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 such as professional ethics, income taxes and investments are discussed.

CIVE 4043
Senior Design
Prerequisite(s): 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.

CIVE 4143*
Environmental Engineering Design
Prerequisite(s): 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.

CIVE 4273*
Construction Engineering and Project Management
Lab 3. Prerequisite(s): 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.

CIVE 4711*
Basic Soils Testing Laboratory
Lab 3. Prerequisite(s): 3713. Laboratory measurement of the physical and mechanical properties of soils; specific gravity, grain size distribution, plasticity, compaction, compressibility, and shear strength.

CIVE 4823*
Human Impact on the Environment
The activities of humans and how they affect the aqueous, terrestrial, and atmospheric environment.

CIVE 4833*
Unit Operations in Environmental Engineering
Prerequisite(s): 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.

CIVE 5000*
Master's Thesis or Report
1-6 credits, max 6. Prerequisite(s): 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.

CIVE 5010*
Civil Engineering Seminar
1-3 credits, max 6. Prerequisite(s): Graduate standing and approval of major professor. Review of literature of major fields of civil engineering.

CIVE 5013*
Aquatic Chemistry
Prerequisite(s): 5813 or concurrent enrollment, CHEM 1515 or equivalent. Application of chemical principles to environmental problems. Chemical kinetics, chemical equilibrium, acid-base chemistry, development of pc-pH diagrams, and coordination chemistry. Precipitation and dissolution reactions and oxidation-reduction reactions.

CIVE 5020*
Civil Engineering Research
1-6 credits, max 6. Prerequisite(s): Graduate standing and approval of major professor. Research and investigations other than thesis studies.

CIVE 5023*
Public Health Engineering
Protection of public health through improved environment in urban, suburban, and rural communities. Practical examples, simple formulas, general rules and guidelines for application of public health principles. Intended for students in engineering, physical sciences and other technical disciplines.

CIVE 5030*
Engineering Practice
1-6 credits, max 9. Prerequisite(s): 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.*

CIVE 5080*
Engineering Problems
1-3 credits, max 6. Prerequisite(s): Graduate standing. Problems of particular interest to graduate students in the field of applied science.

CIVE 5103*
Construction Simulation
Prerequisite(s): Graduate standing or consent of instructor. This course introduces students to effective ways of modeling construction processes and technologies. It provides an investigation of quantitative methods used for the design and analysis of construction operations to maximize productivity and minimize resource idleness. It includes discussions on queueing theory, line-of-balance techniques, linear programming and simulation. Comprehensive group projects that involve modeling and analyzing actual construction operations will be integral parts of this course.

CIVE 5113*
Construction Business Management
Prerequisite(s): Graduate standing or consent of instructor. Fundamental theories and applied methods of financial management of construction companies. The spectrum of the present and future practice of business management at the construction company level. Basic construction business operations in the context of construction accounting, financial management, cash flow analysis, financial planning, and risk analysis.

CIVE 5123*
The Legal and Regulatory Environment of Engineering
Prerequisite(s): Junior, senior or graduate standing. The US 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 Occupation 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.

CIVE 5133*
Construction Contracts and Specifications
Prerequisite(s): Graduate standing or consent of instructor. The nature of contracts. Contract documents. Master format. Principles of specification writing. Contract types. Bonds and insurance. Bidding. Subcontracting. Disputes and disputes resolution.

CIVE 5143*
Project Engineering and Management
Prerequisite(s): 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.

CIVE 5153*
Contract Administration
Prerequisite(s): Graduate standing or consent of instructor. Methods and techniques of tracking and control of construction projects. Evaluation of current research findings to contract implementation.

CIVE 5163*
Construction Equipment Management
Prerequisite(s): Graduate standing or consent of instructor. Analysis of construction equipment. Performance under various operating 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.

CIVE 5173*
Concrete Formwork Design
Prerequisite(s): Graduate standing or consent of instructor. Design of formwork for concrete structures. Analysis of loads, deflections, and stresses of forming systems. Evaluation of economics of formwork designs.

CIVE 5183*
Construction Estimating
Lab 2. Prerequisite(s): 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. Emphasis on preliminary cost estimates during the conceptual design phase of a construction project.

CIVE 5243*
Use and Design of Geosynthetics
Prerequisite(s): 3713, 4711. 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.

CIVE 5263*
Terrain Analysis
Prerequisite(s): 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.

CIVE 5303*
Systems Analysis for Civil Engineers
Prerequisite(s): 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.

CIVE 5313*
Highway Traffic Operations
Prerequisite(s): 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 freeways, 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.

CIVE 5343*
Urban Transportation Planning
Prerequisite(s): 3633. Determinants of demand for transportation and models for demand forecasting. Performance characteristics of transportation systems and models for performance. Quantitative analysis of multimodal transportation networks including prediction of flow patterns and service quality. Evaluation of social, environmental, and political impacts of transportation decisions. Application of systems analysis techniques to the generation, evaluation, and selection of alternative transportation systems.

CIVE 5363*
Design and Planning of Airports
Prerequisite(s): 3633. Nature of civil aviation. Aircraft characteristics and performance related to airport planning and design. Air traffic control and navigation systems. Basics of airport planning and airport demand forecasting. Analysis of airport capacity and delays. Runway length requirements. Configuration and geometric design of runways, taxiways, holding aprons, and landing areas. Airport lighting, marking, and signing. Drainage and noise control.

CIVE 5373*
Design of Traffic Control Systems
Prerequisite(s): 3633. Traffic control systems design, available technological options, and range of agency needs. Design of vehicle detectors, controllers, communications 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.

CIVE 5383*
Geometric Design of Highways
Prerequisite(s): 3633. Geometric, functional, and aesthetic aspects of roadway design. Alignment, sight distance, at-grade intersections, interchanges, and freeway systems. Design tools and techniques.

CIVE 5403*
Advanced Strength of Materials
Prerequisite(s): 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, elastic stability.

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

CIVE 5423*
Matrix Analysis of Structures
Prerequisite(s): Consent of instructor. Matrix analysis of two- and three-dimensional trusses and frames. Development of member stiffness matrices. Assemblage of structure matrices by direct stiffness method. Computer programs for structural analysis.

CIVE 5433*
Energy Methods in Applied Mechanics
Prerequisite(s): 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.

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

CIVE 5453*
Engineering Analysis
Prerequisite(s): 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.

CIVE 5503*
Computer-aided Structural Analysis and Design
Prerequisite(s): 3413; 3513 and 3523 (or concurrent enrollment); senior or graduate standing. Major comprehensive design experience. Promotion of a design office atmosphere in using a team approach. Industry practitioners provide design projects and critique results. Analysis and design of complex structures and preparation of contract documents and drawings. Emphasis on modern computer-based computation and presentation tools.

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

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

CIVE 5533*
Prestressed Concrete
Prerequisite(s): 3523. Design of simple and continuous prestressed concrete beams. Behavior under overload. Calculation of prestress losses and deflections.

CIVE 5653*
Asphalt Materials and Mix Design
Lab 1.5. Prerequisite(s): 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 aggregates. Laboratory sessions focused on the engineering properties of the materials discussed.

CIVE 5673*
Concrete Materials and Mix Design
Lab 1.5. Prerequisite(s): 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 procedures. Laboratory on theoretical and practical aspects of concrete technology.

CIVE 5693*
Pavement Design and Analysis
Prerequisite(s): 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.

CIVE 5703*
Soils in Construction
Prerequisite(s): 3713, 4711 or consent of instructor. Soil types and general behavior during construction; earthwork construction requirements and specific considerations for embankments, pavements, buildings, and retaining structures; groundwater control during construction; soil modification and stabilization; and construction considerations for geosynthetics. Basic design considerations, including selection of placement conditions for compaction; proportioning of groundwater control systems; selection of type and amount of soil modifier and design of geosynthetics to meet specific functions.

CIVE 5713*
Soil Mechanics
Prerequisite(s): 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.

CIVE 5723*
Foundation Engineering
Prerequisite(s): 3713 and 4711. Types of structural foundations including footings, mats, rafts, piles and drilled shafts. Site characteristics, exploration programs, field data, test results and construction materials and methods as basis for selection of type of foundation and design. Geotechnical design procedures and considerations.

CIVE 5733*
Rock Mechanics in Engineering Design and Construction
Prerequisite(s): Undergraduate courses in soils and geology. Stresses, strength variations, and deformational behavior of rock. Engineering classification of rock. Methods of field and laboratory measurement of the engineering properties of rock. Rock mechanics consideration in the design and construction of engineering works.

CIVE 5753*
Engineering Soil Stabilization
Prerequisite(s): 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.

CIVE 5803*
Essentials of Environmental Engineering
Prerequisite(s): 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.

CIVE 5813*
Environmental Laboratory Analysis
Lab 3. Prerequisite(s): 4833 or concurrent enrollment. Analytical procedures for water and waste water contaminants. Emphasis on the chemical theory of procedures, analytical work and an understanding of the significance or need for such laboratory data for surface and groundwater management and water and wastewater treatment processes and design.

CIVE 5823*
Environmental Risk Assessment and Management
Prerequisite(s): 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.

CIVE 5833*
Introduction to Environmental Modeling
Intended as an introductory course for graduate and senior undergraduate students to the fundamentals of environmental modeling. Develops material necessary to construct models capable of identifying contaminant distributions at future times and space for water and air pollution applications. Advanced topics such as stochastic modeling, ecological risk assessment, neural modeling and spatial statistical analysis among others will be presented according to the backgrounds and interests of the enrolled students. In part, the course is designed as the "Physical Science" component for MS students in the Environmental Sciences program.

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

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

CIVE 5873*
Air Pollution Control Engineering
Causes, effects, and control of atmospheric pollution.
(Same course as CHE 5873*)

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

CIVE 5913*
Groundwater Hydrology
Prerequisite(s): 3843. Theory of groundwater movement, storage, exploration and pumping tests. Design of groundwater recovery and recharge systems.

CIVE 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 urban storm water. Systems analysis approaches, primarily linear and dynamic programming, and their application in water resources.

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

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

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

CIVE 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.

CIVE 5993*
Environmental Data and Analysis and Modeling
Prerequisite(s): 5913 or equivalent. Identification and application of various methods to analyze environmental data. Includes statistical, mathematical, and neural modeling. Emphasis on application of geostatistics to spatial environmental problems; including construction modeling semivariogram, kriging, co-kriging, and indicator kriging problems. Deterministic and stochastic simulation methods addressed, including conditional and Monte Carlo simulation with discussions of the inverse problems. More conventional statistical evaluations of environmental monitoring data including trend analysis and sampling adequacy or redundancy.

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

CIVE 6010*
Seminar
1-6 credits, max 12. Prerequisite(s): 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.

CIVE 6403*
Theory of Elasticity
Stress, strain, and deformation analysis of two- and three-dimensional elastic continua. Propagation of stress waves through elastic continua.

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

CIVE 6843*
Stochastic Methods in Hydrology
Prerequisite(s): STAT 4073 or 4033. Stochastic and statistical hydrologic analyses of surface water and ground water systems. Analyses of urban and rural drainage and detention systems. ***(Same course as BAE 6313)***

CIVE 6853*
Modeling of Water Resources Systems
Prerequisite(s): 5913. Application of finite-difference and finite-element methods to predict water flow and chemical and biological water quality in saturated-unsaturated ground waters, streams, lakes, urban areas, and watersheds.

CIVE 6923*
Industrial Wastes Engineering
Prerequisite(s): 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.

CIVE 6953*
Advanced Biological Waste Treatment
Prerequisite(s): 5953. Advanced biological treatment processes and new process developments. Nutrient management, anaerobic wastewater treatment, hazardous waste bioremediation, land treatment, and macrophyte systems. Use of kinetic models for system design.

Communication Sciences and Disorders (CDIS)

CDIS 2033
Sign Languages
Introduction to methods of sign language currently used among the US deaf society, 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.

CDIS 3123
Audiology and Audiometry
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.

CDIS 3213
Introduction to Communication Disorders
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.

CDIS 3223
Speech and Language Development
Normal acquisition of phonology, morphology, semantics, syntax, and pragmatics in children. Biological and cognitive social bases of language acquisition. Description of dialect variations, second language acquisition, and atypical language development. The relationship between spoken and written language development.

CDIS 3313
Phonetics
The analysis and description of speech at the segmental and suprasegmental levels. Development of students' perceptual and analytical skills in speech sound production. Practice using the International Phonetic Alphabet for broad and narrow transcription. Overview of the speech production mechanism and process.

CDIS 4010
Clinic Practicum
1-3 credits, max 3, Lab 2-6. Prerequisite(s): 4022, 4031, 4323 or 4413, senior standing, 3.25 GPA in the major and consent of adviser. Supervised clinical practicum in speech-language pathology and audiology.

CDIS 4022
Clinical Methods and Issues
Prerequisite(s): 3213, 3223, 3313; acceptance into preprofessional 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.

CDIS 4133
Aural Rehabilitation
Prerequisite(s): 3123. Clinical aspects of habilitation and rehabilitation programs for the deaf and the hard-of-hearing, including speech reading, auditory training, speech conservation, speech and language therapy, hearing aid orientation, and counseling. Study of amplification units including assistive listening devices.

CDIS 4213
Anatomy and Physiology of the Speech Mechanism
Structure and function of the respiratory, phonatory, articulatory, and neural systems involved in the oral communication processes.

CDIS 4222*
Language Analysis
Prerequisite(s): 3224, and one of: FLL 2443, ENGL 2443, 4003, 4013, 4063, 4093. Applications of content, form and use analysis methods to language samples of individuals with communication disorders. Analyses of word, phrase, sentence, and discourse levels. Variations as a function of age, culture, modality (spoken or written), and disorder type.

CDIS 4253*
Diagnostic Procedures in Communication Disorders
Prerequisite(s): 3224. Speech and language diagnostic testing and procedures, interpreting diagnostic information and deriving appropriate treatment goals.

CDIS 4313*
Speech Science
Prerequisite(s): Acceptance into CDIS program. Scientific bases of the acoustic parameters, the perceptual and productive processes of speech, and the interrelationships of those factors during speech communication.

CDIS 4323
Language Disorders in Children
Prerequisite(s): 3223. Principles of language assessment, diagnosis, intervention; goal selection and procedural processes for language intervention with infants, toddlers and preschool-age children.

CDIS 4413
Speech Disorders in Children
Prerequisite(s): 3223 or concurrent enrollment; 3313. Current theories and research in clinical phonology and applied linguistics related to phonological disorders in children. Normal development and contemporary approaches to assessment and treatment. Lecture, discussion, projects and clinical observation.

CDIS 4423
Neural Bases of Speech and Language
Prerequisite(s): 4213. Neuroanatomy and neuro-physiological processes related to speech and language. Including basic anatomy of the central and peripheral nervous systems and the physiological processes involved in neuromotor control and neuronal function related specifically to speech and language.

CDIS 4980
Independent Study in Communication Sciences and Disorders
1-3 credits, max 3. Prerequisite(s): Junior standing and consent of instructor. Directed readings or research in communication sciences and disorders.

CDIS 4993
Senior Honors Thesis
Prerequisite(s): 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. Required for graduation with departmental honors in communication sciences and disorders.

CDIS 5000*
Research and Thesis
1-3 credits, max 6. Prerequisite(s): Consent of graduate faculty. Research in speech, language and hearing sciences and disorders.

CDIS 5013*
Research Methods in Communication Disorders
Research methods with emphasis on methods used most frequently in communication sciences and disorders; experience devising, evaluating, and implementing research.

CDIS 5113*
Advanced Language Disorders in Children
Prerequisite(s): 3223, 4323. Principles of language assessment and intervention based on linguistic, cognitive, and social learning theories. Critical analysis of current research. Design of assessment and intervention programs.

CDIS 5123*
Clinical Audiology
Prerequisite(s): 4133, 4313. Hearing disorders and their etiologies. Clinical application of pure tone and speech audiometric tests and impedance screening. Clinical management of the hearing impaired. Central auditory processing disorders diagnosis and management.

CDIS 5143*
Phonological Disorders
Prerequisite(s): 4413. Current issues in linguistic theories related to the assessment and treatment of phonological disorders in children. Critical analysis of current research.

CDIS 5152*
Neurological Communication Disorders
Prerequisite(s): 4213. Communication changes occurring with aging and common neurological diseases and trauma. Neurophysiological bases and etiology. Evaluation and treatment of aphasia and right hemisphere disorders.

CDIS 5163*
Dysphagia
Prerequisite(s): 4213. Anatomy and neurophysiology of the swallowing mechanism in relation to pediatric and adult dysphagia. Evaluation, diagnosis and treatment of swallowing problems in children and adults including videofluoroscopic training with case studies. The first two-thirds of the course focus on adult dysphagia and the latter one third on pediatric dysphagia.

CDIS 5172*
Motor Speech Disorders
Prerequisite(s): 5153. Nature, evaluation and treatment of neurologically-based motor speech disorders such as dysarthria and apraxia.

CDIS 5183*
Traumatic Brain Injury and Dementia
Prerequisite(s): 5152. Nature, evaluation and treatment of acquired cognitive communication disorders secondary to traumatic injury or dementia.

CDIS 5210*
Advanced Practicum
1-6 credits, max 9. Prerequisite(s): Consent of instructor. Practical experience for the advanced student on or off campus.

CDIS 5232*
Communication Disorders in Infants and Toddlers
Prerequisite(s): 3223. Family-centered assessment, intervention, and prevention issues with infants and toddlers, birth to 3 years of age, who are at risk or have communication disorders. Impact of perinatal, neonatal and postnatal biological and environmental risks on developmental outcome.

CDIS 5243*
Language Disorders in School-Age and Adolescence
Prerequisite(s): 4323, 5113. Nature of spoken and written language disorders in school-age children and adolescents. Impact of language disorders on academic achievement. Assessment and intervention strategies.

CDIS 5333*
Voice Disorders
Prerequisite(s): 4313. The physiology of the vocal mechanism and factors which cause voice deviations. Recent research on diagnostic and intervention procedures in a variety of disorders. Independent study, observations in medical settings, and special demonstrations.

CDIS 5422*
Adaptive Communication Systems
Prerequisite(s): Major in communication science and disorders or consent of instructor. Evaluation and management of communication disorders in individuals requiring specially adapted educational intervention programs. Adaptive communication technologies.

CDIS 5433*
Cleft Palate
Prerequisite(s): 4213, 4313. Recent research in the etiology, assessment and management of communicative disorders in individuals with cleft palate.

CDIS 5710*
Special Topics in Communication Disorders
1-4 credits, max 9. Prerequisite(s): Consent of instructor. Individual and group investigations of problems in communication sciences and disorders.

CDIS 5713*
Fluency Disorders
Prerequisite(s): Graduate admission or consent. Current research regarding the nature of etiologies, evaluation and treatment of dysfluent speech in both children and adults.

CDIS 5720*
Seminar in Communication Disorders
1-3 credits, max 3. Prerequisite(s): Consent of instructor. Topics relevant to the evaluation and treatment of communication disorders presented on a rotating basis.

CDIS 5730*
Independent Study in Communication Sciences and Disorders
1-3 credits, max 3. Prerequisite(s): Graduate standing and consent of instructor. Directed readings or research in communication sciences and disorders.

CDIS 5741*
Advanced Professional Issues
Prerequisite(s): 5731. Current legal, ethical, and clinical service provision issues for advanced practicum students in communication sciences and disorders.

CDIS 5760*
Portfolio
1-2 credits, max 2. Prerequisite(s): Graduate standing. Nature and preparation of professional portfolio with faculty guidance.

Computer Science (CS)

CS 1003
Computer Proficiency
Lab 4. For students with minimal personal computer skills. Use of internet and productivity software such as word processing, spreadsheets, databases, and presentation software. The ability to log on to a personal computer, access the OSU network, and access OSU websites is assumed.

CS 1103
(A)Computer Programming
Lab 2. Prerequisite(s): MATH 1513 or equivalent. Introduction to computer programming using a high-level computer language, including subprograms and arrays. Principles of problem solving, debugging, documentation, and good programming practice. Elementary methods of searching and sorting. *Not intended for computer science majors.*

CS 1113
(A)Computer Science I
Lab 2. Prerequisite(s): 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.

CS 2133
Computer Science II
Prerequisite(s): 1113. Recursive algorithms. Intermediate methods of searching and sorting. Mathematical analysis of space and time complexity, worst case, and average case performance.

CS 2301
FORTRAN 77 Programming
Prerequisite(s): Another programming language. FORTRAN 77 control structures, arrays, subroutines, functions, input/output.

CS 2331
SAS Programming
Prerequisite(s): 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.
(Same course as STAT 2331)

CS 2351
UNIX Programming
Lab 2. Prerequisite(s): CS 1113 or EET 2303. The UNIX programming system. The programming environment. The UNIX file system and the shell. Use of pipes and filters.

CS 2433
C/C++ Programming
Prerequisite(s): 1113. C/C++ programming language types, operators, expressions, control flow, functions, structures, pointers, arrays, UNIX interface. Basic object oriented programming using C++ and the related language syntax and functionality.

CS 2570
Special Problems in Computer Science
1-3 credits, max 6. Prerequisite(s): 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 provided in existing classes. Can be individual study or a class with a new subject.

CS 3030
Industrial Practice in Computer Science
1-6 credits, max 12. Prerequisite(s): 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.*

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

CS 3373
Advanced Object-Oriented Programming for Windowing Environments
Prerequisite(s): For CS students, 2133, 2433. For TCOM students, CS 4343 and a working knowledge of C++. Applying the object-oriented computing model to the design and development of software for windowing environments. Effective use of Graphical User Interfaces (GUIs), the Internet, data interchange principles, and related topics. *No credit for students with credit in 5373.*
(Same course as 5373*)

CS 3423
File Structures
Prerequisite(s): 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 database systems.

CS 3443
Computer Systems
Prerequisite(s): 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.

CS 3513
Numerical Methods for Digital Computers
Prerequisite(s): MATH 2153; MATH 3013 or MATH 3263 and 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.

CS 3570
Special Problems in Computer Science
1-6 credits, max 6. Prerequisite(s): 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.

CS 3613
Theoretical Foundations of Computing
Prerequisite(s): 2133, 3653. Introduction to the classical theory of computer science. Sequential machines and their applications to devices, processes, and programming. Models of computation: finite-state automata, push-down automata, Turing machines. The role of non-determinism. Limits of digital computation. Computability and unsolvability. The Church-Turing Thesis.

CS 3653
Discrete Mathematics for Computer Science
Prerequisite(s): 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.

CS 4091*
Statistical Analysis System
SAS dataset construction, elementary statistical analysis, and use of statistics and graphics procedures available in the SAS package.
(Same course as STAT 4091)

CS 4113
Techniques of Computer Science for Science and Engineering
Prerequisite(s): One year calculus and senior or graduate standing. For 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, and program libraries. *No credit as a major elective for computer science majors.*

CS 4143
Computer Graphics
Prerequisite(s): MATH 2163 and prior programming experience. 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.

CS 4154*
Computer Science Migration
Lab 2. Prerequisite(s): 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.

CS 4243
Algorithms and Processes in Computer Security
Prerequisite(s): 3443. Overview of the components of computer and network security. Discussion of external processes required in secure systems, information assurance, backup, business resumption. Detailed analysis of security encryption, protocols, hashing, certification, and authentication. *No credit for students with credit in CS 5243.*

CS 4273*
Software Engineering
Prerequisite(s): 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)

CS 4283*
Computer Networks
Prerequisite(s): 2133, 3443 or ECEN 3213; UNIX knowledge. 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 ECEN 4283)

CS 4323*
Design and Implementation of Operating Systems I
Prerequisite(s): 2133, 3443, 3653, 4343 or ECEN 3213. Process activation and process context block. Batch, multi-programmed, and timeshared operating system. Process management, memory management, and synchronization primitives. Deadlock prevention, avoidance, and detection.

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

CS 4443*
Compiler Writing I
Prerequisite(s): 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.

CS 4513*
Numerical Mathematics: Analysis
Prerequisite(s): MATH 2233, 3013, knowledge of programming 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 MATH 4513)***

CS 4570*
Special Topics in Computing
1-3 credits, max 5. Prerequisite(s): Senior standing and consent of instructor. 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.

CS 4793*
Artificial Intelligence I
Prerequisite(s): 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.

CS 4883
Social Issues in Computing
Prerequisite(s): Senior standing and ENGL 3323 or BCOM 3113 or BCOM 3223. The history and evolution of computing systems, providing the background for the analysis of the social impact of computers. The social implications of computer use and 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.

CS 4993
Senior Honors Project
Prerequisite(s): Departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors project under the direction of a faculty member, with a second faculty reader and an oral examination. Required for graduation with departmental honors in computing and information science.

CS 5000*
Research and Thesis
1-6 credits, max 6. Prerequisite(s): 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.

CS 5030*
Professional Practice
1-9 credits, max 9. Prerequisite(s): 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.*

CS 5070*
Seminar and Special Problems
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Designed to allow students to study advanced topics not provided in existing courses.

CS 5113*
Computer Organization and Architecture
Prerequisite(s): 3443. Computer architecture, computer control, microprogrammed control, addressing structures, memory hierarchies, hardware description languages, specific architectures, hardware simulation, and emulation.

CS 5243*
Algorithms and Processes in Computer Security
Prerequisite(s): 3443. Overview of the components of computer and network security. Discussion of external processes required in secure systems, information assurance, backup, business resumption. Detailed analysis of security encryption, protocols, hashing, certification, and authentication. *No credit for students with credit in 4243.*

CS 5253*
Digital Computer Design
Prerequisite(s): ECEN 3223. 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 ECEN 5253)

CS 5263*
Quantum Computing
Prerequisite(s): Graduate standing. The main theory of quantum information science and its applications to communications, computing and cryptography. Topics include introduction to quantum mechanics, quantum gates, circuits, entropy, cryptographic schemes, and implementations. Current technology in support of quantum processing will be reviewed.

CS 5273*
Advanced Software Engineering
Prerequisite(s): 4273. Continuation of 4273. Formal methods for software design and development. Static analysis. Emerging design and development approaches. Model checking and model-based software reuse. Component-based software engineering and software repositories. ***(Same course as ECEN 5273)***

CS 5283*
Computer Network Programming
Prerequisite(s): 4283. Detailed technical concepts related to Internet and multimedia, high speed LANS, high speed transport protocols, MPLS, multicasting, Int. serv/Diff serv, Router Buffer management, self-similar traffic, and socket programming.

CS 5313*
Formal Language Theory
Prerequisite(s): 3613. Formal language theory applied to procedure oriented languages. Application of finite state algorithms to lexical analysis. Chomsky hierarchy of languages. Generation, recognition, and closure properties of languages.

CS 5323*
Design and Implementation of Operating Systems II
Prerequisite(s): 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.

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

CS 5363*
Advanced Organization of Programming Languages
Prerequisite(s): 3363. Continuation of 3363, mathematical theory of computer language organization functional programming. Parallelism in languages. Mathematics of control structures and data structures. Applicative languages. Symbolic languages.

CS 5373*
Advanced Object-Oriented Programming for Windowing Environments
Prerequisite(s): For CS students, 2133, 2433. For TCOM students, CS 4343 and a working knowledge of C++. Applying the object-oriented computing model to the design and development of software for windowing environments. Effective use of Graphical User Interfaces (GUIs), the Internet, data interchange principles and related topics. *No credit for students with credit in 3373*. ***(Same course as 3373)***

CS 5413*
Data Structures and Algorithm Analysis II
Prerequisite(s): 4154 or 4343. Data structures and their application in recursive and iterative algorithms. Static and dynamic data structure representations and processing algorithms. Dynamic and virtual storage management.

CS 5423*
Principles of Database Systems
Prerequisite(s): 3423, 4343 or equivalents. An overview of database management systems, entity-relationship model, relational model, structural query language, relational algebra, relational database design with normalization theorems, database integrity constraints, and principles of database systems with the Internet.

CS 5433*
Distributed Database Systems
Prerequisite(s): 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, and SQL server.

CS 5513*
Numerical Computation
Prerequisite(s): MATH 2233 and MATH 3013 or MATH 3263 or equivalent courses; CS 3513 or MATH 4513 or an equivalent course; a knowledge of computer programming. Errors in machine computation; condition of problems and stability of algorithms; interpolation and approximation; nonlinear equations; linear and nonlinear systems; differentiation and integration; applications to modeling, simulation, and/or optimization.

CS 5653*
Automata and Finite State Machines
Prerequisite(s): 5313. Sequential machines and automata. Hierarchy of recognizers. Decision problems and closure properties. Finite and infinite state machines. Cellular and stochastic automata. Coverings of automata.

CS 5663*
Computability and Decidability
Prerequisite(s): 5313. Primitive and partial recursive functions. Equivalence of models of computation. The Halting problem and undecidability. Reducing one problem to another or representation change. Tractability and the P-NP problem. Complexity hierarchies.

CS 5793*
Artificial Intelligence II
Prerequisite(s): 4793. Advance knowledge representation and expert system building, including reasoning under uncertainty. Applications to planning, intelligent agents, natural language processing, robotics, and machine learning.

CS 5813*
Principles of Wireless Networks
Prerequisite(s): 4283 or ECEN 4283. Wireless network operation, planning, mobility management, cellular and mobile data networks based on CDMA, TDMA, GSM, IEEE 802-11 WLANS, Adhoc networks, Bluetooth, power management, wireless geolocation and indoor positioning techniques. ***(Same course as ECEN 5563)***

CS 5823*
Network Algorithmics
Prerequisite(s): 4283 and 4323. Discusses principles of efficient network implementation-router architecture, end node architecture, data copying, timer maintenance, demultiplexing, forwarding table, lookups, switching, scheduling, IP traceback.

CS 6000*
Research and Dissertation
2-15 credits, max 30. Prerequisite(s): Graduate standing and approval of advisory committee. Independent research under the direction of a member of the graduate faculty. *For students working toward a PhD degree.*

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

CS 6253*
Advanced Topics in Computer Architecture
Prerequisite(s): 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)***

CS 6300*
Advanced Topics in Programming Languages
2-6 credits, max 12. Prerequisite(s): 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*.

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

CS 6400*
Advanced Topics in Information Systems
2-6 credits, max 12. Prerequisite(s): 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 and distributed DBMS reliability.

CS 6500*
Advanced Topics in Numerical Analysis
2-6 credits, max 12. Prerequisite(s): MATH 5543, 5553. Systems of nonlinear equations, nonlinear least squares problems, iterative methods for large systems of linear equations, finite element methods, solution of partial differential equations. *May be repeated with change of topics.*

CS 6600*
Advanced Topics in Analysis of Algorithms
2-6 credits, max 12. Prerequisite(s): 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.*

CS 6623*
Algebraic Structures of Formal Grammars
Prerequisite(s): 5313, 5653. Context-free languages, Kleene languages, Dyck languages, context-sensitive languages; use of algebraic systems to define languages; linear bounded automata.

CS 6700*
Advanced Topics in Artificial Intelligence
2-6 credits, max 12. Prerequisite(s): 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.*

CS 6800*
Advanced Topics in Computing Networks
2-12 credits, max 12. Prerequisite(s): 5283; Graduate standing in Computer Science; consent of instructor. Large scale embedded networks, deep-space networking, ubiquitous computing, optical networking, Next Generation Internet. *May be repeated with change of topics.*

Construction Management Technology (CMT)

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

CMT 2253
Construction Drawings
Principles of graphic communication are applied to reading and drawing construction plans. Techniques for measuring items of construction work from plans and specifications are also covered.

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

CMT 2343
Concrete Technology
Lab 3. Prerequisite(s): 1214. Fundamentals of concrete and concrete making materials including admixtures. Proportioning concrete mixtures. Batching, mixing, conveying, placing, finishing, and curing concrete. Hot and cold weather concreting, jointing, volume change and crack control.

CMT 3273
Scheduling Construction Projects
Prerequisite(s): 2263 and acceptance to the CMT upper-division or obtain department permission. Scheduling basics, including bar charts and critical-path methods; manual and computer techniques using current software; emphasis on using schedules for construction project management.

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

CMT 3332
Construction Practicum II
Prerequisite(s): 2263, 3331 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.*

CMT 3364
Structures I
Lab 3. Prerequisite(s): 2343, GENT 3323 and acceptance to the CMT Upper Division or obtain department permission. Methods of structural analysis applicable to construction; design of timber structures and forms for concrete structures.

CMT 3433
Principles of Site Development
Lab 3. Prerequisite(s): CIVE 3614, GENT 3323 and acceptance to the CMT Upper Division or obtain department permission. Site layout, vertical and horizontal control, surveying instrument adjustments, site investigations, excavations, site drainage and geotechnical considerations.

CMT 3463
Environmental Building Systems
Lab 3. Prerequisite(s): PHYS 1214 and acceptance to the CMT Upper Division or obtain department permission. Plumbing, heating, air-conditioning, electrical and lighting systems as applied to residences and commercial buildings.

CMT 3554
Structures II
Lab 3. Prerequisite(s): 3364 and acceptance to the CMT Upper Division or obtain department permission. Analysis and design of elements in steel and reinforced concrete structures; review of shop drawings for both types of construction.

CMT 3633
CAD and BIM for Construction Managers
Lab 2. Prerequisite(s): Acceptance into CMT Upper Division. Interpretation and production of construction drawings using computer aided drafting. Theory and use of Building Information Modeling software builds upon computer aided drafting skills.

CMT 4050
Advanced Construction Management Problems
1-6 credits, max 6. Prerequisite(s): Junior standing and consent of instructor. Special problems in construction management.

CMT 4263
Estimating II
Prerequisite(s): 2263 and acceptance to the CMT Upper Division or obtain department permission. Extensive use of actual contract documents for quantity take-off, pricing and assembling the bid for several projects. Use of computers in estimating.

CMT 4273
Computer Estimating
Lab 6. Prerequisite(s): 4263 and acceptance to the CMT Upper Division or obtain department permission. Various software programs applied to estimating for building construction. Automated take off (Digitizer) systems.

CMT 4283
Business Practices for Construction
Prerequisite(s): 4563, ACCT 2103 and acceptance to the CMT Upper Division or obtain department permission. 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.

CMT 4293
Construction Manager Concepts
Prerequisite(s): 3332, 4273, 4283 and acceptance to the CMT Upper Division or obtain department permission. 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.

CMT 4333
Equipment Management for Constructors
Prerequisite(s): Acceptance into CMT Upper Division. Selection and use of equipment, estimating equipment costs, estimating equipment production rates for all types of equipment used in bulding construction and heavy/highway construction.

CMT 4443
Construction Safety and Loss Control
Prerequisite(s): Must be accepted to the CMT Upper Division or obtain department permission. 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.

CMT 4533
Heavy and Highway Estimating
Prerequisite(s): Acceptance into CMT Upper Division. Theory and application of contractor estimating and bidding procedures used in heavy and highway construction projects.

CMT 4563
Construction Law and Insurance
Prerequisite(s): 3273 and acceptance to the CMT Upper Division or obtain department permission. Legal and insurance problems as they pertain to the construction industry.

Counseling Psychology (CPSY)

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.

CPSY 4443
(D)Cultural Diversity in Professional Life
Knowledge, awareness and skills regarding cultural diversity in one's professional life.

CPSY 5000*
Master's Thesis
1-6 credits, max 6. Prerequisite(s): 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.

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

CPSY 5320*
Seminar in Counseling Psychology
3-9 credits, max 9. Prerequisite(s): Graduate standing. In-depth exploration of contemporary topics in counseling psychology.

CPSY 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.

CPSY 5473*
Introduction to Counseling Practice
Prerequisite(s): 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 potential counselor or student personnel administrator.

CPSY 5483*
Community Counseling and Resource Development
Prerequisite(s): Graduate standing. Application of educational, preventive, and crisis interventions in a variety of human service settings, including the development and evaluation of community helping resources.

CPSY 5493*
Professional and Ethical Issues in Counseling
Prerequisite(s): 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.

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

CPSY 5513*
Comprehensive School Counseling Programs
Foundations of school counseling focusing on the knowledge and skills required to develop, implement, coordinate, and manage a comprehensive, developmental school counseling program. ***(Same course as 5573*)***

CPSY 5523*
Individual Appraisal
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.

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

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

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

CPSY 5563*
Conceptualization and Diagnosis in Counseling
Prerequisite(s): 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.

CPSY 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.

CPSY 5593*
Counseling Practicum
Lab 3. Prerequisite(s): 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 consulting 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.

CPSY 5683*
Internship in Counseling I
Prerequisite(s): Grade of "B" or better in 5593 and admission to counseling program. Supervised experience working and studying in a counseling agency or setting.

CPSY 5693*
Internship in Counseling II
Prerequisite(s): Grade of "B" or better in 5683 and admission to counseling program. Supervised experience working and studying in a counseling agency or setting.

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

CPSY 6000*
Doctoral Dissertation
1-25 credits, max 25. Prerequisite(s): 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.

CPSY 6053*
Ethical and Legal Issues in Professional Psychology
Prerequisite(s): Consent of instructor. Ethical and legal standards applied to the professional practice of psychology.

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

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

CPSY 6153*
Personality Theories
Prerequisite(s): Graduate standing. An in-depth analysis of personality theories and personality disorders.

CPSY 6223*
Beck's Cognitive Therapy
Prerequisite(s): Graduate standing in counseling, counseling psychology, school psychology, or clinical psychology; or consent of instructor. The theory and practice of Aaron T. Beck's cognitive therapy approach. Cognitive restructuring, problem-solving, imagery work, and cognitive case conceptualization skills to help clients with a variety of presenting problems.

CPSY 6310*
Advanced Practicum and Supervision
3-12 credits, max 12. Prerequisite(s): Admission to counseling psychology program. For prospective counseling psychologists, counselor educators and supervisors, and practicing counselors. Supervised assistance in development of counseling, consulting, and supervising competencies.

CPSY 6313*
Advanced Group Interventions
Lab 1. Prerequisite(s): Admission to counseling psychology program or consent of instructor. Discussion and exploration of various aspects of group development and treatment. Theory and application of theory. Various factors associated with group psychotherapy cohesion, dynamics and screening.

CPSY 6413*
Counseling Psychology Practicum I
Lab 3. Prerequisite(s): Admission into the doctoral program in counseling psychology. For prospective counseling psychologists. Individual and group supervision and didactic experiences to facilitate the development of counseling psychology competencies with clients at practicum sites. Establishing therapeutic conditions conducive to growth and change.

CPSY 6423*
Counseling Psychology Practicum II
Lab 3. Prerequisite(s): Grade of "B" or better in 6413. For prospective counseling psychologists. Individual and group supervision and didactic experiences to facilitate the development of counseling psychology competencies with clients at practicum sites. Integrating theory and research into the practice of counseling psychology.

CPSY 6433*
Counseling Psychology Practicum III
Lab 3. Prerequisite(s): Grade of "B" or better in 6423. For prospective counseling psychologists. Individual and group supervision and didactic experiences to facilitate the development of counseling psychology competencies with clients at practicum sites. Integrating theory and psychological assessment skills into the practice of counseling psychology.

CPSY 6443*
Counseling Psychology Practicum IV
Prerequisite(s): Grade of "B" or better in 6433. For prospective counseling psychologists. Individual and group supervision and didactic experiences to facilitate the development of counseling psychology competencies with clients at practicum sites. Building integrating consultation skills into the practice of counseling psychology.

CPSY 6543*
Clinical Supervision
Prerequisite(s): Admission to clinical, counseling or school psychology doctoral program, or consent of instructor. Building the doctoral psychology student's knowledge base in theory and research of clinical supervision in psychology, and development and refinement of the student's supervision skills. Current theory and research in supervision, including a practical component.

CPSY 6553*
Advanced Practice in Marital and Family Treatment
Prerequisite(s): Admission to counseling, school or clinical psychology program. 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 PSYC 6553)***

CPSY 6560*
Advanced Internship in Counseling
1-3 credits, max 6. Prerequisite(s): Admission to the doctoral program in psychology. Designed to facilitate counseling effectiveness and to set the stage for a productive life of professional practice.

CPSY 6850*
Directed Reading
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Directed reading for students with advanced graduate standing.

Curriculum and Instruction Education (CIED)

CIED 0123
Improving College Reading Skills
Lab 1. Individualized instruction 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.*

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

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

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

CIED 3153
Teaching Mathematics at the Primary Level
Lab 2. Prerequisite(s): Grade of "C" or better in MATH 3403 or 3603; six hours of math; consent of instructor. Developmental levels in selection and organization of content and procedures for primary mathematics education.

CIED 3430
Early Lab and Clinical Experience in Elementary Education II
1-2 credits, max 3, Lab 3-6. Prerequisite(s): 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.*

CIED 3450
Foreign Language Field Experiences in the Schools, K-12
1-2 credits, max 2, Lab 3-6. Prerequisite(s): Consent of instructor; 2.50 GPA and passing scores on the Oklahoma General Education Test. Seminars, directed observation and participation in foreign language classrooms, K-12. Experiences in addressing the mental, social, physical, and cultural differences among children. *Graded on a pass-fail basis.*

CIED 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. Also includes a field-based experience in a middle school.

CIED 3712
Field Experiences in the Secondary School
Lab 2. Prerequisite(s): 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. Experience in meeting the mental, social, physical, and cultural needs among children. *Graded on a pass-fail basis.*

CIED 4000
Field Studies in Education
1-4 credits, max 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.*

CIED 4003*
Teaching Fundamental Concepts of Mathematics
Prerequisite(s): Full admission to Professional 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.

CIED 4005
Literacy Assessment and Instruction
Lab 0-2. Prerequisite(s): 3005 or HDFS 3213. Provides a 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.

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

CIED 4041
Interdisciplinary Curriculum Design and Development
Lab 2. Prerequisite(s): Full admission to Professional Education and concurrent enrollment in 3430, 4012, 4153, 4323, 4353, and 4362. Planning and development of interdisciplinary teaching units for the elementary school classroom. Pedagogical approaches and materials for teaching integrated themes, as well as research on effective integrated teaching practices.

CIED 4053*
Teaching Geometry in the Secondary School
Prerequisite(s): Full admission to Professional Education. Overview of the present secondary geometry curricula 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.*

CIED 4153
Teaching Mathematics at the Intermediate Level
Lab 1. Prerequisite(s): 3153 and MATH 3403 and 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 grades. Some attention to instruction in upper grades of the elementary school.

CIED 4213
Introduction to the Visual Arts in the Curriculum
Lab 4. Provides an understanding of the theoretical basis for the use of art activities in developing sensory perception and aesthetic sensitivity as an integral part of the curriculum. Includes a wide range of opportunities for student involvement in experimentation and exploration with a variety of two- and three-dimensional art media. Emphasis on both creative expression and appreciation of the visual arts in the home, school and community as a vital aspect of instruction in the school, preschool level through grade eight.

CIED 4263*
Teaching and Learning Foreign
Languages in the Elementary Schools (Grades 1-8)
Purpose, selection and organization of foreign language curriculum content, teaching and learning theories, and procedure and evaluation of outcome for diverse students. Teaching techniques and materials for grades 1-8.

CIED 4313*
Young Adult Literature
Prerequisite(s): Senior or Graduate level standing. 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.

CIED 4323
Social Studies in the Elementary School Curriculum
Prerequisite(s): Full admission to Professional Education. Purposes, selection and organization of content, teaching and learning procedures, and evaluation of outcomes in elementary social studies.

CIED 4353
Science in the Elementary School Curriculum
Lab 2. Prerequisite(s): Completion of 12 hours with a grade of "C" or better in required science courses and be fully admitted to Professional Education. The purposes, selection and organization of content, teaching and learning procedures and evaluation of outcomes in elementary school science.

CIED 4362
Design and Management of the Elementary School Classroom
Prerequisite(s): Full admission to Professional Education. Introduction to the design and management of the physical, social, intellectual aspects of the elementary classroom. Overview of the purposes, selection and organization of classroom management systems and teaching approaches.

CIED 4450
Internship in Elementary Education
1-12 credits, max 12, Lab 3-36. Prerequisite(s): Concurrent enrollment in 4453 or 4730 and 4720 and full admission to Professional Education. Advanced clinical experience as associate (student) teacher in schools, kindergarten through grade eight. *Graded on a pass-fail basis.*

CIED 4453
Senior Seminar in Elementary Education
Prerequisite(s): Concurrent enrollment in 4450 and full admission to Professional Education. Legal and ethical issues, forms of assessment, including standardized testing, working with colleagues and other professionals, integration of performing arts including music and drama, and completion of a professional portfolio. Taken concurrently with student teaching in the final semester of the elementary education program.

CIED 4463
Senior Seminar: Learning and Teaching in Diverse School Cultures
Prerequisite(s): Senior classification; full admission to Professional Education and concurrent enrollment in 4450. Designing elementary classroom environments and curriculum that meet the needs of diverse populations.

CIED 4473
Reading for the Secondary Teacher
Prerequisite(s): Full admission to Professional Education and consent of instructor. Materials and procedures in the teaching of reading in secondary schools for content area teachers.

CIED 4560*
Environmental Education
1-4 credits, max 4, Lab 1. Development of (teacher/leader) competencies in the content, methods, philosophy, and historical perspective of contemporary environmental education curricula using both indoor and outdoor settings as a multidisciplinary learning laboratory. ***(Same course as 5730)***

CIED 4713*
Teaching and Learning in the Secondary School
Prerequisite(s): Full admission to Professional Education (or consent of instructor for graduate students). Purposes, selection and organization of curriculum content, teaching and learning theories and procedures, and evaluation of outcomes for diverse students. Teaching techniques and materials in grades 7-12 subject areas. Available in certification disciplines: art, English/language arts, foreign languages, mathematics, science, social studies. Graduate students will be required to complete additional assignments that meet criteria for advanced level academic work.

CIED 4720
Internship in the Secondary Schools
1-12 credits, max 12, Lab 3-36. Prerequisite(s): Concurrent enrollment in 4730 or 4724 or 4734 and full admission to Professional Education. Supervised observation and student teaching in fields in which the student intends to qualify for teaching certification. Development of awareness of and experience with mental, social, physical and cultural differences among adolescents. Graded on a pass-fail basis.

CIED 4724
Planning and Management in the Multicultural Secondary Classroom
Prerequisite(s): 4713; full admission to Professional Education or 4003 and 4053. Taken concurrently with the student teaching internship. Includes student teaching seminar (one hour). Based on curriculum and teaching theory in 4713, planning and organizing for the secondary classroom in a diverse society, grades 7-12. Classroom management and discipline approaches as well as teacher research, parental involvement, school climate and community relations. Available in discipline-specialized sections: English/language arts, mathematics, science and social studies.

CIED 4730
Planning and Management in the Multicultural Art Classroom K-12
1-2 credits, max 2. Prerequisite(s): 4713 and full admission to Professional Education. Taken concurrently with the student teaching internship. Student teaching seminar (one hour) included. Based on curriculum and teaching theory, planning and organizing for the art classroom in a diverse society, grades K-12. Classroom management and discipline approaches as well as teacher research, parental involvement, school climate and community relations. *Required for art education students.*

CIED 4734
Planning and Management in the
Multicultural Foreign Language Classroom K-12
Prerequisite(s): 4713 and full admission to Professional Education. Taken concurrently with the student teaching internship. Student teaching seminar (one hour) included. Based on curriculum and teaching theory, planning and organizing for the foreign language classroom in a diverse society, grades K-12. Classroom management and discipline approaches as well as teacher research, parental involvement, school climate and community relations. *Required for foreign language education students.*

CIED 5000*
Master's Report or Thesis
1-6 credits, max 6. Prerequisite(s): Consent of adviser. 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.

CIED 5033*
Teaching Foreign Languages in the Schools K-12
Curriculum, materials, methods and procedures related to foreign languages (grades K-12).

CIED 5043*
Issues in Teaching
Current issues and trends in teaching theory, practice and research with emphasis on teacher reflection.

CIED 5050*
Seminar in Integrated Mathematics and Science Applications
1-6 credits, max 6. Seminar topics may differ depending upon the nature of current interests and topics in mathematics and science education.

CIED 5053*
Curriculum Issues
A study of curriculum that includes philosophy, history, decision-making, major concepts and terms.

CIED 5073*
Pedagogical Research
Theory and application of pedagogical inquiry with emphasis on teacher as researcher, pedagogical question posing, and techniques of pedagogical inquiry, including narrative, autobiography, case writing, action research, and artifactual documentation of teacher performance.

CIED 5123*
Curriculum in the Secondary School
Contemporary curricular issues, philosophies, and points of view in secondary school education.

CIED 5143*
Language Arts in the Curriculum
Content and current issues in the language arts. Materials and methods for teaching the communication skills.

CIED 5153*
Advanced Studies in Children's Literature
Study of children's literature within the prevailing political, economic and social factors influencing cultural patterns and values. The tools of research in children's literature and the nature and direction of contemporary children's book publishing.

CIED 5163*
Middle School Curriculum
Theory of planning and developing learning experiences appropriate to the needs and interests of early adolescents.

CIED 5173*
Kindergarten-Primary Curriculum
Study of kindergarten-primary curriculum, including philosophy, history, current practice, and issues. For administrators, teachers and students in curriculum and early childhood education.

CIED 5183*
Media Literacy Across The Curriculum
Examination of the history of media literacy. Major topics and issues in the field of media literacy and curriculum in media literacy across subject areas.

CIED 5223*
Teaching Science in the Schools
Materials, methods and classroom procedures related to science in grades K-12.

CIED 5243*
Environmental Education in the Curriculum
Integration of environmental concepts in the total school curriculum. Review of K-12 environmental education curricula and methods of teaching environmental education in formal and nonformal settings.

CIED 5253*
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.

CIED 5263*
Assessment and Evaluation in School Mathematics
Lab 2. Focus on classroom assessment to help teachers identify what students know about critical mathematics concepts, skills, procedures, and facts. Emphasis would be on using that information to inform their instructional decisions and enhance student learning.

CIED 5270*
Practicum in School Mathematics
1-3 credits, max 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.

CIED 5273*
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.

CIED 5280*
Workshop in Science Education
1-4 credits, max 4. Develops and/or implements elementary and secondary science programs.

CIED 5283*
Problem-Centered Learning in Mathematics
Focus on the different aspects of a problem-centered learning environment. Using current research as a guide, students will examine tasks, collaborative work, and the roles of students, teachers and discourse.

CIED 5293*
Teaching and Learning Mathematics in Technology
The focus of this course is on research and methods of teaching and learning with technology in the mathematics classroom. Topics will include philosophical, social, developmental and theoretical issues associated with the development and use of technology and school reform. Activities and applications will be explored as they relate to the potential for providing a technology-rich learning environment conducive to student construction of mathematical knowledge.

CIED 5313*
Curriculum of the Elementary School
Contemporary trends, philosophies and points of view in elementary school education.

CIED 5323*
Teaching Social Studies in the Schools
Curriculum, materials, methods, and procedures related to social studies.

CIED 5350*
The Visual Arts in the Curriculum
1-3 credits, max 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.

CIED 5353*
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.

CIED 5423*
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.

CIED 5433*
Reading and Writing in the Content Areas
Study of the development and use of reading and writing across the content areas.

CIED 5463*
Reading Assessment and Instruction
Lab 0-2. Prerequisite(s): 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.

CIED 5473*
Reading and Writing Difficulties
Study of research and formal assessment tools related to reading and writing difficulties in children and adults.

CIED 5483*
Literacy and Technology Across the Curriculum
The characteristics of computer-facilitated learning relating to broad definitions of literacy. Use of a variety of computer and literacy tools across the curriculum.

CIED 5523*
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.

CIED 5553*
Literacy Leadership and Coaching
Prerequisite(s): 5463. Develops skills and knowledge for school literacy program design and leadership, and for coaching other teaching professionals in literacy teaching.

CIED 5613*
Effective Teaching of Mathematics in the Secondary School
Prerequisite(s): 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.

CIED 5623*
Multicultural and Diversity Issues in Curriculum
Understanding of the historical and contemporary perspectives toward cultural diversity. Development of an awareness of diverse culture 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.

CIED 5633*
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.

CIED 5640*
Special Topics in Literacy Education
1-6 credits, max 6. Topics vary to address special topics in literacy education.

CIED 5643*
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.

CIED 5663*
Integrating Teaching in the Secondary School
In-service 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 of diverse adolescents, sharing of teaching approaches and materials across the curriculum, and exploration of outreach to school, family and community. Teacher leadership.

CIED 5720*
Education Workshop
1-8 credits, max 8. For teachers, principals, superintendents and supervisors who need advanced curriculum and instruction course work 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.

CIED 5730*
Seminar in Education
1-6 credits, max 6. Seminar topics may differ depending upon the nature of current interests and topics in American education. ***(Same course as 4560*)***

CIED 5750*
Seminar in Mathematics Education
1-6 credits, max 6, Lab 0-6. Prerequisite(s): Consent of instructor. Problems, issues and trends in mathematics education.

CIED 5813*
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.

CIED 5850*
Directed Study
1-6 credits, max 6, Lab 1-6. Prerequisite(s): Consent of instructor. Directed study for master's level students.

CIED 6000*
Doctoral Dissertation
1-25 credits, max 25. Required of all candidates for the Doctor of Philosophy degree. Credit is given upon completion of the dissertation.

CIED 6030*
Contemporary Issues in Curriculum Studies
1-6 credits, max 6. Examination of selected contemporary topics in curriculum studies.

CIED 6033*
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.

CIED 6043*
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.

CIED 6053*
Advanced Curriculum Studies
In-depth examination of key concepts, topics, trends, and the interdisciplinary nature of curriculum studies. Critical analysis of contemporary curriculum discourses.

CIED 6060*
Advanced Special Topics in Literacy Education
1-6 credits, max 6. Topics vary to address special topics in literacy education at the doctoral level.

CIED 6063*
Curriculum History
Examines in-depth the history of various movements in US curriculum thinking and the individuals who promoted them, with attention to the cultural and institutional contexts within which they worked. Emphasis is give to primary sources and the position of curriculum thinking within evolving educational thinking.

CIED 6073*
Advanced Pedagogical Research
Advanced theory and application of pedagogical research with emphasis on teacher as researcher, teacher research as professional development and education reform, techniques of pedagogical research and pedagogical question posing.

CIED 6133*
Theory to Practice in Education
A culminating seminar demonstrating the application of theory from several disciplines to the practical problems of education: curriculum development, organization, teaching strategies and evaluations.

CIED 6143*
School Reform
Current issues in school reform with an emphasis on US education; focus on what it means to engage in reform from dual points of view: curriculum leader and recipient of reform mandate.

CIED 6163*
Advanced Research Strategies in Curriculum
Prerequisite(s): 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.

CIED 6183*
Advanced Media Literacy Across the Curriculum
This course examines the interdisciplinary area of media literacy across the curriculum. Major themes such as issues of hegemony and strategies of media literacy in diverse classrooms will be explored. Students will analyze and evaluate various curriculum theories as applied to media literacy as well as research in the field. Finally, the future of media literacy and debates in the field will be considered.

CIED 6433*
Seminar in Literacy
Research of issues in literacy education using knowledge gained through both research and classroom practice.

CIED 6503*
Doctoral Seminar
In-depth investigation into the doctoral experience and the professoriate including research and writing for the dissertation and for publication; grant writing; professionalism and ethics; professional service; and teaching in higher education. Primarily for students in the PhD program in Curriculum Studies and Professional Education Studies.

CIED 6513*
Staff Development in Literacy Education
Design and delivery of research related to staff development experiences in literacy.

CIED 6683*
Language, Literacy and Culture
The social-cultural perspectives related to the role of language in mediating literate behaviors, cognition and action in learning contexts. Aspects of language use within various learning contexts (situated cognition) and its academic, technical and everyday discourse in understanding the interrelationships among teaching, learning, knowledge and culture.

CIED 6750*
Research in Mathematics and Science Education
1-6 credits, max 6. The examination of current research in mathematics and science learning and teaching research designs, employed, and the generation of new hypotheses.

CIED 6850*
Directed Reading
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Directed reading for students with advanced graduate standing to enhance students' understanding in areas where they wish additional knowledge.

CIED 6853*
Improvement of Instruction in Reading
Problems and issues related to reading instruction. The roles of various school personnel in changing curriculum and methods.

CIED 6880*
Internship in Education
1-8 credits, max 8, Lab 3-24. Prerequisite(s): Consent of instructor. Directed off-campus experiences designed to relate ideas and concepts to problems encountered in the management of the school program.

CIED 6910*
Practicum
1-6 credits, max 6. Prerequisite(s): Consent of adviser. Helps the student carry out an acceptable research problem (practicum) in his/her local school situation. Credit given upon completion of the written report.

Design, Housing and Merchandising (DHM)

DHM 1003
Design Theory and Processes for Apparel and Interiors
Lab 4. Prerequisite(s): DHM majors only. Design elements, principles and processes applied to design and merchandising.

DHM 1103
Basic Apparel Assembly
Lab 4. Basic apparel assembly techniques. Problems including basic fit, spreading and cutting methods and equipment, and use and application of sewing equipment, including lock, chain, and overedge.

DHM 1123
Interior Design Graphics
Lab 6. Prerequisite(s): DHM majors only. Drafting and visual communication techniques related to interiors.

DHM 1433
Innovation and Marketing of Fashion Products
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.

DHM 2003
Creative Problem Solving in Design and Merchandising
Participatory problem solving in design and merchandising; critique of proposed solutions as a positive process of evaluation.

DHM 2073
Computer-aided Design for Interiors
Lab 4. Prerequisite(s): 1123 and pass proficiency review. Computer-aided design and drafting for two-dimensional and three-dimensional interior systems.

DHM 2103
Interior Design Studio I: Residential
Lab 4. Prerequisite(s): Pass proficiency review. Studio course utilizing the design process in the analysis and planning of residential environments using computer-aided and hand drafting techniques.

DHM 2203
Intermediate Apparel Assembly
Lab 4. Prerequisite(s): 1103. Development of skill in apparel assembly. Intermediate problems in fit, spreading, cutting, and sequencing of apparel assembly operations for lined garments, plaids, other special fabrics and closures.

DHM 2212
Heritage of Dress I
Prerequisite(s): 3 credit hours of history. Survey of ancient to Baroque European modes of dress, as that clothing reflects the environment and cultural life of a people.

DHM 2243
Interior Design Studio II:
Interior Components and Construction Documents
Lab 4. Prerequisite(s): 2073, 2103. Studio course exploring the design, materials, construction and production of interior design components for small scale commercial projects using computer-aided and hand drafted documents and renderings for visualization of design solutions.

DHM 2313
Codes and Regulations for Interiors
Prerequisite(s): 1123 or equivalent. Study of local, state, national and international building codes and regulations and the agencies that administer them.

DHM 2573
(L,N)Textiles
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.*

DHM 2693
Digital Design and Presentation Techniques for Apparel
Lab 6. Prerequisite(s): Pass proficiency review. Development of design and presentation skills through the use of computer software to create, capture and alter apparel design images for use in the apparel industry.

DHM 2913
Sewn Product Quality Analysis
Lab 2. Prerequisite(s): 1433, 2573. Sewn product manufacturing process with emphasis on evaluating product quality and its relationship to performance. Examined from the retailers', manufacturers', and consumers' perspectives.

DHM 2993
Communication and Presentation Techniques for Apparel Design
Lab 4. Prerequisite(s): 1003 and SPCH 2713. Creative communication methods and techniques, including a variety of media for two- and three-dimensional presentations in apparel.

DHM 3013
Flat Pattern Design
Lab 4. Prerequisite(s): 2203 and MATH 1483 or 1513, pass proficiency review. Interpretation of dress design developed through the medium of flat pattern; introduction to pattern drafting.

DHM 3023
Computer-aided Flat Pattern Design
Lab 4. Prerequisite(s): 3013 and pass proficiency review. Advanced apparel design problems using flat pattern and computer-aided design (CAD) techniques.

DHM 3153
Mass Production of Apparel and Related Products
Lab 4. Prerequisite(s): 2913, 3023. 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.

DHM 3203
Functional Clothing Design
Lab 4. Prerequisite(s): 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.

DHM 3213
(H)Heritage of Dress II
Prerequisite(s): 3 credit hours of history. Survey of historic modes of dress from the 18th to the 21st centuries, as that clothing reflects the environment and cultural life of a people, and change within the fashion industry.

DHM 3233
(H)Heritage of Interiors I
Religious, civic, commercial, and domestic architecture and furnishings prior to and including the 18th Century with emphasis on the periods which have greatly influenced housing and interior design.

DHM 3301
Supervised Field Experience
Prerequisite(s): 2243 or consent of instructor. Field experience in specialized residential, commercial and institutional design with both historic and contemporary elements.

DHM 3303
Materials and Finishes for Interior Design
Prerequisite(s): 2243 (Interior Design students); 2573 (Merchandising students). An overview and examination of interior materials and finishes.

DHM 3363
Interior Design Studio III: Small Scale Contract
Lab 4. Prerequisite(s): 2243. Analysis and planning of small office, hospitality and retail environments with emphasis on materials, lighting, codes and accessibility using computer-aided 2D drafting and 3D modeling techniques.

DHM 3433
Retailing of Apparel, Interiors and Related Products
Prerequisite(s): DHM majors only, 1433, ACCT 2103, ECON 1113 or 2103. Marketing structures at retail level; job descriptions and responsibilities at management level; financial and control functions.

DHM 3453
Interior Design Studio IV: Environmental Design
Lab 2. Prerequisite(s): 3363. Exploration of the design factors and human performance criteria for lighting, acoustics, and thermal/atmospheric comfort and their applications in studio projects using computer-aided and hand drafted techniques.

DHM 3533
Decorative Fabrics
Lab 4. Historic and contemporary textile designs. Creation of textile designs using personal inspirations, cultural expressions and a variety of techniques.

DHM 3553
Profitable Merchandising Analysis
Prerequisite(s): 3433, ACCT 2103, MATH 1483, 1513 or 2103. 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.

DHM 3563
Merchandise Acquisition and Allocation
Prerequisite(s): 3433, 3553. In-depth study of buying and distributing merchandise.

DHM 3643
Apparel and Accessories for Special Markets
Prerequisite(s): 1433, PSYC 1113, SOC 1113, and completion of 60 credit hours. An 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.

DHM 3823
Professional Practices for Interior Design
Prerequisite(s): 2243, 2313. Specific terminology, procedures, relationships and ethics pertaining to the organization and conduct of interior design practice in the United States.

DHM 3853
Visual Merchandising and Promotions
Lab 1. Prerequisite(s): 1003, 1433 and completion of 60 credit hours. Study and application of principles and practices in merchandise presentation and promotions for commercial purposes.

DHM 3881
Interior Design Pre-Internship Seminar
Prerequisite(s): DHM majors only, 2073, 3363, SPCH 2713. Preparation for obtaining and completing a directed practical experience in a work situation in the interior design field.

DHM 3991
Merchandising and Apparel Design Pre-Internship Seminar
Prerequisite(s): 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 a directed practical experience in an approved work situation related to the fashion industry.

DHM 3994
Internship
Prerequisite(s): 3991 (all students), 3553 (merchandising students), 3023 (apparel design and production students). Directed practical experience in an approved work situation related to the fashion industry.

DHM 4001
Design and Merchandising Speakers Colloquium
Seminars presented by distinguished industry professionals. Current issues and implications for the future of apparel and interiors.

DHM 4003
Environmental Perspectives on Apparel and Interior Design
Prerequisite(s): Completion of 90 credit hours. Analysis of apparel and interior design, development and use from physical, technological, economic, political, religious, social and aesthetic perspectives.

DHM 4011
Post-internship Seminar
Prerequisite(s): DHM majors only, 3994. Study and comparison of student work experiences. Individual student conferences, review of merchant supervisor reactions.

DHM 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.

DHM 4163
Housing in Other Cultures
Housing and interior design and expressions of cultural beliefs, attitudes, family patterns and environmental influences.

DHM 4243*
Draping
Lab 4. Prerequisite(s): 3013 and pass proficiency review. Interpretation of garment design developed through the medium of draping on dress forms.

DHM 4264*
Interior Design Studio V: Large Scale Commercial
Lab 6. Prerequisite(s): 3453. Analysis of large scale office planning and institution design including systems and specifications and emphasizing computer-aided design techniques for construction documents and presentations.

DHM 4293*
Interior Design Studio IV
Lab 4. Prerequisite(s): 4263. Studio course developing comprehensive interior design solutions in historic preservation or adaptive reuse and an advanced design project.

DHM 4323*
Heritage of Interiors II
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.

DHM 4373*
Advanced Computer-aided Design for Interiors
Lab 2. Prerequisite(s): 3373 and pass proficiency review. Advanced computer-aided design and visualization for three-dimensional interior systems.

DHM 4403*
Advanced Apparel Design
Lab 4. Prerequisite(s): 4243 and pass proficiency review. Application of design and pattern-making principles and apparel assembly processes in the development of original designs.

DHM 4423*
Heritage III: Designing for Progress
A thematic survey of movements affecting the design of the built environment after 1900. Social and political developments as generators of new building types, construction techniques, materials and stylistic directions.

DHM 4433*
Facility Management and Design
Survey of nine competency areas of facility management and design, ensuring functionality of the built environment by integrating people, places, processes and technology.

DHM 4453*
Entrepreneurship and Product Development for Apparel and Interiors
Prerequisite(s): 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.

DHM 4503*
Couture Techniques
Lab 4. Prerequisite(s): 4243. Advanced clothing construction techniques using couture methods.

DHM 4523
Critical Issues in Design and Merchandising
Prerequisite(s): Senior standing in major. Capstone course examining professional issues in design and merchandising in the context of central themes from general education.

DHM 4573*
Environmental Sustainability Issues for Designers and Merchandisers
Prerequisite(s): 2573. Scientific concepts are the basis for the understanding the environmental impacts of textile raw materials, manufacturing, dyeing, finishing, packaging and product lifecycle as related to apparel and interior design products. McDonough and Braungart's "cradle to cradle" design model will be introduced through case study analyses for informed design, buying and specification decisions.

DHM 4810*
Problems in Design, Housing and Merchandising
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Selected areas of study in design, housing and merchandising.

DHM 4824
Professional Internship
Prerequisite(s): DHM majors only, 3453, 3881, 4373. A supervised internship experience that simulates the responsibilities and duties of a practicing professional in interior design.

DHM 4850*
Special Unit Course in Design, Housing and Merchandising
1-6 credits, max 6. In-depth study of specific areas of design, housing and merchandising.

DHM 4900
Honors Creative Component
1-3 credits, max 3. Prerequisite(s): 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.

DHM 4993
Textiles, Apparel, Interiors and
Related Products in the International Economy
Prerequisite(s): 2573 (all students), 2913 (apparel design/production and apparel merchandising students), 3303 (interior design and interior merchandising students), 3 credits of ECON, and 90 credit hours. Broad multi-disciplinary study of textiles, apparel, interiors and related products in the international economy.

DHM 5000*
Master's Thesis
1-6 credits, max 6. Prerequisite(s): Graduate standing and consent of major professor. Research related directly to design, housing and merchandising for the master's thesis.

DHM 5001*
Orientation to Graduate Studies in Design, Housing and Merchandising
Process of developing a graduate plan of study in the Department of Design, Housing and Merchandising. Fundamental skills needed for successful completion of a DHM graduate degree.

DHM 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.

DHM 5013*
Research Developments in Design, Housing and Merchandising
Prerequisite(s): 5001. Current methods and needs in research for design, housing and merchandising including the application and integration of research into design, housing and merchandising practice.

DHM 5112*
Research Planning and Proposal Writing
Prerequisite(s): 5001, 5013, STAT 4013 or 5013. Fundamentals of planning and completing qualitative and quantitative research projects, including writing the proposal.

DHM 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.

DHM 5163*
Housing in Different Cultures
Prerequisite(s): Graduate student status. Housing and life style as an expression of cultural aesthetics, beliefs, attitudes and environmental influences.

DHM 5213*
Product Design, Production and Promotional
Strategies for Apparel and Interior Design Industries
Lab 2. Prerequisite(s): 5113. An overview of product design and production techniques for apparel and interior design markets using an industry approach. Promotional strategies needed for successful advertising campaigns.

DHM 5233*
Design Evaluation
Prerequisite(s): Consent of instructor. Theoretical perspectives on evaluation of applied design; examination and evaluation of historic and contemporary designers, their philosophies and their work.

DHM 5240*
Master's Creative Component
1-6 credits, max 6. Prerequisite(s): 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.*

DHM 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.

DHM 5303*
Sociological, Psychological and
Economic Aspects of Consumer Behavior
Analysis and integration of social, psychological and economic theories related to consumer acquisition of products. Application and testing of these theories as appropriate to apparel and interior consumption processes.

DHM 5343*
Constructed Environment and Human Behavior
Prerequisite(s): 5013, 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.

DHM 5353*
Graduate Interior Design Studio
Prerequisite(s): Consent of instructor. Studio course exploring alternative, research-based design solutions for selected interior environments.

DHM 5360*
Advanced Studies in Design, Housing and Merchandising
1-6 credits, max 6. Investigation into special areas in the fields of design, housing and merchandising.

DHM 5363*
Color Theories and Applications for Apparel and Interiors
Prerequisite(s): Nine hours in DHM graduate courses or consent of instructor. Survey of color theories as they apply to the physical, psychological, and aesthetic aspects of apparel and interiors.

DHM 5383*
Design, Housing and Merchandising in Higher Education
Prerequisite(s): Nine credit hours in design, housing and merchandising. Development and organization of curricula and teaching methods for design, housing and merchandising.

DHM 5440*
Career Internship
1-6 credits, max 6. Prerequisite(s): 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.

DHM 5463*
Design and Merchandising Management
Analysis of project management strategies and techniques unique to apparel and interiors industries as applied to budget, schedule, and personnel with emphasis on leadership, quality assurance and risk management issues.

DHM 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.

DHM 5533*
Theory and Design of Functional Apparel
Lab 2. Prerequisite(s): 2573, 3013, 5013, or consent of instructor. 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.

DHM 5543*
Textile Arts and Design
Lab 6. Prerequisite(s): Permission of instructor/adviser. Interpretation of designs developed through experimental studies in textile surface design and manipulation resulting in portfolio/competition quality designs/artwork and written documentation for submissions to a "juror selection" format exhibition.

DHM 5603*
Historical and Contemporary Issues in Trade
The examination of fiber, textile, and apparel industries in a global context. The historical development of the global and US textile and apparel industries and how the global environment (economic, political, and social systems) affects the textile and apparel production and trade. Web-based instruction.

DHM 5613*
Merchandising Research Methods
Prerequisite(s): 5303, 5623, 5633, 5643, 5653 and graduate course in Statistics. An overview of the research process used in social science, including a survey and analysis of research methodologies. A review of current merchandising literature with implications for future research. Web-based instruction.

DHM 5623*
Professional Advancement in Merchandising
Analysis of leadership and how it affects organizational culture and change through a prism of past and current experiences. Various leadership styles examined and a personal leadership philosophy developed for professional advancement in merchandising. Web-based instruction.

DHM 5633*
Product Design, Development and Evaluation
Advanced study of issues and management strategies necessary to design and produce a competitively priced product. Examination of the role of globalization and rapidly changing technology on the development of a successful product. Web-based instruction.

DHM 5643*
Promotional Strategies in Merchandising
Examination of integrated marketing communications (i.e., promotional strategies and techniques) while fostering cultural and global awareness, social responsibility and ethical decision-making in the field of promotion. Web-based instruction.

DHM 5653*
Merchandising Trends
Practices and Theories in Apparel and Interior Industries
Prerequisite(s): Nine credit hours in marketing, merchandising or management. Current trends in merchandising; theories, concepts and processes related to management level problems.

DHM 5663*
International Merchandising Management
Prerequisite(s): Merchandising or business courses or consent of the instructor. Comprehensive understanding of theory, practices, and trends in international merchandising management. An analysis of global retail systems and the way goods are distributed to consumers in various countries.

DHM 5673*
Financial Merchandising Implications
Advanced study of financial trends in the merchandising industries; implications related to sole proprietors, partnerships, franchises, S corporations, and C corporations. Foci will be on the financial implications of recent advances in the field that assist graduate students as they embark on careers in academic and/or the merchandising industries. Web-based instruction.

DHM 5683*
Strategic Planning for the Merchandising Executive
Examination of the merchandising executive planning process utilized to develop successful corporate strategies. Emphasis on the importance of a market orientation for building customer value and sustaining a competitive advantage. Web-based instruction.

DHM 5810*
Problems in Design, Housing and Merchandising
1-3 credits, max 6. Prerequisite(s): Consent of instructor and department head. Individual and group investigations and discussions of special problems in the various phases of design, housing and merchandising.

DHM 5830*
Design, Housing and Merchandising Seminar
1-6 credits, max 6. Prerequisite(s): Consent of instructor. A selected group of current issues in design, housing and merchandising.

DHM 6000*
Doctoral Thesis
1-12 credits, max 30. Prerequisite(s): Consent of major professor. Research in design, housing and merchandising for the PhD degree.

DHM 6133*
Research Methods in Design, Housing and Merchandising
Prerequisite(s): 5013 or equivalent, and six credits of graduate statistics. Survey and discussion of research methods, experiences in research design and analysis of data.

DHM 6403*
Merchandising Theory Application and Strategy Implementation
Prerequisite(s): 5653. Integration of marketing, merchandising, and management theories, strategies, models, and frameworks. Application of theories and implementation of strategies relevant to apparel and interior industries.

DHM 6410*
Independent Study in Design, Housing and Merchandising
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Selected areas of design, housing and merchandising for advanced graduate students working toward the doctorate degree.

DHM 6810*
Advanced Problems in Design, Housing and Merchandising
1-6 credits, max 6. Prerequisite(s): Consent of instructor and department head. Intensive individual or small-group study of problems in various areas of design, housing and merchandising for advanced graduate students who are working toward doctorate degrees.

DHM 6830*
Design, Housing and Merchandising Seminar
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Problems and recent developments in design, housing and merchandising.

Economics (ECON)

ECON 1113
(S)The Economics of Social Issues
Issues-oriented approach. Basic economic principles introduced and developed through study of important social issues: for example, inflation, unemployment, poverty, discrimination, crime, population growth and environmental quality. Develops 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.*

ECON 2103
(S)Introduction to Microeconomics
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 in different types of competition; income distribution; and international exchange. *No general education credit for students also taking ECON 1113 or AGEC 1114.*

ECON 2203
Introduction to Macroeconomics
Prerequisite(s): 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.

ECON 3010
Special Topics in Economics
1-3 credits, max 9. Prerequisite(s): 2203, prior approval of instructor. Analysis of a contemporary topic in economics. Course content will vary to reflect changing social issues and trends in applied economics.

ECON 3023
Managerial Economics
Prerequisite(s): 2103. Application of economic theory and methodology to decision problems of private industry, nonprofit institutions and government agencies; demand and cost analysis, forecasting, pricing and investment.

ECON 3113
Intermediate Microeconomics
Prerequisite(s): 2103. 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.

ECON 3123
Intermediate Macroeconomics
Prerequisite(s): 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.

ECON 3213
Game Theory and Experimental Economics
Prerequisite(s): 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.

ECON 3313
Money and Banking
Prerequisite(s): 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 prices. An introduction to monetary economics and international banking concludes the course.

ECON 3423
(S)Public Finance
Prerequisite(s): Three 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.

ECON 3513
(S)Labor Economics and Labor Problems
Prerequisite(s): Three credit hours in economics. Economic analysis of contemporary labor market problems and survey of US 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.

ECON 3523
(S)Economics of Health Care and Social Security
Prerequisite(s): Three credit hours in economics. Examination of the long-run budget problems created by an aging society and evaluation of policies designed to solve them, with a focus on Medicare, Medicaid, and Social Security.

ECON 3613
(I,S)International Economic Relations
Prerequisite(s): Three credit hours in economics. International trade and finance; international economic organizations; the foreign economic policy of the US.

ECON 3713
(S)Government and Business
Prerequisite(s): Three 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. US antitrust laws, their enforcement and landmark court decisions under these laws.

ECON 3723
The Economics of Sport
Prerequisite(s): 2103. Using economic analysis to understand the world of professional and amateur sport. Emphasis will be on economic decision-making relevant to the teams, leagues and institutions in the world of sport.

ECON 3813*
Development of Economic Thought
Prerequisite(s): Three credit hours in economics. 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.

ECON 3823
(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 HIST 4513)***

ECON 3903
(S)Economics of Energy and the Environment
Prerequisite(s): 2103. Issues related to the development and use of energy resources, and the management of the natural environment.

ECON 3913
State and Local Economic Development
Prerequisite(s): Three hours of economics. The process of local economic growth and development; innovation, technology, and government policy.

ECON 4213
Econometric Methods
Prerequisite(s): 2203 and three credit hours in statistics. 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.

ECON 4223*
Business and Economic Forecasting
Prerequisite(s): 2203 and three credit hours in statistics. Forecasting business and economic variables. Regression models and time series models such as exponential smoothing models, seasonal models, and Box-Jenkins models. Evaluation of methods and forecasting accuracy. Application of methods using computer programs.

ECON 4643
(I,S)International Economic Development
Prerequisite(s): Three credit hours in economics. Problems of underdeveloped economics related to the world economy; obstacles to economic growth and policies for promoting growth.

ECON 4713*
Economics of Industries
Prerequisite(s): 2103. Industrial organization of major US industries. The structure-conduct-performance paradigm is used to evaluate how costs and concentration interact with pricing, marketing and R&D decisions to affect industry profitability, technological progress, and the efficient allocation of resources. Case studies included.

ECON 4723*
Economic Analysis of Law
Prerequisite(s): Three credit hours in economics. Use of economic analysis to explain why certain laws exist 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, distributive justice, and discrimination.

ECON 4823
Comparative Economic Systems
Prerequisite(s): 2203. Comparative analysis of the economic theory and institutions of capitalism, socialism, and mixed systems.

ECON 4993
Economics Honors Thesis
Prerequisite(s): 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 economics*.

ECON 5000*
Research and Thesis
1-6 credits, max 6. Workshop for the exploration and development of research topics. Research leading to the master's thesis.

ECON 5003*
Research Report
Prerequisite(s): Consent of committee chairperson. Supervised research for MS report.

ECON 5010*
Research and Independent Studies
1-3 credits, max 10. Prerequisite(s): Consent of departmental committee under a workshop arrangement or supervised independent studies.

ECON 5013*
Contemporary Environmental Policy
Economic, social and political factors that influence the formation and implementation of environmental policy. Environmental policy instruments (including pollution taxes, standards and marketable pollution permits), measurement of environmental damages and risk. Risk comparison, regulatory issues, health risk assessment, and risk communication. Political-economic considerations.

ECON 5033*
Macroeconomic Analysis
Prerequisite(s): Three hours of economics or consent of instructor. Study of the determinants of aggregate output, employment, price level, and interest rates, including international aspects. Monetary, fiscal, and exchange rate policies and impact on the macroeconomy and business environment. *No credit for PhD students in economics.*

ECON 5043*
Microeconomic Analysis
Prerequisite(s): 3113 and MATH 2144 or consent of instructor. A calculus-based microeconomics course developing basic consumer, producer, and equilibrium models.

ECON 5113*
Managerial Economics
Economic theory applied to business decision-making. Concepts of microeconomics and macroeconomics related to understanding the economic system, analysis of policy, forecasting, and international economics. *No credit for PhD students in economics*.

ECON 5123*
Microeconomic Theory I
Prerequisite(s): 3113. Contemporary price and allocation theory with emphasis on comparative statics.

ECON 5133*
Macroeconomic Theory I
Prerequisite(s): 3123. National income, employment and the price level from the point of view of comparative statics.

ECON 5213*
Introduction to Econometrics
Prerequisite(s): STAT 3013 or equivalent; consent of instructor. Introductory course in econometric regression analysis for first year graduate students in economics, business and agricultural economics. A review of basic probability and statistics, linear regression with one or more explanatory variables, binary dependent variables regression, instrumental variables regression, the use of panel data, and program evaluation. Assessment of the internal validity of estimated models.

ECON 5223*
Mathematical Economics I
Prerequisite(s): 3113 and MATH 2163 or equivalent. Mathematical concepts of single variable and multivariate calculus, topological properties of Euclidean space, convergence, linear algebra, optimization theory and the Kuhn-Tucker Theorem with applications from economic theory.

ECON 5243*
Econometrics I
Prerequisite(s): 4213 or STAT 4043. Theory and application of econometrics to economic problems. Topics include OLS, GLS, distributed lags, serial correlation, heteroske-dasticity, and simultaneous equations.

ECON 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.

ECON 5413*
Economics of the Public Sector I
Allocation and distribution effects as well as incidence of governmental budget policies.

ECON 5433*
Economics of the Public Sector II
Fiscal policy as a means of promoting economic stabilization and growth.

ECON 5543*
Labor Market Theory and Analysis
A critical evaluation of the theoretical literature dealing with labor market processes, including labor supply and demand, the investment in human capital, discrimination, and unemployment.

ECON 5603*
Global Economics
This courses presents an introduction to economic issues from a global perspective for the non-specialist. It emphasizes the problems and challenges the process of globalization poses to national economies. The first part of the course presents the main theories of international trade and their relevance to explaining current global trade patterns. The second part of the course examines the foreign exchange market and the process of exchange rate determination. It covers various international financial issues such as global current account imbalances, the role of the dollar in international financial markets and international currency crises.

ECON 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 payments, portfolio balance and asset market approaches to the determination of exchange rates.

ECON 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 entrepreneurship. Growth models.

ECON 5633*
International Trade
International trade and commercial policy. Comparative advantage, general equilibrium and modern trade theories; welfare implications of international resource allocation models; the theory of protection and international interdependence.

ECON 5643*
Economic Development II
Major problems of development policy. Inflation and mobilization of capital, investment criteria, agriculture, foreign trade, population and manpower, planning and programming methods.

ECON 5703*
The Economics of Organization and Competitive Advantage
Prerequisite(s): 3113 or 5113 or consent of instructor. An analysis of organizational architecture (the assignment of decision-making rights, performance evaluation, and reward systems within an organization). An appropriate architecture to give an organization a competitive advantage and to help an organization develop prowess in innovation and reputation, providing other sources of competitive advantage.

ECON 5713*
Industrial Organization I
Organization and operation of the enterprise sector of a free enterprise economy; interrelations of market structure, conduct and performance; public policies affecting these elements.

ECON 5723*
Industrial Organization II
Alternative market structures and their relationships to market performance; the empirical evidence concerning these. Public policies toward business, including emphasis on US antitrust laws and economic analysis of their enforcement; theories of public utility regulation.

ECON 5903*
Regional Economic Analysis and Policy
Selected topics in location theory, regional economic growth and policies toward regional development in the US.

ECON 5913*
Urban Economics
The urban area as an economic system. Problems of economic policy in urban environment.

ECON 6000*
Research and Thesis
1-12 credits, max 30. Prerequisite(s): Approval of advisory committee. Workshop for the exploration and development of research topics. Research leading to the PhD dissertation.

ECON 6010*
Seminar in Economic Policy
1-3 credits, max 6. Intensive analysis of selected problems in economic policy. Individual research, seminar reports and group discussion of reports.

ECON 6113*
Seminar in Economic Theory
Microeconomics.

ECON 6123*
Seminar in Economic Theory
Macroeconomics.

ECON 6133*
Microeconomic Theory II
Prerequisite(s): 5123. Contemporary price and allocation theory with emphasis on general equilibrium analysis. Welfare economics.

ECON 6143*
Macroeconomic Theory II
Prerequisite(s): 5133. National income, employment and the price level from the point of view of dynamics. Growth models.

ECON 6243*
Econometrics II
Prerequisite(s): 5243. Advanced econometric theory covering single and simultaneous equations models, seemingly unrelated regressions, limited dependent variable models, causality, and pooled models.

ECON 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.

ECON 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)

EDUC 1111
Orientation to Education
Lab 1. Designed to aid in the transition from high school to university, and to increase student success at Oklahoma State University and the College of Education. Student will explore topics and resources related to the academic and social development of OSU students. In addition, students are encouraged to reflect on their own personal characteristics, values, and attitudes and relate these to their chosen major and ultimately their profession.

EDUC 2000
Special Topics in Education
1-3 credits, max 3. Specialized readings in education.

EDUC 2510
Innovative Education Studies
1-3 credits, max 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.*

EDUC 3080
International Experience
1-18 credits, max 36. Prerequisite(s): Consent of the associate dean of the college. Participation in a formal or informal educational experience outside of the USA.

EDUC 3090
(I)Study Abroad
12-18 credits, max 18. Prerequisite(s): 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 US.

EDUC 3110
Honors Directed Study
1-3 credits, max 3. Prerequisite(s): Admission to the College of Education's Honor Program. Individualized directed study approved by a sponsoring professor or Honors coordinator.

EDUC 4050
Honors Colloquium
1-9 credits, max 9. Prerequisite(s): 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.

EDUC 4110
Professional Education Seminar
1-6 credits, max 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.

EDUC 5110*
Contemporary Educational Issues
1-6 credits, max 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.*

EDUC 5910*
Educational Field Experiences
1-6 credits, max 6. Prerequisite(s): 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.

EDUC 5993*
Instructional Effectiveness in Higher Education
Prerequisite(s): Graduate standing or consent of instructor. For teaching assistants in all areas. The many aspects of teaching in higher education. Both theory, e.g., traditional instructional design and practical applications, e.g., how to create a lecture. Issues related to instructional design, development of classroom climate, understanding and assessment of students, classroom practices, materials creation for teaching and development of support systems.

Educational Leadership (EDLE)

EDLE 2513
Foundations of Ethical Leadership
Prerequisite(s): 24 hours in good standing; admission into the UGLC or consent of instructor. Introduces students to a variety of theoretical views of ethics and leadership studies through the identification of contemporary ethical challenges and the development of foundational leadership skills to meet those challenges. ***(Same course as EPSY 2513)***

EDLE 4513
Ethical Leadership for the Common Good
Prerequisite(s): 2513 or EPSY 2513. Builds on foundational knowledge of ethical theory and leadership studies through application of ethical theory and leadership skills to specific contexts and evaluation of their results. ***(Same course as EPSY 4503)***

EDLE 5000*
Thesis or Report
1-10 credits, max 10. Prerequisite(s): 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.

EDLE 5203*
Foundations of Adult and Continuing Education
Societal trends, issues and institutions which have influenced the development and current status of adult and continuing education. Analyses and critiques of contemporary adult and continuing education activities, materials and clientele groups served, and their implications for new and existing programs in the field.

EDLE 5253*
The Principalship
Prerequisite(s): 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.

EDLE 5313*
Characteristics of Adult Learners
Learning patterns, interests and participation patterns among adults in a variety of educational settings. Theories of learning and behavior modification for adults, with implications for adult and continuing education programs. Particular attention given to learners in occupational, adult basic, community junior college, extension and proprietary program settings.

EDLE 5323*
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.

EDLE 5353*
Instructional Strategies for Adults
An analysis and application of the various techniques and materials available to facilitate the learning process for adults. Concentration on the process of designing effective learning experiences for adults and developing competencies of the facilitators of group and self-directed learning.

EDLE 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.

EDLE 5633*
Community Education
Purpose, organization and administration of community education and its various components.

EDLE 5720*
Education Workshop
1-4 credits, max 8. Analysis of organizational, administrative, and instructional problems by common schools and higher education personnel.

EDLE 5723*
Education Law
Study of the legal framework of education (constitutional law, case law, and Oklahoma law) with emphases on church-state issues, tort liability, teachers' rights, and student rights.

EDLE 5813*
Leadership Theory and Ethical Decision-Making
Developing understanding of leadership theory and issues related to decision-making in educational settings. Exploring leadership and decision-making within an ethical context.

EDLE 5883*
Field Studies Internship I
Lab 3. Prerequisite(s): Consent of instructor. Directed internship experiences designed to relate ideas and concepts to problems encountered in education by faculty and administrators.

EDLE 5893*
Field Studies Internship II
Lab 3. Prerequisite(s): Consent of instructor. Directed advance internship experiences designed to relate ideas and concepts to problems encountered in educational organizations by faculty and administrators.

EDLE 5953*
Developing Educational Organizations
Prerequisite(s): 5813. Understanding and critically analyzing conventional and novel approaches to the climate and governance of schools and higher education.

EDLE 5973*
Foundations of Higher Education
Overview of the historical background and philosophical foundations of American higher education.

EDLE 5983*
Administrative Issues in Higher Education
Overview of the organization and administration operations and analyses of social, political and legal influences on colleges and universities.

EDLE 6000*
Doctoral Dissertation
1-15 credits, max 15. Required of all candidates for the Doctor of Education degree. Credit given upon completion of the thesis.

EDLE 6003*
Educational Ideas
Decision-making processes used in educational systems and use of modern technologies for curricular enhancement and professional development.

EDLE 6143*
Resources for the Study of Educational Leadership
Introduction to research traditions, tools and processes that are integral to the study of educational leadership.

EDLE 6233*
Critical Issues in Higher Education
Issues that have shaped and are shaping higher education in American society.

EDLE 6243*
Connecting Theory and Practice in Administering Schools
Application of research findings and theoretical concepts to best practice in administering educational organizations.

EDLE 6343*
Problem Solving in School Administration
Identifying and analyzing administrative problems, individually and collectively, in school settings.

EDLE 6363*
Special Topics in School Finance Policy
Prerequisite(s): Admission to the Graduate College and EDLE 5323 or equivalent. Investigation of problems in education finance policy within the interconnected concepts of liberty, equity, equality, adequacy and efficiency.

EDLE 6393*
The Human Factor in Administering Schools
Analysis and critique of current issues in school personnel administration such as recruitment, selection, promotion, morale, salary, staff relations and teacher assessment.

EDLE 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.

EDLE 6453*
Special Topics in Education Law
Analysis and critique of selected topics in school law relating to public school administration.

EDLE 6463*
Higher Education Law
National and state constitutional provisions, laws, and court cases concerning higher education. Considerable legal research required.

EDLE 6583*
The Impact of College on Students and on Society
The psychological and sociological impact that attending four-year colleges and universities has on undergraduates from their freshman year until they graduate.

EDLE 6603*
Organizational Theory in Education
Selected organizational typologies, conceptualizations and theoretical frameworks as they relate to organizational behavior and behavior of personnel in organizations.

EDLE 6650*
Problems in Educational Administration
1-4 credits, max 8. Special administrative problem in common schools or higher education, e.g., school plant, school/community relations, administration and the instructional programs, attrition and finance.

EDLE 6683*
The Community Junior College
The American two-year college including historical and philosophical development, curricula, students and the learning process, faculty and instruction, administration and governance, support and control. Principles, practices and problems of community colleges in America.

EDLE 6703*
Finance in Higher Education
Problems and prospects of financing American education, with in-depth discussion of selected topics, e.g., social capital, federal aid, faculty salaries and state support.

EDLE 6710*
Special Problems
1-4 credits, max 8. Assists administrators with either recurrent or unique problems arising in common schools or in higher education. Emphasizes evaluation and planning related especially to staff, programs and faculty needs.

EDLE 6713*
Effective Teaching in Colleges and Universities
Relevant research and practice about effective college teaching, role of faculty in higher education settings, and development of teaching strategies and lessons for application in college classrooms.

EDLE 6733*
Planning and Educational Change
Organizational and environmental parameters, sources of change, barriers to change, and strategies for planning and implementing organizational change.

EDLE 6753*
Historical Development of Higher Education
History and development of higher education, studies of objectives and functions of institutional types and of students and faculty.

EDLE 6803*
Administration in Higher Education
Functions and principles of administration in higher education from historical and contemporary points of view. Both internal and external forces acting on the institution treated.

EDLE 6823*
Educational Leadership
Leadership and the implications of leadership across contexts, cultures and time.

EDLE 6833*
College and University Presidency
The role and function of the presidency. For those who anticipate a career in college and university administration or a related management position.

EDLE 6843*
The Academic Department
Organization and administration in higher education emphasizing an analysis of the academic department and its leader, the department head.

EDLE 6850*
Directed Reading
1-4 credits, max 6. Directed reading for students with graduate standing.

EDLE 6853*
Research Traditions in Educational Leadership
Exploration of advanced integrated research strategies and the development of designs and methods supporting the field of educational leadership.

EDLE 6870*
Seminar
1-6 credits, max 6. Topical issues related to administration and/or higher education, including research techniques available to analyze such topics.

EDLE 6883*
Internship in Education I
Lab 3. Prerequisite(s): Consent of instructor. Directed internship experiences designed to relate ideas and concepts to problems encountered in education by faculty and administrators.

EDLE 6893*
Internship in Education II
Lab 3. Prerequisite(s): Consent of instructor. Field experiences in a variety of educational work settings.

EDLE 6910*
Practicum
1-5 credits, max 9. Prerequisite(s): Consent of instructor. Required of all candidates for the Specialist in Education degree. Designed to help the student carry out an acceptable field study or research problem. Credit given upon completion of the written report.

Educational Psychology (EPSY)

EPSY 1003
Learning to Learn
Learning effective strategies to succeed through online individualized assessment, positive attitude development, habit change, development and self-efficacy and self-regulation. Learning tools include goal setting, developing information skills, questioning, transformational learning, presentation and information use skills. Analyzing class materials, problem solving, creativity, teacher analysis, reflection, developing classroom motivation and appropriate classroom behavior to lead to classroom success.

EPSY 2513
Foundations of Ethical Leadership
Prerequisite(s): 24 hours in good standing; admission into the UGLC or consent of instructor. Introduces students to a variety of theoretical views of ethics and leadership studies through the identification of contemporary ethical challenges and the development of foundational leadership skills to meet those challenges. ***(Same course as EDLE 2513)***

EPSY 3110
Educational Psychology Seminar
1-3 credits, max 3. Problems, trends, contemporary topics, and pertinent issues in educational psychology. Concentrated study of selected areas not usually addressed in the undergraduate curriculum.

EPSY 3113
Psychological Foundations of Childhood
The child from conception to puberty with focus on educational implications of development in cognitive, affective and psychomotor domains.

EPSY 3213
Psychology of Adolescence
The adolescent from pubescence to adulthood with focus on educational implications of development in cognitive, affective and psychomotor domain.

EPSY 3413
Child and Adolescent Development
The person from conception through adolescence with focus on education implications of development in cognitive, affective, social, and physical domains.

EPSY 3513
Behavior Management for Teachers of Diverse Learners
Comprehensive and practical introduction to classroom management for diverse learners. Avoidance of behavioral problems through planning, organization and class management; group management procedures to promote positive learning environments, individualized management for specific behavior problems are addressed.

EPSY 3533
Motivating Learners
Current practices in learner motivation, school age through adult. Developing positive attitudes and building community in classrooms to stimulate motivation of all learners.

EPSY 4063*
Exploration of the Creative Experience
The creative experience in art (visual to performing), articulation (oratory to literature), thought (philosophy to psychology), business (practices to products), leisure (procreation to recreation). Western and Eastern viewpoints. Personal creative development fostered by modeling and by investigation of proven techniques. A wide range of creative endeavor with an experiential approach. Future-oriented applications.

EPSY 4223
Human Learning in Educational Psychology
Instructional psychology focusing on the study of teaching and learning theory as part of an instructional program to deal with individual, cultural, and environmental differences. Case studies and group discussion emphasizing motivation, planning, evaluation, classroom problems and management.

EPSY 4503
Ethical Leadership for the Common Good
Prerequisite(s): EPSY or EDLE 2513. Builds on foundational model of ethical theory and leadership studies through application of ethical theory and leadership skills to specific contexts and evaluation of their results.
(Same course as EDLE 4513)

EPSY 4513*
Prevention and Intervention for
Violent Incidents and Emergencies in School Settings
The literature and best practices for prevention and intervention for violent incidents and emergencies in school settings.

EPSY 4533
Competency Motivation
Development of competence through the application of research strategies in achievement motivation. Examines intellectual ability, motives, goals, attributions, competence perceptions and values as they relate to developmental issues, demographics, contextual influences, culture, and self-regulation.

EPSY 5000*
Master's Thesis
1-6 credits, max 6. Prerequisite(s): Consent of advisory committee chairperson. Report of research conducted by a student in the master's program in school and educational psychology. Credit given and grade assigned upon completion and acceptance of the thesis.

EPSY 5023*
Introduction to School Psychological Service
Prerequisite(s): Admission to school psychometry or school psychology program or consent of instructor. History, role and function, and issues and problems of the school psychological service worker.

EPSY 5063*
Introduction to Gifted and Talented Education
Concepts, techniques and strategies for providing differentiated educational programs and experiences for the gifted and talented. State and Federal legislation; development of gifts and talents; program types; identification systems; program development; materials development; teaching techniques and methodologies.

EPSY 5103*
Human Development in Psychology
Introduction to basic research and theories of cognitive, emotional and social development. Applications to educational and family settings.

EPSY 5113*
Child Psychopathology
Prerequisite(s): 5103 or equivalent; enrolled in school psychology, counseling psychology or clinical psychology program or consent of instructor. Survey of theoretical and conceptual issues related to etiology, assessment and treatment of childhood psychopathology. Educational, empirical and clinical taxonomic systems compared and contrasted.

EPSY 5163*
Counseling Techniques for Teachers of Gifted and Talented Students
Techniques for dealing with the conflicts experienced by gifted and talented students. Strategies for consulting with teachers, peers, and parents regarding optimal development of gifts. Peer counseling techniques, dealing with self-concept, social and emotional concerns, problem solving and decision-making, referral procedures and self analysis for teachers related to learning and teaching philosophy and style.

EPSY 5210*
Introductory Practicum in School Psychometry
2-6 credits, max 6. Prerequisite(s): Admission to school psychology program and consent of instructor. Various roles and functions of school psychologists; supervised experience with and shadowing of psychological service delivery activities, introduction to science-based child learner success orientation and professional identify as school psychologists.

EPSY 5213*
Advanced Educational Psychology
Learning and its effect upon coping and adjustment. How learning, environmental and personality factors interact to change human behavior.

EPSY 5310*
Practicum in Child and Adolescent Therapy
1-6 credits, max 6, Lab 2. Prerequisite(s): Permission of instructor. For student in School Psychology, supervised therapy experience with children, adolescents, and their parents.

EPSY 5320*
Seminar in Educational and School Psychology
3-9 credits, max 9. In-depth exploration of contemporary topics in educational and school psychology.

EPSY 5363*
Differentiated Curriculum
Techniques and Materials for Gifted and Talented
Development of curriculum content for horizontal and vertical enrichment and acceleration. Commercial and teacher-prepared materials in imagination; imagery; analogy; metaphor; inductive, deductive and abductive thinking; science; philosophy; psychology; logic systems; problem solving; concept learning; creativity; creative dramatics, etc. Conceptual approaches to the use of the preceding in various interest-based and non-interest-based formats.

EPSY 5403*
Issues in Adolescent Development
Current issues in adolescent development in an educational context and culture, including self, family, peers, school and work relationships. Gender differences within culture, race and class examined. Current dilemmas explored using critical theory and action research.

EPSY 5463*
Psychology of Learning
Application to education of the principles and theories of the psychology of learning.

EPSY 5503*
Crisis Intervention and Emergency Action in School Settings
Current models for crisis intervention and emergency actions plans in school settings. Preparation for crisis intervention and experience in evaluating crisis and emergency action plans in schools.

EPSY 5510*
Practicum in School Psychology
2-6 credits, max 6. Prerequisite(s): Admission to school psychology program and consent of instructor. Supervised experience in the schools of psychological service delivery. Assessment, consultation, direct interventions and development of professional practice for school psychologists within school settings. Science-based child-success model. Two-three semester sequence.

EPSY 5603*
Developmental Issues in Instruction
Prerequisite(s): Three hours in developmental psychology, educational psychology or consent of instructor. Developmental issues in instruction at all levels from early childhood through adulthood. Specific impacts of developmental stages on the acquisition and retention of cognitive, affective and psychomotor development at various levels and contexts will be examined and applications to instruction will be provided.

EPSY 5620*
Practicum with Exceptional Learners
1-8 credits, max 8, Lab 1-8. Prerequisite(s): Consent of instructor. Supervised individual and group experience with exceptional learners. The particular experience (learning disability, mental retardation, gifted, etc.) is determined by the student's field of specialization.

EPSY 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.

EPSY 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.

EPSY 5720*
Educational and School Psychology Workshop
1-9 credits, max 9. Workshop on various topics related to educational and school psychology.

EPSY 5753*
Psychoeducational Assessment of Pre-schoolers
Relevant issues and challenges associated with the intellectual, social and behavioral assessment of preschool children, from the vantage point of recent research, discourse and policy initiatives. The link between assessment and intervention.

EPSY 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.

EPSY 5783*
Psycho-educational Testing of Exceptional Individuals
Intensive practice in the selection, administration and interpretation of individual tests, appropriate for exceptional individuals.

EPSY 5793*
Individual Intellectual Assessment of Children and Youth
Prerequisite(s): 5783 or consent of instructor. Intensive study of the Wechsler Scales, the Stanford-Binet, and other selected tests of mental ability. Emphasis and practice in administration, scoring, interpretation. Issues related to report writing and non-discriminatory assessment.

EPSY 5803*
Advanced Intellectual Assessment, Contemporary
Theories and Assessment of Intelligence and Cognitive Abilities
Prerequisite(s): 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.

EPSY 5813*
Parent and Family Interventions in School Psychology
Prerequisite(s): By consent of instructor only. Empirically-supported, parent-implemented interventions for children and adolescents addressing a variety of home and school problems within the discipline of school psychology.

EPSY 5853*
Applied Behavior Analysis
Intensive study of behavior and analytical principles as they relate to the functional assessment and intervention development with an emphasis on developmental issues. Fundamental theoretical and philosophical issues, procedures and findings within applied behavior analysis in educational and related psychology specialties.

EPSY 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, pullouts, 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.

EPSY 5963*
Developing Resources to Support Educational Programs
Development, management and evaluation of programs in intra- and extra-class settings. Program types include parent, volunteer, mentor, tutor, group sponsors in technology, business involvement, curricular enhancement and service learning. Developing community and business interest through public relations, financial development, grantsmanship or resource information sources. Developing Internet resources to support learners.

EPSY 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.

EPSY 6000*
Doctoral Dissertation
1-25 credits, max 25. Prerequisite(s): 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.

EPSY 6030*
Doctoral Seminar in School Psychology
3-6 credits, max 6. Prerequisite(s): 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.

EPSY 6033*
Introduction to Psychotherapy with Children and Adolescents
3 credits. Prerequisite(s): 5113. Development of individual and group skills in therapy with children and adolescents. Applications of theories of psychotherapy to a variety of disorders and coping skills, crisis intervention and adaptive social skills training.

EPSY 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.

EPSY 6063*
Research Applications with Q Methodology
Research applications using qualitative, quantitative and Q methodology. Subjectivity and abductive reasoning explored with a limited research project. Professional research skills, including ethics, process, team research and manuscript development.

EPSY 6110*
Seminar in School Psychology
1-3 credits, max 6. An assessment of psychological techniques applied to problems encountered in the internship.

EPSY 6113*
Child Personality Assessment
Prerequisite(s): Admission to school psychology or counseling psychology program, or consent of instructor. The personal and social assessment of children using objective and projective techniques.

EPSY 6133*
History and Systems of Psychology
History and systems of psychology related to contemporary applied psychology.

EPSY 6143*
Introduction to Developmental Psychopharmacology
Prerequisite(s): Graduate student in School of Applied Health and 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.

EPSY 6153*
Advanced Research in Educational Psychology
Prerequisite(s): Admission to doctoral program in Educational Psychology (School, Educational, Counseling, REMS Options). Research in educational psychology in areas such as philosophy of science, issues in basic and applied research in psychology, research ethics, advanced quantitative and qualitative research design. Preparation of the dissertation and grant proposals and dissemination of research.

EPSY 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 effects of mood on memory, emotion in feminist epistemology, the role of feeling in the writing process, intuition, and narrative thought. Exploration of potential research.

EPSY 6210*
Internship in School Psychology
3-6 credits, max 12. Prerequisite(s): 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 non-doctoral 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.

EPSY 6310*
Doctoral Practicum in School Psychology
1-6 credits, max 6. Prerequisite(s): 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.

ESPY 6323*
Psychological Consultation
Prerequisite(s): 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.

EPSY 6333*
Instructional Assessment and Consultation
Prerequisite(s): 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.

EPSY 6343*
Behavioral Assessment and Consultation
Prerequisite(s): 5113 or equivalent; admission to school psychology, clinical psychology or counseling psychology program; or consent of instructor. Development of psychological skills in systematic behavioral assessment and consultation with application to school, agency and home settings. Systematic behavioral observation, data collection and intervention design, implementation and evaluation.

EPSY 6443*
Theories and Problems in Educational Psychology
Prerequisite(s): Admission to the doctoral program in educational psychology or consent of instructor. Theoretical foundations and nature of the problems studied in educational psychology; current issues and historical overview.

EPSY 6460*
Internship in Educational Psychology
1-9 credits, max 9. Prerequisite(s): 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.

EPSY 6533*
Human Motivation
A theoretically-oriented approach to the concept of motivation; essential precursors to human behavior and applications to the solution of real and hypothetical problems.

EPSY 6610*
Doctoral Internship in School Psychology
3-6 credits, max 6. Prerequisite(s): 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.

EPSY 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.

EPSY 6850*
Directed Readings in Educational and School Psychology
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Directed reading for students with advanced graduate standing in educational and school psychology.

EPSY 6880*
Internship in Education
1-8 credits, max 8, Lab 3-24. Prerequisite(s): 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)

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.

EDTC 4113*
Multi-media Program Production
Prerequisite(s): 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.*

EDTC 5000*
Master's Report or Thesis
1-6 credits, max 6. Prerequisite(s): Consent of instructor. 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.

EDTC 5103*
Advanced Computing Applications in Education
Lab 0-2. Includes educational applications involving authoring systems, database management, hardware interfacing, and non-instructional uses within the school environment. Impact of current issues on instructional computing.

EDTC 5113*
Digital Media Production for Instruction
Introduction to the production of digital media for instruction. Topics covered: Instructional design for digital media, message design, use of graphics, multimedia development tools. Current research, trends, tools and issues in media production will also be addressed.

EDTC 5153*
Computer-Based Instruction Development
Lab 0-2. Prerequisite(s): 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.

EDTC 5203*
Foundations of Educational Technology
A general introduction to the field of Educational Technology. Course topics will include: the history of the field, current trends, and various models for designing instructions, as well as the people who introduced them. To the extent possible, this material will be placed in the context of "real-life" instructional design.

EDTC 5720*
Education Workshop
1-8 credits, max 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.

EDTC 5753*
Introduction to Instructional Design
Introduction to the systematic design of instruction. Topics covered: Analysis, design, development, implementation, and evaluation of instructional materials in a variety of educational settings. Current research, trends and issues in instructional design will be addressed.

EDTC 5773*
Instructional Systems Management
Principles of management relevant to instructional systems, including, but not limited to: project, resource, quality, change, financial, information technology, human resource, program evaluation, product, knowledge and performance management.

EDTC 5850*
Directed Study
1-3 credits, max 3. Prerequisite(s): Consent of instructor. Directed study for master's level students.

EDTC 6000*
Doctoral Dissertation
1-15 credits, max 15. Required of all candidates to the Doctor of Education degree. Credit is given upon completion of the thesis.

EDTC 6153*
Advanced Computer-Based Instructional Development
Prerequisite(s): 5153 or consent of instructor. Design of user-friendly instructional interfaces and computer-based learning management systems.

EDTC 6333*
Human Computer Interaction
Prerequisite(s): 5153 or consent of instructor. Human cognitive architecture, information processing, and design of effective educational, computer-based interfaces.

EDTC 6423*
Trends and Issues in Educational Technology
Selected problems, issues and trends in educational technology.

EDTC 6850*
Directed Reading
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Directed reading for students with advanced graduate standing to enhance students' understanding in areas where they wish additional knowledge.

EDTC 6880*
Internship in Education
1-8 credits, max 8. Prerequisite(s): Consent of instructor. Directed off campus experiences designed to relate ideas and concepts to problems encountered in the management of the school program.

EDTC 6910*
Practicum
1-6 credits, max 6. Prerequisite(s): 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)

ECEN 2011
Experimental Methods I
Lab 3. Prerequisite(s): PHYS 2114; Co-requisite(s): ENSC 2613. Basic electrical measurements and instrumentation techniques and devices. Use of voltmeters, ammeters, oscilloscopes, impedance bridges to study resistive, inductive, and capacitive circuit elements in steady state and transient operation. Reinforces ENSC 2613 and introduces design of instrumentation networks. *Serves as introduction for non-majors.*

ECEN 3020
Supervised Research Project
1-3 credits, max 3. Prerequisite(s): Consent of instructor and ECEN department head. Supervised research project for qualified students. May be repeated no more than three times for a total of three credit hours.

ECEN 3021
Experimental Methods II
Lab 3. Prerequisite(s): 2011, ENSC 2613; Co-requisite(s): ECEN 3713. Second laboratory in electrical measurements and instrumentation techniques and devices. Frequency response using gain/phase meter and spectrum analyzer. Identification of unknown two-port networks, steady state operation of linear networks. Reinforces ECEN 3713 and continues with the design of networks.

ECEN 3031
Experimental Methods III
Lab 3. Prerequisite(s): 3021, 3713; Co-requisite(s): 3313. Third laboratory in electrical measurements and instrumentation techniques and devices. Use of transistor curve tracers. Transistor operating points. Behavior of BJT amplifiers. MOSFET circuits and behavior. Operational amplifiers and feedback circuits. Reinforces ECEN 3313, continuing the design experience in the context of electronics.

ECEN 3113
Energy Conversion
Lab 2. Prerequisite(s): 3714. 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.

ECEN 3213
Microcomputer Principles and Applications
Lab 2. Prerequisite(s): Junior standing or above. Introductory microcomputers. Digital logic elements and number systems, memory components and organization. Microprocessor and microcomputer system architecture, assembly language programming, software development, interfacing techniques.

ECEN 3233
Digital Logic Design
Lab 2. Boolean algebra, optimization of logic networks. Design using SSI, and MSI, LSI components. ROM and PLA applications. Analysis and design of clock sequential logic networks. Flip-flops, counters, registers. Asynchronos circuit design and analysis. Laboratory experience in implementing combinational and sequential logic devices.

ECEN 3314
Electronic Devices and Applications
Lab 2. Prerequisite(s): 2011, 3714. 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. Theoretical concepts and methods are demonstrated and reinforced through laboratory exercises.

ECEN 3513
Signal Analysis
Prerequisite(s): 3201, 3713 or 3714. Deterministic signals. Fourier series and Fourier transforms. Impulse response, convolution and correlation. Sampling theorem. Analog modulation techniques.

ECEN 3613
Electromagnetic Fields
Prerequisite(s): ENSC 2613, MATH 2163 and MATH 2233. Time-harmonic and transient response of transmission lines. Maxwells equations and their applications to engineering problems in electrostatics, magnetostatics, time-harmonic fields and plane wave propagation.

ECEN 3623
Mathematical Foundations of Electromagnetics and Photonics
Lab 2. Prerequisite(s): 3613. Mathematical and computational treatment of fundamental electromagnetic theory, with applications to microwave engineering, photonics and semiconductor design. Energy and power; Laplace and Poisson equations; wave equation, including reflection, refraction, and diffraction; and classical electromagnetic radiation at macroscopic and microscopic levels.

ECEN 3714
Network Analysis
Lab 2. Prerequisite(s): 2011, ENSC 2613, MATH 2233. Laplace transform, transfer functions, magnetically coupled circuits and two-port networks. Theoretical concepts and methods are demonstrated and reinforced through laboratory exercises.

ECEN 3723
Systems I
Prerequisite(s): ENSC 2123. 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 MAE 3723)***

ECEN 4010*
Technical Problems and Engineering Design
1-12 credits, max 12. Prerequisite(s): 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.

ECEN 4013
Senior Design Lab I
Lab 4. Prerequisite(s): 2011, 3714, 3314, 3213 or 3233 or ENSC 3213, ENGL 3323. 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.

ECEN 4024
Senior Design Lab II
Lab 6. Prerequisite(s): 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.

ECEN 4030
Undergraduate Professional Practice
1-8 credits, max 8. Prerequisite(s): Approval of ECEN department head. Experience in application of electrical engineering principles to typical problems encountered in industry. Solutions to the problems by student participation in the role of engineer or engineering intern.

ECEN 4133*
Power Electronics
Prerequisite(s): 3113. Power electronic devices, components, and their characteristics; DC to AC conversion; fundamentals of inverters and waveshaping devices; application aspects; control aspects; characteristics and state-of-the-art of advanced power inverter and power conditioning topologies.

ECEN 4153*
Power System Analysis and Design
Prerequisite(s): 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.

ECEN 4213*
Computer-based System Design
Prerequisite(s): 3213 or ENSC 3213 and CS 1113. Design of microprocessor-based systems through proper integration of hardware and software. Serial and parallel communications, sensor interfacing, computer control of external devices, and color graphics hardware. Design of PASCAL and assembly language modules for optimum real-time system performance.

ECEN 4233*
High Speed Computer Arithmetic
Prerequisite(s): 3233. Course covers computer arithmetic as applied to general purpose and application-specific processors. Focus is on developing high-speed arithmetic algorithms and understanding their implementation in VLSI technology at the gate level.

ECEN 4243*
Computer Architecture
Lab 2. Prerequisite(s): 3213 or ENSC 3213 and ECEN 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 CPU's, memory system design including cache, virtual memory, error detection and correction, I/O operations, including direct memory access and peripheral interface design.

ECEN 4273*
Software Engineering
Prerequisite(s): 3213 or ENSC 3213 or CS 1113, CS 3443. 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)***

ECEN 4283*
Computer Networks
Prerequisite(s): 3213 or ENSC 3213 or CS 3443; UNIX knowledge. 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)

ECEN 4303*
Digital Electronics Circuit Design
Prerequisite(s): 3233 and 3314 or 3313. Theory of digital and electronics circuits. Digital logic families TTL, IIL, ECL, NMOS, CMOS, GaAs. Large signal models for transistors. Implementation at RAM and ROM. Circuit design for LSI and VLSI.

ECEN 4313*
Linear Electronics Circuit Design
Prerequisite(s): 3314. Class A and B small-signal, push-pull power, complementary symmetry, differential and operational amplifiers, utilizing field-effect transistors, bipolar transistors, tunnel diodes and integrated circuits. Emphasis on amplification in electronic devices, design and analysis of wide-band amplifier circuitry.

ECEN 4353*
Communication Electronics
Prerequisite(s): 3314. Design of tuned voltage and power amplifiers, oscillators and mixers, modulation and detection, and parametric amplifiers.

ECEN 4413*
Automatic Control Systems
Prerequisite(s): 3723 or MAE 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 techniques, root-locus design of single input single output systems and simple compensation techniques. ***(Same course as MAE 4053***)

ECEN 4503*
Random Signals and Noise
Prerequisite(s): 3513, 3714. Analysis of electrical systems using elementary concepts of probability, random variables and random processes. Frequency and time domain response of linear systems driven by random inputs. Statistical properties of electrical noise. Analysis and design of optimum linear systems.

ECEN 4523*
Communication Theory
Prerequisite(s): 3513. Noise in modulation systems. Digital data transmission. Design of optimal receivers. Introduction to information theory.

ECEN 4533*
Data Communications
Prerequisite(s): 4503. Signal detection in noise. Tradeoffs between bandwidth signal-to-noise ratio and rate of information transfer. Transmission multiplexing and error handling. Elements of computer network design. Data link protocols.

ECEN 4613*
Microwave Engineering
Prerequisite(s): 3613. Aspects of propagation, transmission, and radiation of microwave energy. Plane wave propagation; lossless and lossy media, reflection, refraction, and polarization. Transmission line theory; lumped element model, characteristic impedance, impedance matching, and transient response. Theory of waveguides and cavity resonators. Microwave network theory and S-parameters. Introduction to radiating systems.

ECEN 4703*
Active Filter Design
Prerequisite(s): 3714. Introduction to passive filters; operational amplifiers as network elements; filter specifications; design of active filters. Laboratory design projects and computer simulations.

ECEN 4743*
Introduction to Biomedical Engineering Modeling and Systems
Prerequisite(s): 3714, 4763. An overview of the field of biomedical engineering and an introduction of the modeling approaches implemented in biomedical engineering. Topics include bio-electronics, biomechanics, compartmental modeling, bio-signal processing, biomedical optics, etc. The course will demonstrate a few of major fields of activity in which biomedical engineers are engaged and modeling approaches are implemented.

ECEN 4763*
Introduction to Digital Signal Processing
Prerequisite(s): 3513. Introduction to discrete linear systems using difference equations and z-transforms. Discrete Fourier analysis. Design of digital filters. Sampling theorem. Applications of digital signal processing.

ECEN 4773*
Real Time Digital Signal Processing
Prerequisite(s): 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 Motorola, Texas Instruments and others. Link between DSP theory and practical implementation.

ECEN 4823*
Design of Optical Systems
Lab 2. Prerequisite(s): PHYS 2114. Introduction to optics through the design, construction, and characterization of optical systems. Emphasis on geometrical optics and spectroscopy.

ECEN 4843*
Design of Lasers and Systems
Lab 2. Prerequisite(s): 3613. Introduction of the design of lasers and optical systems based on lasers including the design, construction, and characterization of lasers. Gaussian beams and optics, laser gain materials, laser cavities, advanced topics.

ECEN 5000*
Thesis or Report
1-6 credits, max 6. Prerequisite(s): Approval of major professor. A student studying for the master's degree will enroll in this course for a maximum of six credit hours.

ECEN 5030*
Professional Practice
1-8 credits, max 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.

ECEN 5060*
Special Topics
1-6 credits, max 30. Prerequisite(s): Consent of instructor. Engineering topics not normally included in existing courses. Repeat credit may be earned with different course subtitles assigned.

ECEN 5070*
Directed Studies
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Investigation outside of the classroom of topics not normally covered in lecture courses.

ECEN 5113*
Power System Analysis by Computer Methods
Quasi-static control of power systems and analysis of power systems under abnormal operating conditions. Transient stability studies. Models formulated and solutions outlined for implementation on the computer.

ECEN 5123*
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.

ECEN 5153*
Direct Energy Conversion
Energy conversion techniques and applications; thermo-electrics, thermionics, fuel cells, MHD 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.

ECEN 5193*
Power Economics and Regulation
Prerequisite(s): Vector calculus, familiarity with complex numbers. Natural monopoly, regulated mono-polities. Power pricing. Deregulation and the Energy Policy Act of 1992. Bulk power markets, transmission access and wheeling. Economic dispatch and system operations. Security and reliability. Environmental externalities and Clean Air Act compliance. Procurement of new capacity and integrated resource planning. Co-generators and independent power producers.

ECEN 5223*
Digital Systems Testing
Prerequisite(s): 3233. Testing of combinational and sequential circuits. Test generation techniques. Design of reliable and testable circuits and systems. Testing for LSI and VLSI.

ECEN 5253*
Digital Computer Design
Prerequisite(s): 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)***

ECEN 5263*
VLSI Digital Systems Design
Prerequisite(s): 4303; 5253 recommended. Design of very large-scale digital systems on a single chip. Review of MOS technology. Design rules imposed by fabrication techniques. Systematic structures for control and data flow; system timing; highly concurrent systems. Experimental opportunities available.

ECEN 5283*
Computer Vision
The development of machine vision and advanced image understanding techniques for robotics, automated inspection, biomedicine. Object recognition, motion analysis, object tracking, segmentation, representation, and 3-D analysis.

ECEN 5313*
Solid-state Electronics I
An advanced study of electronic networks. Application of solid-state devices to the medium- and low-frequency regions. Integrated networks as replacements for discrete-component networks. Discrete and integrated operational amplifiers. Broad-band and tuned amplifiers.

ECEN 5333*
Semiconductor Devices
Prerequisite(s): 3314 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.

ECEN 5353*
Advanced Power Electronics
Prerequisite(s): 4133. Characteristics of high power semiconductor devices and the application of such devices to power conditioning, inversion and wave shaping at high power levels.

ECEN 5363*
CMOS Analog Integrated Circuit Design
Prerequisite(s): 4313. Advanced study of solid state CMOS linear integrated circuits. Topics include: Op Amps, comparators, multipliers, D/A and A/D 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.

ECEN 5373*
RF Microwave Circuit Design
Prerequisite(s): 3314 , 4613 and 5333 or equivalent. Smith chart, single- and multi-port network, filter design, RF/microwave components and modeling, matching and biasing network, amplifier, oscillators and mixers.

ECEN 5413*
Optimal Control
Prerequisite(s): 5713 or MAE 5713. Optimal control theory for modern systems design. Specification of optimum performance indices. Dynamic programming, calculus of variations and Pontryagin's minimum principle. Iterative numerical techniques for trajectory optimization.
(Same course as MAE 5413)

ECEN 5423*
Control of Hybrid Systems
Prerequisite(s): 5713 Linear Systems or consent of instructor. Introduction and definitions. Modeling of hybrid systems. Analysis of hybrid systems. Stability analysis. Switched control systems. Hybrid control design. Applications in power systems, robotics, transportation and multivehicle systems.

ECEN 5433*
Robotics Kinematics, Dynamics and Control
Prerequisite(s): 4413 or MAE 4053 or consent of instructor. Kinematic and dynamic analysis of robot manipulators. Inverse kinematics, motion planning and trajectory generation. Industrial practice in robot servo control. Dynamics and control in the presence of constraints. Actuators and sensors. Force sensors and vision systems. Robotic force control and its applications in industry. Passivity-based control algorithms. Advanced control techniques for motion and force control. ***(Same course as MAE 5433)***

ECEN 5463*
Nonlinear System Analysis and Control
Prerequisite(s): 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)

ECEN 5473*
Digital Control Systems
Prerequisite(s): 4413 or MAE 4053. Input-output and state-space representation of linear discrete-time systems. Approximate methods in discrete-time representation. Stability methods. Controllability, observability, state estimation, and parameter identification. Design and analysis of feedback control system using frequency-domain and state-space methods. Introduction to optimal control. ***(Same course as MAE 5473)***

ECEN 5483*
Digital Data Acquisition and Control
Prerequisite(s): 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 MAE 5483)***

ECEN 5493*
Software Design for Real-time Distributed Systems
Prerequisite(s): 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.

ECEN 5513*
Stochastic Systems
Prerequisite(s): 3513 and 4503 or STAT 4033. Theory and applications involving probability, random variables, functions of random variables, and stochastic processes, including Gaussian and Markov processes. Correlation, power spectral density, and non-stationary random processes. Response of linear systems to stochastic processes. State-space formulation and covariance analysis. ***(Same course as MAE 5513*)**

ECEN 5523*
Estimation Theory
Prerequisite(s): 5513 or MAE 5513. 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)***

ECEN 5533*
Modern Communication Theory
Prerequisite(s): 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 and computer communication networks.

ECEN 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.

ECEN 5553*
Telecommunications Systems
Prerequisite(s): Graduate standing or consent of instructor. Surveys the ways and means that voice, data and video are moved long distances. Covers data networks (Ethernet LAN's, Frame Relay and Internet WAN's); the telephone system (POTs, network switching, SONET, and cellular telephone); and video (NTSC, compressed video standards such as MPEG and last mile delivery).

ECEN 5563*
Principles of Wireless Networks
Prerequisite(s): 4283 or CS 4283. Wireless network operation, planning, mobility management, cellular and mobile data networks based on CDMA, TDMA, GSM; IEEE 802-11 WLANS, Adhoc networks, Bluetooth, power management, wireless geolocation and indoor positioning technique.
(Same course as CS 5813)

ECEN 5613*
Electromagnetic Theory
Prerequisite(s): 3613. First graduate level treatment of classical electromagnetic theory. Wave equation, potential theory, boundary conditions. Rectangular, cylindrical and spherical wave functions. Conducting and dielectric guiding structures. Scattering and radiation. Introduction to numerical techniques.

ECEN 5623*
Antenna Theory
Prerequisite(s): 3613. Fundamental antenna parameters, including directivity, efficiency, radiation resistance, and pattern. Analysis of dipole, loop, aperture, broad- band, and traveling wave antennas. Array theory. Introduction to numerical techniques used in modern antenna design.

ECEN 5633*
Radar Theory
Prerequisite(s): 3613; 4503 or 5513. Theoretical treatment of radar principles. Overview of radar systems and techniques, radar equation, integration of signals. Radar cross-section of single and multiple targets. Waveform design, resolution, ambiguities and accuracy. Range, speed and angular measurements. Detection of targets in noise. Statistical description of clutter. Signal processing techniques.

ECEN 5643*
Antennas and Propagation for Wireless Communications
Prerequisite(s): 3613, 4503. Aspects of radiowave propagation for fixed and mobile communication systems. Review of Maxwell's equations and plane wave propagation, antenna principles. Reflection, refraction, diffraction, fading and scintillation, attenuation, ducting, diversity. Propagation in a cellular environment. Satellite communications.

ECEN 5703*
Optimization Applications
Prerequisite(s): 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. *This applications oriented course is intended for engineering and science students.* ***(Same course as CHE 5703, IEM 5023 & MAE 5703)***

ECEN 5713*
Linear Systems
Prerequisite(s): 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 solutions; controllability, observability, and stability; linearization and realization theory; and state feedback and state observer.
(Same course as MAE 5713)

ECEN 5733*
Neural Networks
Prerequisite(s): 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 & MAE 5733)***

ECEN 5753*
Digital Processing of Speech Signals
Prerequisite(s): 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; vocal tract spectrum calculation; speech coding; homomorphic processing; applications of speech processing. Introduction to more advanced topics as time permits.

ECEN 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.

ECEN 5773*
Intelligent Systems
Prerequisite(s): 5733. 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, DES); intelligent control architecture (e.g., bottom-up, top-down, seminotics); reinforcement learning and hybrid systems; and case studies and design projects.
(Same course as MAE 5773)

ECEN 5783*
Medical Imaging
A comprehensive introduction to the standard medical imaging modalities used today. Topics include radiation, radiation-interaction with matter, X-ray radiography, ultrasound, computer topography, image reconstruction and analysis, MRI, nuclear medicine, and radiation therapy. The fundamental mathematics underlying each imaging modality is reviewed and the hardware needed to implement each system is examined.

ECEN 5793*
Digital Image Processing
Prerequisite(s): 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.

ECEN 5803*
Geometrical Optics
Prerequisite(s): PHYS 3213 or consent of instructor. Foundations of geometrical optics, geometrical theory of optical imaging, geometrical theory aberrations, image forming instruments. ***(Same course as PHYS 5123*)***

ECEN 5823*
Physical Optics
Prerequisite(s): PHYS 3213 or consent of instructor. Multiple beam interference, diffractions, imaging, near field optical probes of matter, surface plasmons, light scattering from random media, optical coherence tomography- biomedical applications, negative materials, perfect lenses and super resolution. ***(Same course as PHYS 5303)***

ECEN 5833*
Fiber-Optic Communication Systems
Prerequisite(s): 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.

ECEN 5843*
Microelectronic Fabrication
Lab 1. Prerequisite(s): 3314. Contamination control and clean-room, 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.

ECEN 5853*
Ultrafast Optoelectronics
Prerequisite(s): Graduate standing or consent of instructor. Combining ultra fast laser pulses with electronic circuitry. Increased device performance. Optoelectronic/electrical pulses as short as 0.2 psec. High performance areas illustrating the power of advanced techniques in applications.

ECEN 5923*
Introduction to MEMS
Prerequisite(s): 5843 or consent of instructor. Fundamentals of Microsystems. Topics include: energy transduction mechanisms, energy dissipation modeling, energy methods, mechanics of small scale, fabrication process design, micromachining, electronic interface.

ECEN 6000*
Research
1-16 credits, max 36. Prerequisite(s): Consent of major professor. Independent research for students continuing graduate study beyond the level of the MS degree.

ECEN 6001*
PhD Seminar Series
Prerequisite(s): Approval of ECEN department head. Seminar series for PhD studies and research.

ECEN 6050*
Preliminary PhD Research and Proposal
3 credits, max 3. Prerequisite(s): Consent of adviser. Independent research and report of an advanced electrical engineering problem. Work performed serves as foundation of the oral PhD preliminary exam.

ECEN 6060*
Advanced Special Topics
1-6 credits, max 30. Prerequisite(s): Consent of instructor. Advanced engineering topics not normally included in existing courses. Repeat credit may be earned with different course subtitles assigned.

ECEN 6070*
Advanced Directed Studies
1-6 credits, max 12. Prerequisite(s): Admission into PhD program and consent of instructor. Investigation outside of the classroom of topics not normally covered in lecture courses.

ECEN 6123*
Special Topics in Power Systems
Prerequisite(s): 5113. Selected relevant current topics related to power system operation and planning.

ECEN 6253*
Advanced Topics in Computer Architecture
Prerequisite(s): 5253 or CS 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 CS 6253)***

ECEN 6263*
Advanced VLSI Design and Applications
Prerequisite(s): 5223 and 5263. System timing. Designing testable integrated circuits. Specialized parallel processing architectures. Application examples.

ECEN 6363*
Analog VLSI for Signal Processing
Lab 2. Prerequisite(s): 4273. Continuation of 5363. Advanced theory and practice of analog VLSI design methodology. Very large scale design and implementation of signal processing solutions, including over sampled A/Ds, neural networks and filters.

ECEN 6423*
System Identification
Prerequisite(s): 5473 or 5713 or MAE 5473 or MAE 5713. Linear and nonlinear system modeling of random systems. Models of linear time-invariant systems, nonparametric methods and preliminary model development, parameter estimation methods, convergence and consistency, asymptotic distributions of parameter estimates. Nonlinear modeling. ***(Same course as MAE 6423)***

ECEN 6453*
Adaptive Control
Prerequisite(s): 5473 or 5713 or MAE 5473 or MAE 5713. Analysis and design of control techniques that 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 MAE 6453)***

ECEN 6463*
Advances in Nonlinear Control
Prerequisite(s): 5463 or MAE 5463. Introduction to vector fields and Lie algebra; controllability and observability of nonlinear systems; local decompositions; input-output and state-space representation of nonlinear systems; feedback linearization; controlled invariance and distribution; control of Hamiltonian systems. ***(Same course as MAE 6463)***

ECEN 6483*
Robust Multivariable Control Systems
Prerequisite(s): 5713 or MAE 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 MAE 6483)***

ECEN 6803*
Photonics I: Advanced Optics
Lab 9. Prerequisite(s): 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. Emphasis on ultrashort laser pulses. ***(Same course as CHEM 6803 & PHYS 6803)***

ECEN 6810*
Photonics II: THz Photonics and THz-TD
1 credit, max 4, Lab 3. Prerequisite(s): 6803. THz photonics and THz time-domain spectroscopy (THz-TDS). Concepts and techniques of driving electronic circuitry with ultra short laser pulses to generate and detect freely propagating pulses of THz electromagnetic radiation using several operational research systems. ***(Same course as CHEM 6810 & PHYS 6810)***

ECEN 6820*
Photonics II: Spectroscopy II
1 credit, max 4, Lab 3. Prerequisite(s): 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 & PHYS 6820)

ECEN 6823*
Advanced Optical Techniques
Prerequisite(s): 5853. State-of-the-art optical devices and research methodologies. Investigation and discussion of contemporary developments in non-linear optical devices and laser applications. Includes both analytical and experimental techniques.

ECEN 6830*
Photonics II: Spectroscopy III
1 credit, max 4, Lab 3. Prerequisite(s): 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. Multiphotonic excitations. Fast measuring techniques, including subnanosecond detectors, picosecond streak cameras, and ultra fast four-wave mixing and correlation techniques. Time-dependent photoconductivity measurements.
(Same course as CHEM 6830 & PHYS 6830)

ECEN 6840*
Photonics III: Microscopy I
1 credit, max 4, Lab 3. Prerequisite(s): CHEM 3553 or consent of instructor. The structure and imaging of solid surfaces. Basics of scanning probe microscopy (SPM). Contact and non-contact atomic force microscopy (AFM). Scanning tunneling microscopy (STM) in air. ***(Same course as CHEM 6840 & PHYS 6840)***

ECEN 6850*
Photonics III: Microscopy II
1 credit, max 4, Lab 3. Prerequisite(s): CHEM 3553 or consent of instructor. Advanced techniques of scanning probe microscopy (SPM). Magnetic force microscopy, Kelvin force microscopy, scanning probe microscopy (STM) in vacuum. Characterization of materials with SPM. Nanolithography with SPM. Device manufacturing and analysis.
(Same course as CHEM 6850 & PHYS 6850)

ECEN 6860*
Photonics III: Microscopy III and Image Processing
1 credit, max 4, Lab 3. Prerequisite(s): 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 CHEM 6860 & PHYS 6860)***

ECEN 6870*
Photonics IV: Synthesis and Devices I
1 credit, max 4, Lab 3. Prerequisite(s): 6803 and 6840. Preparation of functional nanostructures and related optical/electronic devices. Physical and chemical methods of thin film deposition. Engineering of prototypes of light emitting diodes, sensors, optical limiting coatings, lithographic patterns.
(Same course as CHEM 6870 & PHYS 6870)

ECEN 6880*
Photonics IV: Semiconductor Devices, Testing and Characterization
1 credit, max 4, Lab 3. Prerequisite(s): 6803, 6840. 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 CHEM 6880 & PHYS 6880)***

ECEN 6890*
Photonics IV: Semiconductor Synthesis and Devices III
1 credit, max 4, Lab 3. Prerequisite(s): 6803. 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 & PHYS 6890)

Electrical Engineering Technology (EET)

EET 1003
Introduction to Microcomputer Programming
Lab 2. Co-requisite(s): MATH 1513. Programming a microcomputer in BASIC. Algorithms to solve defined problems. Numerical limitations of small machines.

EET 1104
Fundamentals of Electricity
Lab 3. Prerequisite(s): MATH 1513 and consent of department. Elementary principles of electricity covering basic electric units. Ohm's law, Kirchoff's law, circuit solutions, network solutions, magnetism, inductance and capacitance.

EET 1244
Circuit Analysis I
Lab 4. Prerequisite(s): 1104. Co-requisite(s): MATH 1613. Analysis of AC electric circuits. The use of network theorems and phasors, coupled circuits, resonance, filters, and power.

EET 2303
Technical Programming
Lab 3. Prerequisite(s): 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.

EET 2544
Pulse and Digital Techniques
Lab 3. Prerequisite(s): 1244 and 1225. Electronic circuits used in digital control and computation. Pulse generation, Boolean algebra and logic circuits.

EET 2635
Solid State Devices and Circuits
Lab 1. Prerequisite(s): 1244, MATH 1613. Diodes, transistors, LSI linear devices; their operation and applications in electronic circuits.

EET 3005
Electronics Analysis I
Prerequisite(s): 1104, 1244, 2544, 2635, MATH 1513, 1613, or evaluated equivalent. Co-requisite(s): MATH 2123. Extensive use of mathematics in analyzing discrete, linear device, linear systems and non-linear 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. Intended for transfer and returning students. Enrollment by adviser consent.*

EET 3104
Elements of Electricity and Electronics
Lab 1. Prerequisite(s): MATH 1513. Essentials of electricity, controls, and electronics for non-majors. *No credit for ECT majors.*

EET 3113
Circuit Analysis II
Prerequisite(s): 3123; Co-requisite(s): GENT 3123. Application of elementary switching functions and LaPlace transforms to electronic circuit analysis. Circuit analysis in the S-plane, transfer functions. Application of circuit analysis software.

EET 3124
Project Design and Fabrication
Lab 1. Prerequisite(s): 1244, 2544, 2635. Methods of designing, analyzing and fabricating electronic circuits using standard software packages. Heat transfer characteristics and problem solutions are included.

EET 3254
Microprocessors I
Lab 3. Prerequisite(s): 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.

EET 3264
Microprocessors II
Lab 3. Prerequisite(s): 2544, 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.

EET 3354
Communication and Signal Processing
Lab 1. Prerequisite(s): 1244, 2635, MATH 2133, GENT 3123; Co-requisite(s): 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); modulators and mixers; frequency multiplication; special purpose IC's.

EET 3363
Data Acquisition
Lab 3. Prerequisite(s): 2544, 2634. Methods used to convert physical variables to digital signals and vice versa. Signal conditioning, digital-to-analog converters, analog-to-digital converters, sample-and-hold circuits, sensors, and transducers. The use of computers in data acquisition and signal processing.

EET 3524
Advanced Logic Circuits
Lab 1. Prerequisite(s): 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.

EET 3533
Introduction to Telecommunications
Lab 1. Prerequisite(s): 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.

EET 4050
Advanced Electronic Problems
1-4 credits, max 4. Prerequisite(s): Junior standing and consent of head of department. Special problems in the electronic area.

EET 4314
Elements of Control
Lab 3. Prerequisite(s): 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.

EET 4363
Digital Signal Processing
Prerequisite(s): 3123, 3354, 3363. Introduction to Digital Signal Process. Theoretical development of Fourier transforms, IIR and FIR filters. Significant Design and programming projects.

EET 4514
Advanced Telecommunication Topics
Lab 1. Prerequisite(s): 3533. Study of data transmission techniques between digital electronic devices.

EET 4654
Microwave Techniques
Lab 1. Prerequisite(s): 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.

EET 4833
Industrial Project Design I
Lab 1. Prerequisite(s): 20 credit hours of upper-division electronics courses or consent of instructor. Course mirrors the design process in industry. Topics covered are Design Team formation, Identify Objectives, define design specifications, write specifications, create a state of work and Gantt chart, create a project budget, perform a Preliminary Design Review, Design Prototype.

EET 4843
Industrial Project Design II
Prerequisite(s): 4833. Student continues in the project steps of Change Board Review, Critical Design Review, Developing & Writing Test Specs., Product Fabrication and Testing, Formal Technical Report Submission and Outcomes Assessment Exam.

Engineering (ENGR)

ENGR 1111
Introduction to Engineering
An introduction to the study and practice of engineering. Skills for students in CEAT; expected engineering student behavior; tools needed by CEAT students; and the role of engineers in society. An introduction to engineering ethics; safety issues; and the relationship of engineering to social, global and contemporary issues. Student enrichment opportunities in the CEAT.

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.

ENGR 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.

ENGR 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.

ENGR 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.

ENGR 1412
Introductory Engineering Computer Programming
Lab 2. Programming to solve problems typical of practice in engineering. Techniques and methods.

ENGR 2030
Co-op Industrial Practice I
1-3 credits, max 6. Prerequisite(s): Sophomore 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.*

ENGR 2100
Orientation Projects
1-3 credits, max 3, Lab 2-6. Prerequisite(s): Pre-engineering standing. Enrollment in independent study or small groups. Projects to assist students with special needs to adjust to engineering curriculum.

ENGR 3030
Co-op Industrial Practice II
1-3 credits, max 6. Prerequisite(s): 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*.

ENGR 3061
Domestic Scholars Experience
Prerequisite(s): Consent of the coordinator of CEAT Student Services. Participation in the domestic scholars experience.

ENGR 3080
International Experience
1-18 credits, max 36. Prerequisite(s): Consent of the associate dean of the college. Participation in a formal or informal educational experience outside of the USA.

ENGR 3090
(I)Study Abroad
1-18 credits, max 36. Prerequisite(s): Consent of the Study Abroad office and associate dean of the college. Participation in an OSU reciprocal exchange program.

ENGR 4010
Engineering Problems and Design
0-6 credits, max 6. Prerequisite(s): Permission of the instructor. Special projects and independent study.

ENGR 4030
Co-op Industrial Practice III
1-3 credits, max 6. Prerequisite(s): 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.

ENGR 4060*
Topics in Technology and Society
1-3 credits, max 6. Problems of society relating to technology and added problems stemming from their solution. Minimal reliance on mathematics; *for engineering and non-engineering students.*

ENGR 4103
Impact of Law on Engineering Practice
Prerequisite(s): Junior standing or consent of instructor. Principles and impact of US and international laws and regulations on technical professionals, including the impact of environmental regulations, intellectual property laws, tort claims, and product liability on the design, research and oversight of technologies.

ENGR 4113
(S)Intellectual Property Law for Technical Professionals
Prerequisite(s): Junior standing 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.

ENGR 4123
(S)Tort and Products Liability Law for Technical Professionals
Prerequisite(s): Junior standing or consent of instructor. Legal liability of the work product and duties of technical professionals to the public. Relevant statutory, regulatory and common law relating to torts, specifically products liability.

ENGR 4133
Environmental Regulation for Technical Professionals
Prerequisite(s): Junior standing or consent of instructor. Environmental laws and regulations are omnipresent in the practice of engineering, science and architecture. Survey of the environmental laws and regulations affecting the practice of these professions.

ENGR 4201
Principles of Nuclear Engineering
Radiation, radioactivity, contamination and biological effects of ionizing radiation. Fission, nuclear reactor power plants, radioactive waste disposal and food irradiation. *No credit if the student already has credit in 4203 or 4211. Web-based instruction.*

ENGR 4203
Utilization of Nuclear Technologies in Society
Radiation gauging for shielding purposes. Food irradiation and medical instrument sterilization. PET scans and other medical applications. Nuclear power systems for propulsion, as well as small and large scale electric production. *Web-based instruction.*

ENGR 4211
Introduction to Nuclear and Radiation Engineering Concepts
Aspects and applications of nuclear and radiation engineering. History of nuclear development, basic concepts of radiation and radioactivity, radio waste management, global warming, nuclear power plants, industrial applications, health and medical applications and job opportunities. *No credit if the student already has credit for 4201 or 4203. Web-based instruction.*

ENGR 4213
Elements of Nuclear Engineering
Prerequisite(s): PHYS 2114 and MECH 2163. Survey of nuclear engineering concepts and applications. Nuclear reactions, radioactivity, radiation interaction with matter, reactor physics, risk and dose assessment, applications in medicine, industry, agriculture and research. *Web-based instruction.*

ENGR 4223
Nuclear Reactor Engineering
Prerequisite(s): 4213 and MATH 2233. Physics of nuclear reactors and design principles for nuclear power plants. Current and proposed designs of nuclear power plants. Analysis of energy, control systems and economics of nuclear power plants. *Web-based instruction.*

ENGR 4233*
Energy Systems and Resources
Prerequisite(s): 4213. Fundamentals of energy conversion and transport. Non-renewable and renewable energy sources and utilization. Advanced energy applications. *Web-based instruction.*

ENGR 4243*
Radiation Protection and Shielding
Prerequisite(s): 4213 and MATH 2233. Principles and concepts of radiation protection and shield design; dosimetric units and response functions, hazards of radiation doses, radiation sources, basic methods of dose evaluations, and shielding designs techniques for photons and neutrons. *Web-based instruction.*

ENGR 4253
Nuclear Reactor Analysis
Prerequisite(s): 4213 and MATH 2233. Analysis of nuclear reactor performance and design of systems within specified characteristics. One-group diffusion models for designing multiregion reactors. Computing neutron distributions and multiplication factors, dynamics and safety characteristics for nuclear reactor designs, computing reactivity effects and the design of both homogenous and heterogonous reactors within constraints. *Web-based instruction.*

ENGR 5103*
Advanced Impact of Law on Engineering Practice
Prerequisite(s): Graduate standing. Principles and impact of US and international laws and regulations on technical professionals, including the impact of environmental regulations, intellectual property laws, tort claims, and product liability on the design, research and oversight of technologies.

ENGR 5113*
Advanced Intellectual Property Law for Technical Professionals
Prerequisite(s): Graduate standing. Law and regulations of patents and other IP protection methods. Impact of statutory and common law has made on the practice of technical professionals and how they can exploit IP in their daily work.

ENGR 5123*
Advanced Tort and Products Liability Law for Technical Professionals
Prerequisite(s): Graduate standing. Legal liability of the work product and duties of technical professionals to the public. Relevant statutory, regulatory and common law relating to torts, specifically products liability.

ENGR 5133*
Advanced Environmental for Law for Technical Professionals
Prerequisite(s): Graduate standing. Environmental laws and regulations are omnipresent in the practice of engineering, science, and architecture. This course will survey the environmental laws and regulations affecting the practice of these professions.

Engineering Science (ENSC)

ENSC 2113
Statics
Prerequisite(s): 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.

ENSC 2123
Elementary Dynamics
Prerequisite(s): 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.

ENSC 2143
Strength of Materials
Prerequisite(s): 2113. Bending moments, deformation and displacement in elastic and plastic deformable bodies. Axial, torsional and shear loads. Buckling stress transformations and combined loads.

ENSC 2213
Thermodynamics
Prerequisite(s): CHEM 1314, 1414 or 1515, MATH 2144, PHYS 2014. Properties of substances and principles governing changes in form of energy. First and second laws.

ENSC 2613
Introduction to Electrical Science
Prerequisite(s): MATH 2153 and PHYS 2114. Elements of electrical engineering; AC and DC circuits, mesh and node formulation of network equations, steady-state response to sinusoids, energy, power and power factor.

ENSC 3213
Computer Based Systems in Engineering
Prerequisite(s): CS 1113 or ENSC 1412 and sophomore or higher standing. A comprehensive introduction to technology and application of microprocessors, concepts of computer and computation, interfacing and communication, data acquisition and representation. Applications of general-purpose and embedded processors in various disciplines of engineering and engineering problem solving.

ENSC 3233
Fluid Mechanics
Prerequisite(s): 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.

ENSC 3313
Materials Science
Prerequisite(s): 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)

ETM 5110*
Seminar
1-6 credits, max 6. Prerequisite(s): Admission to the master's program or consent of instructor. Guided study in a topic area selected to enhance a student's program.

ETM 5111*
Introduction to Strategy, Technology, and Integration
Prerequisite(s): Admission to the MS in ETM program or consent of instructor. The first credit hour of a three-credit hour 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.

ETM 5121*
Capstone to Strategy, Technology and Integration I
Prerequisite(s): Admission to the MS 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.

ETM 5132*
Capstone to Strategy, Technology and Integration - Part 2
Prerequisite(s): Admission to the MSETM program or consent of instructor. This is the second part of the capstone and the third and final credit hour of the creative component requirement. Students present a project they have completed. This project is intended to make substantive use of MSETM course material and to be a notable and relevant contribution to the student's organization. Students also participate in the formal critique and discussion of other projects.

ETM 5211*
Enterprise Integration
Prerequisite(s): Admission to the MS 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.

ETM 5221*
Application and Execution of Engineering Teaming
Prerequisite(s): Admission to the MS in ETM program or consent of instructor. Management and group issues inherent in the application and implementation of high performing work teams. The team's roles in improving organizational performance, along with the best practice procedures and techniques that increase team effectiveness.

ETM 5231*
Benchmarking
Prerequisite(s): Admission to the MS in ETM program or consent of instructor. Benchmarking as an effective approach to study and adopt or adapt methodologies representing best specific practices from any industry; or identify and assess performance based on equivalent and common measures, usually from those in the same or similar industries, including competitors.

ETM 5241*
Strategic Project Management
Prerequisite(s): Admission to the MS 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.

ETM 5251*
Problem Solving and Decision-Making
Prerequisite(s): Admission to the MS in ETM program or consent of instructor. Patterns utilized by successful managers for decision making. Organizational skills, investigation through questioning and logic, decision-making among alternatives, and ensuring the success of decision. Analyzing problems and decisions, appraising situations, managing problems of human performance, and implementing processes.

ETM 5271*
Technology Forecasting and Assessment
Prerequisite(s): Admission to the MS in ETM program or consent of instructor. A framework and analytical tools for developing technological foresight. Technology monitoring, forecasting and assessment in the context of a family of emerging technologies.

ETM 5282*
Comprehensive Planning
Prerequisite(s): Admission to the MSETM program or consent of instructor. Continuous and systematic process of thought about the future, resulting in a plan or specific course of action for communicating, coordinating and controlling activities. Strategic, long-range, tactical, operational, contingency and performance planning.

ETM 5291*
Failure Mode and Effects Analysis in Design
Prerequisite(s): Admission to the MS in ETM program or consent of instructor. A design technique for reducing risk and improving reliability of a system, design or process. Potential failures in any of these studied methodically during design. The concepts, tools and techniques applicable to any product or process.

ETM 5311*
Value Engineering
Prerequisite(s): Admission to the ETM program or consent of instructor. The application of Value Engineering (also known as Value Analysis, Value Methodology) to improve customer value for a project, process, or product during or after engineering design. The development of VE, its objectives, definitions and methodologies, the use of the VE system, and its range of application. VE's use for improving performance reducing life cycle cost.

ETM 5321*
Understanding Variation I
Prerequisite(s): One college-level statistics course; admission to MS in ETM program or consent of instructor. The use of data analysis tools to understand variation in engineered processes and products. Understanding and applying, with the assistance of modern and widely available software, those analysis techniques used frequently by engineers and scientists to evaluate measurement systems, compare alternative approaches, analyze and interpret data from experiments, determine desirable sample sizes, and perform tolerancing and sensitivity analysis.

ETM 5331*
Understanding Variation II
Prerequisite(s): One college-level statistics course; admission to MS in ETM program or consent of instructor. The use of design and data analysis tools to understand contribution to total variation in engineered processes and products. Understanding and applying, with the assistance of modern and widely available software, those design and analysis techniques used frequently by engineers and scientists. Screening and modeling designs and response surfaces used to relate key input variables to key output variables. Statistical process control and process capability analysis used to assess performance.

ETM 5341*
Leadership Strategies for Technical Professionals
Prerequisite(s): Admission to the ETM program or consent of instructor. Leadership strategies, principles, styles and dynamics that must be understood by technical professionals engaged in the creation of products, processes, and services in technology-based organizations.

ETM 5351*
Planning Technical Projects
Prerequisite(s): Admission to the MSETM program or consent of instructor. Techniques and tools for project definition, staffing, scheduling, resource allocation, and time estimation. Behavioral and quantitative dimensions of project management. Performance measures of project progress and completion.

ETM 5361*
Managing Virtual Project Teams
Prerequisite(s): Admission to the MSETM program or consent of instructor. The management and group issues inherent in the application and implementation of effective teamwork in virtual work- spaces. The appropriate use of virtual team issues and challenges associated with effective teamwork; virtual team structures, process, and technology facilitation skills; group dynamics; and team motivation.

ETM 5371*
Ethics for Practicing Engineers
Prerequisite(s): Admission to the MSETM program or consent of instructor. A values-based approach to professional ethics and its application to the decision-making in a technology-intensive environment. Ethical concerns related to the expectations of stakeholders.

ETM 5381*
Design and Implementing Change in Technical Management
Prerequisite(s): 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.

ETM 5391*
New Product Introduction and Commercialization
Prerequisite(s): 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.

ETM 5411*
Engineering Economic Analysis
Prerequisite(s): 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.

ETM 5421*
Technology Organization and Structure
Prerequisite(s): 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.

ETM 5431*
Managing Technical Functions
Prerequisite(s): 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.

ETM 5451*
Legal Side of Technical Personnel Management
Prerequisite(s): Admission to MS in ETM program or consent of instructor. The technical manager's role and legal issues involved in personnel decision-making so as to avoid legal problems and litigation. Hiring, discipline and discharge, discrimination, health and safety and right to privacy.

ETM 5461*
Intellectual Property Management
Prerequisite(s): Admission to MS in ETM program or consent of instructor. Overview of intellectual property law and management of intellectual property. Exploration of ways to manage intellectual property from conception through production and licensing. Types of intellectual property and associated legal issues and management processes.

ETM 5471*
Introduction to System Safety
Prerequisite(s): Admission to the MSETM program or consent of instructor. System safety as a discipline in research, development and acquisition of systems, sub-systems and components. The history and methodologies of mishap prevention including the development of system safety management and engineering processes.

ETM 5481*
Sustainable Enterprise Strategies
Prerequisite(s): Admission to the MSETM program or consent of instructor. The principles of sustainability in the context of industrial enterprises. The implications of sustainability in design of products, industrial systems and infrastructure. The importance of life cycle cost analysis as a key engineering economy tool.

ETM 5913*
Six Sigma Tools I
Prerequisite(s): Admission to the MSETM program or consent of instructor. This course provides an introduction to the six sigma body of knowledge as defined by the American Society of Quality (ASQ). Examines the foundations of six sigma and the statistical tools used in the initial stages of the DMAIC problem solving methodology.

ETM 5923*
Six Sigma Tools II
Prerequisite(s): 5913 and admission to the MSETM program or consent of instructor. Provides detail on the "analyze, improve and control" portions of the DMAIC problem solving methodology in addition to quality function deployment (QFD) techniques, failure mode and effects analysis (FMEA) and basic robust design processes, including noise strategies, tolerance design and process capability tools.

ETM 5933*
Lean Tools I
Prerequisite(s): Admission to the MSETM program or consent of instructor. Introduces lean thinking and tools for continuous improvement. Lean enterprise concepts. Identification of non-value-added elements. Implementation of 5S, TPM, set-up reduction and Value Stream Mapping (VSM).

ETM 5943*
Lean Sigma Implementation
Prerequisite(s): 5913, 5933 and admission to the MSETM program or consent of instructor. Introduction to implementation skills necessary to successfully combine lean manufacturing and six sigma concepts into a small to mid-sized firm and manage continuous improvement efforts. Successfully combining leadership, organizational dynamics and customer expectation. Planning, deploying and monitoring.

Engineering Technology

(See specific technology programs listed alphabetically)

English (ENGL)

ENGL 0003
Academic English for Graduate Students
Study and practice of English listening, reading and speaking skills required for graduate study. *Graded on satisfactory-unsatisfactory basis.*

ENGL 1010
Studies in English Composition
1-2 credits, max 2. Special study in composition to allow transfer students to fulfill general education requirements as established by Regent's policy.

ENGL 1113
Composition I
The fundamentals of expository writing with emphasis on structure, development and style.

ENGL 1123
International Freshman Composition I
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.*

ENGL 1213
Composition II
Prerequisite(s): 1113 or 1123 or 1313. Expository composition with emphasis on technique and style through intensive and extensive readings.

ENGL 1223
International Freshman Composition II
Prerequisite(s): 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.*

ENGL 1313
Critical Analysis and Writing I
Expository writing forms, including summary, critique, and synthesis. Writing assignments based on readings from across the curriculum. *May be substituted for 1113 for gifted writers who seek a more challenging course.*

ENGL 1413
Critical Analysis and Writing II
Critical thinking, research, and writing skills necessary for success in courses across the curriculum. Some sections available for honors credit. *May be substituted for 1213 for gifted writers who seek a more challenging course.*

ENGL 1923
(H)Great Works of Literature
Readings in the great works of the most important writers of Britain and America, such as Shakespeare, Dickens, Twain, Faulkner, and others.

ENGL 2243
(H,I)Language, Text and Culture
Investigation of how human language relates to culture.

ENGL 2413
(D,H)Introduction to Literature
Fiction, drama/film and poetry. Written critical exercises and discussion.

ENGL 2443
(I)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)***

ENGL 2453
(H)Introduction to Film
Lab 2. The principles of film form as they affect the art of watching and thinking about motion pictures.

ENGL 2513
(H)Introduction to Creative Writing
Literary composition with emphasis on techniques and style through readings and writings in fiction, poetry and drama.

ENGL 2543
Survey of British Literature I
The beginnings through the Neo-Classic Period.

ENGL 2653
Survey of British Literature II
The Romantic Period to the present.

ENGL 2773
(D)Survey of American Literature I
The Puritans through the Romantic Period.

ENGL 2883
(D)Survey of American Literature II
The Romantic Period to the present.

ENGL 3030
Fiction Writing
3 credits, max 6. Prerequisite(s): 2513. Directed readings and practice in writing fiction with special attention to techniques.

ENGL 3040
Poetry Writing
3 credits, max 6. Prerequisite(s): 2513. Directed readings and practice in writing poetry with special attention to techniques.

ENGL 3050
Screenwriting
3 credits, max 6. Prerequisite(s): 2513. Readings and practice in writing scripts with special attention to form.

ENGL 3123
(H)Mythology
Myths, their cultural context, and their place in world literature.

ENGL 3153
(D,H)Readings in Literature by Women
The collection of literature written by women in England and America, classical and modern figures.

ENGL 3163
(H)World Literature I
Selected literary masterpieces exemplifying ideals and values in Western cultures.

ENGL 3170
Readings in Literature and Other Disciplines
3 credits, max 6. A study of literature and its historical or thematic connections to one or more of the fine arts or disciplines in the humanities or social sciences.

ENGL 3173
(H,I)World Literature II
Selected literary masterpieces exemplifying ideals and values in non-Western cultures. Emphasis on the study of non-Western literature available in English.

ENGL 3183
(D,H)Native American Literature
Origins and development of a literary tradition in its historical and cultural context.

ENGL 3190
Readings in Postcolonial and Multiethnic Literature
3 credits, max 6. Principal literary and critical texts written in English either by writers from parts of the world once colonized by the West or by American writers of different ethnic origins whose work bridges cultures.

ENGL 3193
(D,H)African-American Literature
Origins and development of a literary tradition in its historical and cultural context.

ENGL 3200
Special Problems in Language and Literature
1-3 credits, max 3. Prerequisite(s): 9 credit hours of English. Specialized readings and independent study.

ENGL 3203
Advanced Composition
Prerequisite(s): 9 hours of English. An advanced writing course based on contemporary theories of composition.

ENGL 3223
Technical Communication Theory and Criticism
Study and application of principal critical theories in technical communications.

ENGL 3243
Literary Theory and Criticism
Study of the major works of critical theory and literary criticism.

ENGL 3263
Screen Theory and Criticism
Study of the theory of film, television, and new media.

ENGL 3303
American Sign Language Interpreting Practicum
Prerequisite(s): 12 hours of ASL or permission of Instructor. Observation and supervised interpreting for students who wish to work as professional ASL interpreters.

ENGL 3323
Technical Writing
Prerequisite(s): 1113/1123 or 1213/1223 or 1313 and junior standing. Applied writing in areas of specialization. Intensive practice in professional writing modes, styles, research techniques and editing for specialized audiences and/or publications. *This course may be substituted for 1213/1223 with an "A" or "B" in 1113/1123 and consent of the student's college.*

ENGL 3333
(H)Short Story
Origins, development, theory and craft of the short story.

ENGL 3343
Readings in Poetry
Poetry as a genre. The historical development of poetry in English, its major figures, its definitions, its key elements.

ENGL 3353
(H)Image and Text
Lab 2. The theory and practice of the relationship between verbal and visual texts, including adaptation of literary works for the screen, and examinations of the aesthetic industrial, and cultural relationships between visual and literary media.

ENGL 3363
(H)Readings in 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).

ENGL 3373
Readings in Nonfiction
Theory and practice of creative nonfiction in English, including autobiography, travel writing, literary journalism, correspondence and the essay.

ENGL 3383
Readings in Narrative
Readings in narrative of different periods and different genres.

ENGL 3410
Popular Fiction
3 credits, max 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.

ENGL 3430
Topics in Television Studies
3 credits, max 6. Examination of the study of television in the US, including narrative and visual practices, genres, political economy and social effects, and comparison with television in other national settings and other forms of media. *No credit for students with credit in AMST 3430.*

ENGL 3443
(H)Studies in Film Genre
Lab 2. A comparative study of types of films both inside the Hollywood system and in other national cinemas. The western, the film noir and the musical, as well as genres from such countries as France, Germany and Japan. Focused knowledge of selected genres, a sense of the economic imperatives that necessitate generic "contracts" between film producers and viewers and knowledge of the history of specific genres. ***(Same course as AMST 3443)***

ENGL 3453
(H)History of American Film
Lab 2. 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.

ENGL 3463
(H,I)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.

ENGL 3813
(D,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.
(Same course as AMST 3813)

ENGL 3903
One-to-One Writing Instruction: Theory and Practice
Lab 4. Prerequisite(s): Six hours English or consent of instructor. Students will learn why and how to effectively instruct writing one-to-one through observation and participation in the OSU Writing Center. Introductory understanding of composition theory; knowledge of writing center research; familiarity with tutoring strategies; and insight into the composition process.

ENGL 3933
(H)Shakespeare
Recurring themes and their variations in Shakespeare's work. Nature of these genres in the period and Shakepeare's innovations. The structure and language of the plays, occasional examination of historical documents and contexts, modern performances, and critical essays.

ENGL 4003*
History of the English Language
The growth of the English language.

ENGL 4013*
English Grammar
The traditional terminology and concepts of English grammar leading or evolving into the several current systems of description.

ENGL 4043
Teaching English to Speakers of Other Languages
Designed to develop the skills and techniques needed in teaching English to speakers of other languages (TESOL). Examines the theoretical issues behind the practice and methodologies and classroom techniques, including the testing of English and the selection and preparation of teaching materials.

ENGL 4063*
Descriptive Linguistics
The methodology of linguistic analysis.

ENGL 4080*
Studies in Sociolinguistics
3 credits, max 6. Study of a topic in sociolinguistics, chosen at the instructor's discretion.

ENGL 4083*
Applied Linguistics
The study of topics in psycholinguistics, including language and the brain, animal communication and language acquisition.

ENGL 4093*
Language in America
Historical development of American English. Regional, social and cultural language differences.

ENGL 4100
Studies in Medieval British Literature
3 credits, max 6. Special topics encompassing the many different ethnic traditions and genres found in medieval British literature.

ENGL 4110
Studies in 16th Century British Literature
3 credits, max 6. Literature themes of the English Renaissance focusing on related authors and topics. Authors include Shakespeare, Spenser, Sidney, Marlowe, Raleigh, Wyatt, and Surrey.

ENGL 4120
Studies in 17th Century British Literature
3 credits, max 6. Obtaining an understanding of 17th century British literature while developing skills as a critical thinker, a reader of literary texts and a writer of expository prose.

ENGL 4130
Studies in 18th Century British Literature
3 credits, max 6. Selected topics in British literature from 1660-1800. Various writers and their works and themes and literary developments of the period. Topics vary by semester.

ENGL 4160
Studies in 19th Century British Literature
3 credits, max 6. Exploration of the literary culture of nineteenth-century Britain. Topics might range from romantic poetry to the Victorian novel.

ENGL 4170
Studies in 20th Century British Literature
3 credits, max 6. Various topics focusing on the literature and culture of Britain and Ireland, such as 20th century British and Irish fiction, poetry, or drama; The City; The Irish Renaissance.

ENGL 4200
Studies in Early American Literature
3 credits, max 6. Readings and topics in early American literature and culture.

ENGL 4210
Studies in 19th Century American Literature
3 credits, max 6. Themes in 19th century American literature with attention to social and cultural contexts.

ENGL 4220
Studies in 20th Century American Literature
3 credits, max 6. Topics focusing on the literature and culture of the United States, such as 20th century American fiction, poetry, or drama; alienation and activism; the impact of science and technology.

ENGL 4223*
Introduction to Old English
The basics of pronunciation, vocabulary, and grammar, enabling students to read short works in prose and poetry.

ENGL 4233*
Old English Poetry: Beowulf
Prerequisite(s): 4223. A close reading of the poem, taking into account the original Old English manuscript and recent translations.

ENGL 4263
(H)Aesthetics of Film
Lab 2. The form, meaning and value of American and international motion pictures.

ENGL 4300
Studies in Romanticism
3 credits, max 6. Principle works of Romanticism, reflecting the cultural, social, and political developments.

ENGL 4303
British Drama 1500-1660
Medieval and Renaissance drama by Shakespeare's contemporaries.

ENGL 4310
Studies in Modernism
3 credits, max 6. Selected topics in literature of the early twentieth century. Texts and themes will vary by semester.

ENGL 4313
British Drama 1660-1800
Restoration and Heroic Drama and cultural controversies related to the theater.

ENGL 4320
Studies in Postmodernism
3 credits, max 6. Approaches to the exploration of postmodernism in literature, other art forms, and culture. The analysis of representative postmodern texts from various genres such as fiction, poetry, drama, film and mass media.

ENGL 4323
British Drama Post 1800
Genre development. Major writers and their works.

ENGL 4333
American Drama
Genre development. Major writers and their works.

ENGL 4343
Studies in American Sign Language
Prerequisite(s): 6 hours of ASL or permission of Instructor. An examination of psycholinguistic and sociolinguistic research on ASL and its speakers, to familiarize students with current theory and practice in applied linguistics.

ENGL 4350
Contemporary International Cinema
3 credits, max 6, Lab 2. Examines major trends in contemporary international cinema of the last fifteen years. National cinema may include France, Germany, Italy, Spain, Sweden, China, Taiwan, India, South Korea, and Russia, amongst others.

ENGL 4353
Linguistics of American Sign Language
Prerequisite(s): 6 hours of ASL or permission of instructor. Linguistic analysis of American Sign Language, including referential and locative features, morphology, syntax, and semantics. Students will gain an understanding of ASL structure.

ENGL 4400
Studies in Regional Literature
3 credits, max 6. Literature of a nation such as Ireland or Canada, or of a region such as the American Southwest. Topic varies by semester.

ENGL 4403
American Poetry to 1900
Genre development. Major writers and their works.

ENGL 4413
American Poetry Post 1900
Genre development. Major writers and their works.

ENGL 4433
British Poetry Post 1900
Genre development. Major writers and their works.

ENGL 4450
Culture and the Moving Image
3 credits, max 9. The study of the moving image in a social or cultural context, including genre, auteur and auteurism, film and feminism, television and other media.

ENGL 4453
Contemporary Literature
Genre development. Major writers in the novel, poetry, or drama and their works.

ENGL 4460
Creative Nonfiction
3 credits, max 6. Theory and practice of creative nonfiction in English, including autobiography, memoir, travel writing, literary journalism, correspondence, and the essay.

ENGL 4520*
Problems in English
1-3 credits, max 6. Prerequisite(s): 12 credit hours of English. Specialized readings and independent studies.

ENGL 4523*
Technical Writing Internship
Prerequisite(s): Six 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.

ENGL 4533*
Advanced Technical Writing
Prerequisite(s): Six credit hours of English, including 3323. Specialized writing projects growing out of areas of specialization with emphasis on practical and marketable skills.

ENGL 4543*
Technical Editing
Prerequisite(s): Nine credit hours of English. Scientific and technical editing skills; emphasis on editing project.

ENGL 4553*
Document Design
Prerequisite(s): 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.

ENGL 4563
Scientific and Technical Literature
Prerequisite(s): Six credit hours of English. Scientific and technical style.

ENGL 4600
Studies in Chaucer or Milton
3 credits, max 6. Various topics focusing on the works of Chaucer or Milton.

ENGL 4630*
Advanced Fiction Writing
3 credits, max 6. Prerequisite(s): 3030. Intensive practice in fiction writing.

ENGL 4640*
Advanced Poetry Writing
3 credits, max 6. Prerequisite(s): 3040. Intensive practice in poetry writing.

ENGL 4650*
Advanced Screenwriting
3 credits, max 6. Discussion of professional screenplays and critiquing peers' work; completion of exercises on structure, visualization, and characterization; and writing a fictional screenplay.

ENGL 4700
Single Author or Work Pre-1800
3 credits, max 6. Study of a single author or work prior to 1800 along with supporting literature. Chosen at the instructor's discretion.

ENGL 4710
Single Author or Work Post-1800
3 credits, max 6. Study of a single author or work after 1800 along with supporting literature. Chosen at the instructor's discretion.

ENGL 4723
(H)Studies in Shakespeare
Focus on advanced topics in major plays and selected criticism.

ENGL 4893*
Research Writing for International Graduate Students
Prerequisite(s): Graduate standing or permission of the instructor. Analysis and practice in the grammar and rhetorical structures specific to writing research papers in the disciplines.

ENGL 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.

ENGL 4993
Senior Honors Thesis
Prerequisite(s): 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.

ENGL 5000*
Thesis
1-9 credits, max 12. MA thesis.

ENGL 5013*
Introduction to Graduate Studies
Principles and procedures in scholarly research.

ENGL 5043*
Traditions in Literary Criticism and Theory
A survey of the major documents in literary theory and criticism from Plato to 1965.

ENGL 5063*
Seminar in Shakespeare
Intensive study of a limited number of plays. Assignment of problems to individual students.

ENGL 5093*
Seminar in Milton
Poetry, major prose and criticism.

ENGL 5120*
Studies in Teaching English as a Second Language
1-3 credits, max 6. Selected topics in teaching English as a second language; e.g. cross-cultural communication, materials preparation, bilingual education.

ENGL 5123*
Social and Psychological Aspects of Language
An introduction to language acquisition, processing, and production, and their interaction with social contexts.

ENGL 5130*
Studies in English Grammar
3 credits, max 6. Selected study of current topics in grammatical theory as it applies to the teaching of English.

ENGL 5140*
Seminar in Linguistics
3 credits, max 6. Selective study of current topics in linguistics.

ENGL 5143*
Seminar in Descriptive Linguistics
An introduction to phonology, morphology, syntax and semantics.

ENGL 5163*
Middle English Literature
Major works in Middle English.

ENGL 5210*
Seminar or Directed Study
1-6 credits, max 9. Specialized readings or independent studies.

ENGL 5213*
Composition Theory and Pedagogy
Materials and methods of instruction in composition.

ENGL 5223*
Teaching Technical and Business Writing
Materials and methods of instruction in teaching technical and business writing.

ENGL 5243*
Teaching English as a Second Language
Theories of second language acquisition. Materials and methods of instruction.

ENGL 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.

ENGL 5313*
Internship, Teaching English as a Second Language
Supervised teaching of beginning through advanced English as a second language courses.

ENGL 5333*
Seminar in TESL: Testing
Standardized testing for teaching English as a second language.

ENGL 5340*
Studies in Discourse Analysis
Selected topics in the study of language in use in spoken or written contexts.

ENGL 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.

ENGL 5360*
Seminar in Screen Studies
3 credits, max 9. The exploration of key aesthetic issues of analysis and evaluation as they pertain to film criticism.

ENGL 5363*
Critical Approaches to Screen Studies: Theory and History
Designed to provide students with an overview of fundamental theoretical and historical scholarship in film and television studies.

ENGL 5370*
Studies in Television and News Media
3 credits, max 9. Exploration of aesthetic, cultural, and ideological aspects of television and new media in the United States and abroad.

ENGL 5410*
Seminar in British Literature of the 16th Century
3 credits, max 6. Selected writers and their works, themes and literary developments of the 16th century.

ENGL 5420*
Seminar in British Literature of the 17th Century
3 credits, max 6. Selected writers and their works, themes and literary developments of the 17th century.

ENGL 5440*
Seminar in British Literature of the 18th Century
3 credits, max 6. Selected writers and their works, themes and literary developments of the 18th century.

ENGL 5460*
Seminar in British Literature of the 19th Century
3 credits, max 6. Selected writers and their works, themes and literary developments of the 19th century.

ENGL 5480*
Seminar in Modern Literature
3 credits, max 6. Selected writers and their works, themes and literary developments of modern literature.

ENGL 5503*
Technical Documentation Production
Practical considerations to managing professional publications—paper-based, web-based or any of many electronic forms.

ENGL 5513*
Introduction to Technical Communications
Development of critical cognitive skills of analysis, synthesis, and interpretation from the perspective of "consumer of research".

ENGL 5520*
Internship in Technical Writing
1-6 credits, max 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.

ENGL 5523*
New Genres in Technical Writing
Theoretical and practical considerations in specialized writing projects that include manuals, proposals and visual aids used to communicate technical information delivered in an online medium or as a combination of online and print documents.

ENGL 5553*
Information Design for Professional Publication
Study of information design theories to design and integrate textual and visual information using appropriate tools.

ENGL 5563*
History of Scientific Rhetoric
Structural, stylistic and rhetorical analysis of selected scientific and technical works.

ENGL 5573*
Theories of Communication
Survey of a broad range of theories of communication and application of those theories to technical communication.

ENGL 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.

ENGL 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.

ENGL 5630*
Seminar in Early American Literature
3 credits, max 6. Selected writers and their works, themes and literary developments of the 17th and 18th centuries.

ENGL 5660*
Seminar in American Literature of the 19th Century
3 credits, max 6. Selected writers and their works, themes and literary developments of the 19th century.

ENGL 5680*
Seminar in Contemporary Literature
3 credits, max 6. Selected writers and their works, themes and literary developments in contemporary literature.

ENGL 5723*
Craft and Forms of Poetry
Theory and practice of the poetic forms.

ENGL 5730*
Seminar in Fiction Writing
3 credits, max 9. Writing fiction at the professional level.

ENGL 5740*
Seminar in Poetry Writing
3 credits, max 9. Writing poetry at the professional level.

ENGL 5750*
Seminar in Scriptwriting
3 credits, max 6. Scriptwriting at the professional level.

ENGL 5763*
Craft and Forms of Fiction
Theory and practice of the fictional films.

ENGL 5990*
Special Problems
1-3 credits, max 6. Investigation into a designated area of English leading to material for creative component option (MA). *Graded on a pass-fail basis.*

ENGL 6000*
Dissertation
1-9 credits, max 60. PhD dissertation.

ENGL 6130*
Studies in Fiction Writing
3 credits, max 9. Prerequisite(s): 5730. Individual projects in fiction.

ENGL 6140*
Studies in Poetry Writing
3 credits, max 9. Prerequisite(s): 5740. Individual projects in poetry.

ENGL 6210*
Seminar or Directed Study
1-6 credits, max 9. Specialized readings or independent studies.

ENGL 6220*
Seminar in Genre
3 credits, max 9. The development, traditions, concerns or characteristics of genre in selected texts. Major genres and subgenres considered.

ENGL 6240*
Studies in Literature
3 credits, max 9. Advanced topics in literature and literary research.

ENGL 6250*
Seminar in Race, Region or Gender
3 credits, max 9. A study of the complex relations between race, region or gender and the texts that represent them.

ENGL 6260*
Studies in Literary Criticism
3 credits, max 9. Selected work in literary criticism, for example ancient and neo-classical, 19th century, 20th century.

ENGL 6350*
Topics in Rhetorical Theory
3 credits, max 6. Study of advanced topics in rhetorical theory and research. May focus on an important thinker, or a specific theme, or some combination of thinkers and themes.

ENGL 6360*
Seminar in Film and Society
3 credits, max 9. Social conduct and value systems as they affect the role of media in culture.

ENGL 6410*
Topics in Linguistics
3 credits, max 9. Prerequisite(s): 5143. Study of advanced topics in linguistic theory and research.

ENGL 6420*
Topics in Second Language Acquisition
3 credits, max 9. Prerequisite(s): 5243. Study of topics in second language theory and research.

ENGL 6500*
Studies in Technical Writing
1-3 credits, max 9. Selected topics in technical writing.

Entomology (ENTO)

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.

ENTO 2091
Livestock Entomology
Lab 2. Prerequisite(s): 2992. Economic importance, biology and control of pests affecting domestic animals.

ENTO 2991
(L,N)Introduction to the Science of Entomology
Lab 2. Prerequisite(s): 2992. Laboratory-based course focused on insect structure, function and classification. Biology and ecology of insects are demonstrated in both laboratory and field settings. Designed to reinforce and supplement concepts introduced in ENTO 2992 through practical application.

ENTO 2992
(N)Introduction to the Science of Entomology
Basic biology and classification of insects and closely related animals. Overview of the ecological roles of insects in both natural and managed ecosystems.

ENTO 3021
Postharvest Insect Pests
Lab 2. Prerequisite(s): 2991 & 2992 concurrent enrollment or 2091. 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.

ENTO 3044
Insect Physiology
Lab 2. Prerequisite(s): 2991 & 2992; one course in organic chemistry and nine credit hours of biology. Functions of organ systems and demonstration of selected techniques for study of insect physiology. *Offered in combination with 5044. No credit for both 3044 and 5044.*

ENTO 3331
Insect Pests of Agronomic Crops
Lab 2. Prerequisite(s): 2991 & 2992 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.

ENTO 3421
Horticultural Insects
Lab 2. Prerequisite(s): 2991 & 2992 or concurrent enrollment. Identification, biology and control of pests attacking horticultural crops. Emphasis on pests injurious to vegetables, fruits, pecans, greenhouse plants, turf and ornamental trees and shrubs.

ENTO 3461
Insects in Forest Ecosystems
Lab 2. Prerequisite(s): 2991 & 2992 or concurrent enrollment. Identification and seasonal life history of insect pests and beneficial insects on shade trees in urban settings, in commercial forests, and in forest products.

ENTO 3644
Insect Morphology
Lab 4. Prerequisite(s): 2991 & 2992 or equivalent. Insect development and comparative morphology. *Offered in combination with 5644. No credit for both 3644 and 5644.*

ENTO 3663
Turfgrass Integrated Pest Management
Lab 2. Prerequisite(s): 2991, 2992, 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)***

ENTO 4223*
Ecological Methodology
Lab 2. Prerequisite(s): 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.

ENTO 4400
Special Topics
1-3 credits, max 3. Prerequisite(s): Consent of instructor. Special topics in plant pathology, entomology or related fields. ***(Same course as PLP 4400)***

ENTO 4464*
Insect Biology and Classification
Lab 4. Prerequisite(s): 2992 and 2991 or ZOOL 1604. Insect phylogeny, taxonomy, behavior, morphology and physiology in the context of ecosystem function. Major roles of insects in shaping ecosystem diversity, as indicators of environmental integrity, and as vectors of plant and animal pathogens and parasites.

ENTO 4483
Aquatic Entomology
Lab 2. Prerequisite(s): 2991 and 2992 or ZOOL 1604. Biology, taxonomy and ecology of insects and other invertebrates, inhabiting freshwater environments. Emphasis is placed on identification and biology of individual taxa. Roles of insects in aquatic ecology, as a forage base, and as indicators of biotic integrity of aquatic systems. Linkages between aquatic systems and terrestrial systems are also examined. *No credit for students with credit in ENTO 5483 or ZOOL 5483.* ***(Same course as ZOOL 4483)***

ENTO 4800
Entomology Practicum
1-6 credits, max 6. Prerequisite(s): Consent of practicum coordinator and adviser. Supervised research or extension experience with faculty in the Entomology/Plant Pathology Dept. or with approved governmental agencies or private employers. *Written report required at close of practicum. Graded on pass-fail basis.*

ENTO 4854*
Medical and Veterinary Entomology
Lab 4. Prerequisite(s): 3553. Biology and control of insects affecting public health.

ENTO 4922*
Applications of Biotechnology in Arthropod and Pathogen Control
Prerequisite(s): 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)***

ENTO 5000*
Master's Research and Thesis
1-6 credits, max 6. Research in entomology.

ENTO 5003*
Insect Biochemistry
Prerequisite(s): Consent of instructor. Biochemical processes in insects and closely related arthropods with emphasis on metabolic pathways unique to this group. Biochemical aspects of arthropod host interactions.

ENTO 5020*
Special Problems
1-8 credits, max 8. Prerequisite(s): Graduate standing. Selected studies in the area of entomology, acarology or araneology.

ENTO 5044*
Insect Physiology
Lab 2. Prerequisite(s): 2991, 2992 or equivalent; one course in organic chemistry and nine credit hours of biology. Functions of the organ systems and demonstration of selected techniques for study of insect physiology. *Offered in combination with 3044. No credit for both 3044 and 5044.*

ENTO 5464*
Systematic Entomology
Prerequisite(s): 3553 or equivalent. Classification and comparative biologies of terrestrial insects.

ENTO 5483*
Aquatic Entomology
Lab 2. Prerequisite(s): 2991 and 2992 or ZOOL 1604. Biology, taxonomy and ecology of insects and other invertebrates, inhabiting freshwater environments. Emphasis is placed on identification and biology of individual taxa. Roles of insects in aquatic ecology, as a forage base, and as indicators of biotic integrity of aquatic systems. Linkages between aquatic systems and terrestrial systems are also examined. Graduate students will be expected to complete additional collection requirements and biotic integrity analyses. *No credit for students with credit in ENTO 4483 or ZOOL 4483.* ***(Same course as ZOOL 5483)***

ENTO 5513*
Biological Control
Lab 2. Prerequisite(s): 2991 & 2992 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.

ENTO 5524*
Integrated Management of Insect Pests and Pathogens
Lab 4. Prerequisite(s): 2991, 2992 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 5524)***

ENTO 5550*
Advanced Agronomic Entomology
1-5 credits, max 5. Prerequisite(s): 4523. Special problems in advanced agronomic entomology.

ENTO 5613*
Host Plant Resistance
Lab 2. Prerequisite(s): 2991, 2992 and PLP 3344 or equivalent and 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)***

ENTO 5623*
Advanced Biotechnology Methods
Lab 3. Prerequisite(s): BIOC 3653, BIOL 3023 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 biotechnology, including genome analysis, gene transfer, identification and isolation of genes and their products and regulation of gene expression in plants and arthropods. ***(Same course as PLP 5623)***

ENTO 5644*
Insect Morphology
Lab 4. Prerequisite(s): 2991, 2992 or equivalent. Insect development and comparative morphology. *Offered in combination with 3644. No credit for both 3644 and 5644.*

ENTO 5710*
Advanced Medical and Veterinary Entomology
1-5 credits, max 5. Prerequisite(s): 4854. Special problems in methods of disease transmission, animal parasite control and the relationships existing between parasite and host.

ENTO 5733*
Insect Chemical Ecology
Prerequisite(s): BIOL 1114, CHEM 3015 or equivalent. Ecological 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 semiochemicals such as pheromones and allelochemicals.

ENTO 5753*
Insecticide Toxicology
Prerequisite(s): Organic chemistry or 15 credit hours biology. Properties and mode of action of the major insecticidal materials. Assessment of their impact on the environment.

ENTO 5833*
Insect Molecular Biology
Prerequisite(s): 2991, 2992 and BIOL 3024 or equivalent or consent of instructor. Concepts and methods in molecular biology with emphasis on genetics of insects. Application of molecular techniques in insect biology.

ENTO 5850*
Epidemiology of Arthropod-borne Diseases
1-4 credits, max 4, Lab to be arranged. Prerequisite(s): 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.

ENTO 5870*
Scientific Presentations
1 credit. Prerequisite(s): Consent of instructor. Preparation and delivery of scientific presentations including 50-minute seminars, 10-minute talks, and posters. ***(Same course as PLP 5870)***

ENTO 5992*
Career Skills and Professionalism for Scientists
Prerequisite(s): 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)***

ENTO 6000*
Doctoral Research and Dissertation
1-10 credits, max 30. Prerequisite(s): MS in entomology or consent of major professor. Independent investigation under the direction and supervision of a major professor.

ENTO 6100*
Advanced Insect Physiology
1-5 credits, max 5. Prerequisite(s): 3044 or 5044 or equivalent. Special problems in advanced insect physiology.

Environmental Science (ENVR)

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.

ENVR 4010
Internships in Environmental Science
1-6 credits, max 6. Prerequisite(s): Junior standing in environmental science or consent of instructor. Supervised internships with business, industry, or governmental agencies in environmental assessment and remediation.

ENVR 4112
Land Measurement and Site Analysis
Lab 2. Prerequisite(s): MATH 1513 or equivalent. Methods and techniques used to locate sites and evaluate physical conditions. Includes map interpretation and land description, use of Global Positioning System, Rectangular System Land Description and determination of land elevations, areas and slopes. ***(Same course as MCAG 4112)***

ENVR 4500
Environmental Science Problems
1-6 credits, max 6. Prerequisite(s): 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.

ENVR 4512
Environmental Impact Analysis
Outline of the National Environmental Policy Act (NEPA) documentation of potential environmental impacts for decision makers. Development of environmental assessment, environmental impact statements, and categorical exclusion documents that result from the NEPA processes. *Graded on a pass/fail basis.*

ENVR 4573
Ethical Issues in Agriculture and the Environment
Application of ethical concepts and economics theory to real-world agricultural and environmental issues. Recognition of the moral, ethical, and economic dimensions of value that aid in understanding and resolving the controversial aspects of these private and public issues.

ENVR 4813
Environmental Science Applications and Problem Solving
Lab 2. Prerequisite(s): AGEC 3503, BISC 3034, FOR 4813, GEOL 3073, POLS 4363, senior standing, or consent of instructor. Integrated problem solving applied to environmental issues using physical, biological, economic, quantitative, policy and administrative principles. Primarily for environmental science majors.

ENVR 5000*
Research for Thesis or Report
1-6 credits, max 6. Prerequisite(s): Approval of advisory committee and departmental steering committee. Research leading to master's thesis or report.

ENVR 5050*
Readings in Environmental Science Topics
1-3 credits, max 9. Prerequisite(s): Consent of the instructor. This course provides an avenue for masters students to extend their knowledge of Environmental Science topics not covered in other courses. *This course is not available for doctoral students.*

ENVR 5123*
Environmental Problem Analysis
Prerequisite(s): 5303. This course reviews the process of environmental problem analysis using current practical examples. This course draws on theories from various disciplines and applies appropriate techniques of analysis.

ENVR 5200*
Special Topics in Environmental Science
1-4 credits, max 10. Prerequisite(s): 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.

ENVR 5210*
Seminar in Environmental Science
1-3 credits, max 6. Prerequisite(s): Consent of the instructor. This seminar is offered as a special topics course for masters students. The theme of the seminar will vary in accordance with recent advances in environmental science and the interests of the faculty instructor.

ENVR 5303*
Issues in Environmental Sustainability
Prerequisite(s): 3000 or 4000 level ecology course. The course reviews human-nature relationships and how they affect the ability of future generations to sustainably improve their quality of life. The course also considers methods of environmental stewardship that can contribute to sustainability. In-class and/or online discussions of issues, guest presentations by outside experts, and reports on selected topics are included.

ENVR 5503*
Environmental Management Practicum
Prerequisite(s): 18 credit hours, which must include one environmental compliance course (POLS 5633 or CIVE 5123), and one environmental risk course (POLS 5643, POLS 5653, or CIVE 5823); OR comparable courses as approved by the instructor. This course explores methods of analyzing sustainable solutions to complex environmental, safety and health problems using an integrated team approach. This approach combines technical, legal, economic, and sociopolitical information into a coherent analytical framework. *Required for masters students pursuing a plan of study in environmental management.*

ENVR 5510*
Environmental Management Internship
3 credits, max 6. Prerequisite(s): 5503 and consent of program director. The student must identify and solve an environmental problem under the supervision of a competent professional environmental manager, and submit and defend a formal report presenting the problem, solution analysis methodologies, and recommended solution. *The internship must involve at least 240 contact hours with the manager. The course is required of all masters students pursuing a plan of study in environmental management.*

ENVR 5523*
Industrial Ecology for Environmental Scientists
Prerequisite(s): General biology. Provides students with an overview and broad understanding of ecology principles as applied to an industrial setting. The course begins with an overview of general ecological principles such as ecosystem components and structures, biogeochemical cycles, energy flows, and properties of populations. The course concludes with a consideration of industrial ecology principles such as sustainability, pollution prevention, life cycle assessment and waste minimization.

ENVR 5543*
Environmental Management Systems
Prerequisite(s): 5303 or equivalent knowledge with consent of instructor. This course introduces strategies for the design and operation of environmental management systems that reduce environmental impacts in conformance with ISO 14000 standards. Topics include aspect identification, impact assessment, impact reduction strategies, and management oversight. Other topics such as training, internal and external auditing, and integration with other management programs will also be addressed.

ENVR 5703*
Chemical Aspects of Environmental Science I
Prerequisite(s): 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.

ENVR 5713*
Chemical Aspects of Environmental Science II
Prerequisite(s): 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.

ENVR 5733*
Environmental Site Assessment
This course introduces concepts associated with conducting environmental site assessments (ESAs) and contaminant remediation. Topics include review of federal regulations regarding site assessments, an overview of Phase I and Phase II ESA methodologies, proper soil/water sampling techniques, soil/geology/hydrogeology principles relating to environmental assessments, and various remediation strategies. The course includes field exercises simulating Phase I and Phase II ESA investigations, interpretation of historical aerial photos, and wetland identification.

ENVR 5743*
Environmental Impact Assessment
The course teaches students how to understand and apply the National Environmental Policy Act to evaluate and document potential environmental impacts for decision makers. The course reviews the development of environmental assessment, environmental impact statement and categorical exclusion documents that result from the NEPA process. Emphasis is placed on the development of an environmental assessment program.

ENVR 5823*
Watershed Management
Prerequisite(s): 5813. This course provides an overview of watershed management that integrates law, politics, economics, watershed science, engineering, education, social marketing, and conflict resolution. Students will also learn how to critically evaluate watershed management programs. *Field trips to watersheds are included.*

ENVR 6000*
Research for Dissertation
1-12 credits, max 24. Prerequisite(s): Approval of advisory committee. Research leading to the PhD dissertation.

ENVR 6011*
Survey of Environmental Science
This course introduces newly admitted environmental science students to environmental research conducted by faculty at OSU. The course also helps students prepare interdisciplinary plans of study that support their professional and research goals. *It is required of all ES doctoral students during their first year of enrollment. The course may also be taken by ES master's students, but is not required.*

ENVR 6023*
Interdisciplinary Research Proposal Preparation
Prerequisite(s): Permission of student's research adviser. This course teaches students how to prepare and defend interdisciplinary research proposals and offers suggestions for preparing for qualifying exams. Students will learn how to frame research questions, conduct literature reviews, select among interdisciplinary research methods, organize research proposals, and present results. *Enrollment in the course requires permission of the student's research adviser. This course is required of all ES doctoral students before they intend to prepare and defend a dissertation prospectus and take the doctoral candidate qualifying exam.*

ENVR 6031*
Interdisciplinary Research Report Preparation
Prerequisite(s): 6023 or AGED 5983 and permission of the student's research adviser. This course teaches students how to prepare and defend interdisciplinary dissertations. Students will learn how to interpret results, articulate findings, justify conclusions, and identify implications. They will also learn how to deliver professional conference presentations and write professional papers. *The course requires permission of the student's research adviser. The course is required of all ES doctoral students just before they intend to prepare and defend their dissertations. ES master's students who want to learn more about preparing and defending a thesis may also enroll.*

ENVR 6050*
Advanced Readings in Environmental Science
1-3 credits, max 9. Prerequisite(s): Consent of the instructor. This course provides an avenue for doctoral students to extend their knowledge of environmental science topics not covered in other courses.

ENVR 6210*
Advanced Seminar in Environmental Science
1-3 credits, max 9. Prerequisite(s): Consent of the instructor. This course is offered as a special topics course for doctoral students. The theme of the course will vary in accordance with recent advances in environmental science and the interests of the faculty instructor. *No masters student may enroll in this course.*

ENVR 6310*
Advanced Topics in Environmental Science
1-3 credits, max 6. Prerequisites: 24 credit hours of graduate credit and permission of instructor. This course covers current topics and issues in environmental science. Though the topics will vary, each course will typically include environmental assessment, environmental sustainability and environmental policy. *Group discussions and team projects may be required.*

ENVR 6503*
Advanced Environmental Management Practicum
Prerequisite(s): 30 credit hours, which must include one environmental compliance course (POLS 5633 or CIVE 5123), and one environmental risk course (POLS 5643, PLS 5653, or CIVE 5823); OR comparable courses as approved by the instructor. This course discusses and compares advanced methods of analyzing sustainable solutions to complex environmental, safety and health problems. A framework for integrating technical, legal, economic, and sociopolitical analysis into a risk-based model will be developed and applied to a real-world case study. Required for doctoral students pursuing a plan of study in environmental management.

ENVR 6516*
Advanced Environmental Management Internship
6 credits. Prerequisite(s): 6503 and consent of program director. The student must identify and solve an environmental problem in collaboration with a competent professional environmental manager, and submit and defend a formal report presenting the problem, problem and solution analysis methodologies, and recommended solution. *The internship must involve at least 480 contact hours with the manager. The course is an experience for all ES doctoral students pursuing a plan of study in environmental management.*

ENVR 6623*
Social Aspects of Environmental Planning
This course develops students' theoretical and practical understanding of social aspects of environmental planning. The course addresses topics such as social impact assessment, the role of public involvement, environmental justice, and other social considerations in the implementation of environmental programs. It will also demonstrate the application of social science techniques in environmental planning and prepare students for the application of social perspectives in environmental decision-making - in both the public and private sectors.

Finance (FIN)

FIN 2123
Personal Finance
A first course in the management of the individual's financial affairs. Budgeting, use of credit, mortgage financing, investment and estate planning.

FIN 3113
Finance
Prerequisite(s): ACCT 2203 or concurrent enrollment; and ECON 2203 or concurrent enrollment; and STAT 2023 or equivalent or concurrent enrollment or consent of instructor. Operational and strategic financial problems including allocation of funds, asset management, financial information systems, financial structure, policy determination and analysis of the financial environment.

FIN 3613
General Insurance
Prerequisite(s): 3113. Introduction to the theory and general principles of insurance. A broad analysis of the elements and operation of property, casualty, health and life insurance.

FIN 3713
Real Estate Investment and Finance
Prerequisite(s): 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.

FIN 4063
Applied Financial Studies
Prerequisite(s): Consent of the instructor. Structured internship or field project with supporting academic study.

FIN 4113
Financial Markets and Institutions
Prerequisite(s): 3113 and ECON 3313 or concurrent. Money and capital markets, flow-of-funds, commercial banks and other financial intermediaries.

FIN 4213
International Financial Management
Prerequisite(s): 3113 or consent of instructor. Financial management topics unique to business firms operating in an international environment. Topics include global economic and business environments, international monetary system, foreign exchange markets, foreign exchange risk and management, foreign direct investment, and trade finance. Recent and current international financial events.

FIN 4223
Investments
Prerequisite(s): 3113. Various approaches to selecting and timing investment opportunities, e.g., common stocks, bonds, commodities and options. Modern concepts of portfolio theory.

FIN 4333*
Financial Management
Prerequisite(s): 3113 or consent of instructor. 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.

FIN 4363
Energy Finance
Prerequisite(s): 3113. Introduction to basic terminology, industry structure, and supply and demand outlook in the oil, gas and power industries. A broad analysis of applications in the energy industry including financial statement analysis, valuation, risk analysis in capital budgeting, risk management, alternative energy topics and energy specific case studies.

FIN 4443*
Banking Strategies and Policies
Prerequisite(s): 3113 and ECON 3313 or concurrent enrollment. Theories and practices of bank asset management; banking markets and competition.

FIN 4453*
Bank Decision Simulation and Analysis
Prerequisite(s): 3113 and 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.

FIN 4550
Selected Topics in Finance
1-6 credits, max 6. Prerequisite(s): 3113 or consent of instructor. Advanced topics in finance. Topics are updated each semester.

FIN 4653
Bond Markets
Prerequisite(s): 3113 and 4113. Provides a broad introduction to treasury, corporate, municipal, mortgage backed, and asset backed bond markets. The analytical techniques for valuing bonds, quantifying their exposure to changes in interest rate and credit risk exposures and investment decision-making are explored. Concepts are applied through case studies and projects.

FIN 4763
Financial Futures and Options Markets
Prerequisite(s): 3113 and 4223. Foundation in financial futures and options markets. A balance of institutional detail 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.

FIN 4813
Portfolio Management
Prerequisite(s): 3113 and 4223 with a grade of "C" or better. Overview of portfolio management from the point of view of a trust officer, mutual fund manager, pension fund manager, or other manager of securities. Emphasizes the need of financial managers for an understanding of problems, trends, and theory of portfolio management.

FIN 4843
Risk Management
Prerequisite(s): 3113 and 4223. Introduction to relevant analytical tools necessary for the effective management of risk.

FIN 4913
Advanced Risk Management
Prerequisite(s): 3113 and 4223 and 4843 (with a grade of "C" or better), and 4763. Applications of risk management concepts and skills for the development of programs to manage risk exposures.

FIN 5000*
Research and Thesis
1-6 credits, max 6. Prerequisite(s): Good standing in Master of Science in quantitative financial economics program. Consent of program coordinator. Research and thesis for master's students.

FIN 5010*
Finance Projects and Independent Studies
1-6 credits, max 6. Prerequisite(s): Good standing in a graduate program, consent of project adviser, consent of department head. Graduate projects and independent study in finance.

FIN 5013*
Business Finance
Prerequisite(s): Graduate standing. 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 to the firm and individuals.

FIN 5053*
Theory and Practice of Financial Management
Prerequisite(s): 5013 or equivalent and prior or concurrent enrollment in ACCT 5183 or equivalent or consent of instructor. Concepts and theories applicable to the financial administration of a firm. Cases, problems and readings to illustrate various financial problems and techniques of solution.

FIN 5153*
Corporate Financial Strategy
Prerequisite(s): 5013 or equivalent and prior or concurrent enrollment in ACCT 5183 or equivalent or consent of instructor. Strategic financial decisions and their implementation, including capital structure policy, capital budgeting, risk assessment and management, corporate restructuring, management performance assessment, cost of capital, financial resource planning, dividend policy, and capital raising. Familiarity with basic financial tools and techniques including time value of money, asset pricing and security valuation, and financial statement analysis.

FIN 5213*
International Business Finance
Prerequisite(s): 5013. Theories and financial management practices unique to business firms which operate in, or are influenced by, an increasingly global economy.

FIN 5223*
Investment Theory and Strategy
Prerequisite(s): 5013 or consent of instructor. Selected investment topics and advanced portfolio management techniques.

FIN 5243*
Financial Markets
Prerequisite(s): 5013. An analysis of the structure of financial markets, the determination and behavior of interest rates, the functioning of and the flow of funds.

FIN 5333*
Corporate Governance
Prerequisite(s): 5013. The theoretical and applied analysis of the governance structure of a corporation. The interconnections of the board of directors, CEO, management and shareholders. Case problems and readings address the advantages and disadvantages of various corporate governance practices.

FIN 5550*
Special Topics in Finance
1-6 credits, max 12. Prerequisite(s): Consent of instructor. Theoretical and applied aspects of specialized financial areas. Evaluation of models, current trends and problems.

FIN 5763*
Derivative Securities and the Management of Financial Price Risk
Prerequisite(s): 5013 or consent of instructor. Differing amounts of financial price risk for individuals and corporations in volatile financial environment. The development of arbitrage-based models for the pricing of derivative securities, and the use of a full range of derivative securities to manage exposure to financial price risk.

FIN 5773*
Financial Engineering
Prerequisite(s): MATH 4513 and FIN 5763 or consent of instructor. Techniques for the design, development and implementation of innovative financial instruments and processes to the formulation of creative solutions of problems in finance.

FIN 5883*
Quantitative Financial Applications
Prerequisite(s): 5223 and consent of the head of the department. Application of financial solution techniques through directed case work in appropriate business and public sector settings. Simulation, small group instruction and field-based experiences.

FIN 6053*
Financial Theory and Corporate Policy
Prerequisite(s): Consent of the instructor. Theoretical and empirical underpinnings of modern corporate finance.

FIN 6660*
Seminar in Finance
3-6 credits, max 12. Prerequisite(s): Consent of instructor. Advanced research with emphasis on theoretical problems and solutions. Selected topics covered.

Fire Protection and Safety Technology (FPST)

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.

FPST 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.

FPST 2023
Introduction to Occupational Safety Techniques
Lab 3. Occupational facilities, equipment and operations and their inherent hazards. Directed toward worker, machine and environmental control.

FPST 2050
Studies in Loss Control
1-4 credits, max 6. Prerequisite(s): Consent of instructor and adviser. Problems in applied fire protection technology, occupational safety, industrial hygiene or hazardous materials management of particular interest to the loss control specialist.

FPST 2153
Fire Protection Management
Applied human relations, technical knowledge and skills for achieving optimum effectiveness from a fire protection organization.

FPST 2243
Design and Analysis of Sprinkler Systems
Lab 3. Prerequisite(s): 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.

FPST 2344
Elements of Industrial Hygiene
Lab 3. Prerequisite(s): CHEM 1225. Toxic or irritating substances, physical, biological, ergonomic and other occupational stress factors causing employee illness or discomfort. Environmental pollution sources and controls.

FPST 2483
Fire Protection Hydraulics and Water Supply Analysis
Lab 3. Prerequisite(s): 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.

FPST 2650
Technical Problems and Projects
1-4 credits, max 4. Special problems or projects assigned by advisers with the approval of the department head. A comprehensive written report or equivalent creative effort.

FPST 3013
Industrial Safety Organization
Survey course. Recognition, evaluation and control of occupational health and safety hazards. Accident prevention, accident analysis, training techniques, workman's compensation insurance, guarding and personal protective equipment.

FPST 3113
Advanced Extinguishing Systems Design and Analysis
Prerequisite(s): 2483, 2243. Automatic fixed fire-extinguishing systems and water supply systems. Emphasis upon computer assistance through use of existing design programs.

FPST 3143
Structural Designs for Fire and Life Safety
Lab 3. Prerequisite(s): 1213, 1373, 2243 and GENT 2323 or ENSC 2113. 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.

FPST 3213
Human Factors in Accident Prevention
Prerequisite(s): 2344, 3013 and GENT 2323 or ENSC 2113. Human factors and workplace ergonomics as it relates to the prevention of accidents and workplace injuries. Fundamentals and techniques of task analysis.

FPST 3233
Radiological Safety
Lab 2. Ionizing radiation problems; detection and measurement, shielding and exposure limiting, radiation health aspects, storage, handling and disposal.

FPST 3373
Fire Dynamics
Lab 3. Prerequisite(s): 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.

FPST 3383
Building Electrical Systems
Prerequisite(s): 1373. Detail current standards for design, selection and installation of electrical distribution ad utilization equipment. Emphasis on personnel safety and fire prevention using current codes and standards.

FPST 3713
Hydraulic Design of Automatic Sprinkler Systems
Prerequisite(s): 1373, 2483, MATH 1513. Hydraulic calculation technique for the design and analysis of automatic sprinkler fire extinguishing systems.

FPST 3723
Industrial Fire Pump Installations
Prerequisite(s): 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.

FPST 3733
Sprinkler System Design for High Piled and Rack Storage
Prerequisite(s): 2243, MATH 1513. Specific design techniques for sprinkler system protection of commodities stored in solid piles or racks over 12 feet in height.

FPST 4050
Special Problems in Loss Control
1-4 credits, max 6. Prerequisite(s): Consent of department head. Special technical problems in fire protection and safety.

FPST 4133
Industrial Hygiene Instrumentation
Lab 3. Prerequisite(s): 2344, CHEM 1225, PHYS 1114. Description, operation and application of quantitative instruments in general use in industrial hygiene.

FPST 4153
Issues in Local Government and Fire Services
Prerequisite(s): 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.

FPST 4333
System Safety Analysis
Lab 3. Prerequisite(s): 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.

FPST 4403
Hazardous Materials Incident Management
Lab 3. Prerequisite(s): 2023, 2344, CHEM 1225. An interdisciplinary approach to hazardous materials incident management. Legislative requirements. Emphasis on comprehensive safety and health program compliance relating to hazardous materials incidents or waste sites. Regulatory code activities, transport-related inspections, incident modeling, and use of environmental safety software for problem solving and documentation.

FPST 4684
Industrial Loss Prevention
Lab 3. Prerequisite(s): 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.

FPST 4993
Advanced Fire and Safety Problems
Prerequisite(s): 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.

Food Science (FDSC)

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

FDSC 2253
Meat Animal and Carcass Evaluation
Lab 2. Prerequisite(s): ANSI 1124. Evaluation of carcasses and wholesale cuts of beef, pork, and lamb. Factors influencing grades, yields, and values in cattle, swine, and sheep. ***(Same course as ANSI 2253)***

FDSC 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.*

FDSC 3113
Quality Control
Lab 2. Prerequisite(s): Introductory microbiology and organic chemistry. Application of the principles of quality control in food processing operations to maintain the desired level of quality.

FDSC 3154
Food Microbiology
Lab 4. Prerequisite(s): 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 MICR 3154)***

FDSC 3182
Meat Grading and Selection
Lab 4. Prerequisite(s): ANSI 2253. Classifying and grading carcasses and wholesale cuts of beef, pork and lamb; factors influencing quality and value. ***(Same course as ANSI 3182)***

FDSC 3210
Animal and Product Evaluation
1-2 credits, max 2, Lab variable. Prerequisite(s): Consent of instructor. Advanced instruction in evaluating slaughter and breeding animals and grading and evaluating meat, poultry, and dairy products.
(Same course as ANSI 3210)

FDSC 3333
Meat Science
Lab 3. Prerequisite(s): ANSI 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 economical utilization of meat animals, as well as in the manufacture of meat products emphasized in the laboratory. ***(Same course as ANSI 3333*)***

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

FDSC 3603
Processing Dairy Foods
Lab 2. Prerequisite(s): Organic chemistry. Theory and practice in formulation and processing: butter and margarine, cottage cheese, blue and processed cheeses, evaporated and sweetened condensed milk, ice cream, ice milk, and other frozen desserts.

FDSC 4333*
Processed Meat
Lab 3. Prerequisite(s): ANSI 3033 or 3333. Meat and meat product composition. Techniques in the molding and forming of meat; sausage formulation; curing; quality control; and cost analysis. ***(Same course as ANSI 4333*)***

FDSC 4373
Food Chemistry II
Lab 2. Prerequisite(s): 3373. Chemical/biochemical mechanisms that affect the structure and properties of foods during processing and handling. *No credit for FDSC 5373.*

FDSC 4763*
Analysis of Food Products
Lab 2. Prerequisite(s): Organic chemistry. Application of quantitative chemical and physical methods of analysis to the examination of foods.

FDSC 4910
Food Industry Internship
3-12 credits, max 12. Prerequisite(s): Consent of instructor. Full-time internship at an approved production, processing or agribusiness unit or other agency serving the food industry. Maximum credit requires a six month internship in addition to a report and final examination. *Graded on a pass-fail basis.*

FDSC 5000*
Research and Thesis in Food Science
1-6 credits, max 6, Lab 2-12. Prerequisite(s): Consent of major adviser. Research for master of science degree in Food Science planned, conducted and reported under guidance of major adviser.

FDSC 5120*
Special Topics in Food Science
1-4 credits, max 8. Prerequisite(s): Graduate standing and consent of instructor. Advanced topics and new developments in food science especially with reference to foods of animal origin.

FDSC 5213*
Advances in Meat Science
Prerequisite(s): BIOC 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. ***(Same course as ANSI 5213*)***

FDSC 5300*
Food Science Seminar
1 credit, max 3. Prerequisite(s): Graduate standing. Maximum two credit hours for MS degree. Maximum three credit hours for PhD degree. Critical reviews or studies of the scientific research literature related to the field of food science. Oral reports or group discussions.

FDSC 5333*
Carcass Value Estimation Systems
- Effective Spring '09 - Prerequisite(s): Graduate classification. Analysis of scientific literature regarding carcass composition, quality and palatability. Overview of technology used to evaluate carcass quality factors.
(Same course as ANSI 5333)

FDSC 5373*
Advanced Food Chemistry
Lab 2. Prerequisite(s): FDSC 3373. Chemical/biochemical mechanisms that affect the structure and properties of foods during processing and handling.

FDSC 5553*
Interpreting Animal and Food Science Research
Prerequisite(s): STAT 5013 or concurrent enrollment. Critical evaluation and knowledgeable communication on the design, analyses, and reporting of animal science and food science research. ***(Same course as ANSI 5553)***

FDSC 6000*
Research and Thesis in Food Science
1-10 credits, max 30, Lab 2-20. Prerequisite(s): MS degree or consent of major adviser. Independent research for PhD degree in Food Science planned, conducted and reported in consultation of a major professor.

Foreign Languages and Literature (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.

FLL 1000
Special Studies in Foreign Languages and Literatures
1-10 credits, max 10. Special studies in areas not regularly offered; basic level.

FLL 2000
Special Study in Foreign Languages and Literatures: Intermediate
1-5 credits, max 10. Prerequisite(s): 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.

FLL 2103
(H)Masterworks of Western Culture: Ancient and Medieval
Ideas and values of Western culture as revealed through literary, artistic, historical, and philosophical contexts from Greek, Roman, and Medieval periods.

FLL 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.

FLL 2443
(I)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)***

FLL 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.

FLL 3500
Specialized Study in a Modern Foreign Language
1-20 credits, max 20, Lab 1-5. Prerequisite(s): Consent of instructor. Instruction and/or tutorial work in a modern foreign language other than those offered in a major program.

FLL 4000
Specialized Studies in Foreign Languages and Literatures
1-9 credits, max 9, Lab 1-9. Prerequisite(s): Junior standing or consent of instructor. Individual guided study, tutorial or seminar on specially selected topics in a foreign language or literature.

FLL 4993
Senior Honors Thesis
Prerequisite(s): 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.

FLL 5210*
Graduate Studies in Foreign Languages
1-6 credits, max 20. Prerequisite(s): 15 upper-division hours in the language. Graduate studies in foreign languages.

Forensic Sciences (FRNS)

FRNS 5000*
Research and Thesis
1-6 credits, max 6, Lab 1-6. Prerequisite(s): Consent of major adviser. Research in forensic sciences for MS degree.

FRNS 5013*
Survey of Forensic Sciences
Prerequisite(s): Consent of instructor. Predominantly online class providing overview of various forensic sciences and how they relate to presentation of evidence and to civil and criminal procedures involved in solving problems of law. Law and ethics, forensic pathology, forensic dentistry and anthropology, forensic toxicology and molecular biology (DNA), forensic nursing and death scene investigation, forensic psychology, criminalistics, questioned documents, forensic engineering and technology, forensic accounting, and management techniques in forensic sciences. A review of current guidelines for knowledge, procedures, quality assurance and control, and certification/accreditation from national standards boards and scientific and technical working groups.

FRNS 5023*
Questioned Document Examination
Lab 2. Prerequisite(s): 5013 or concurrent enrollment. Functions of questioned document examiners, beyond document analysis to relating services and issues. History of questioned documents, handwriting and handprinting, process for obtaining exemplars, types of document examination (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 train the student as a document examiner and in no way certifies or qualifies the student to conduct questioned document analysis at the conclusion of this course.

FRNS 5033*
Theory and Practice of Forensic Handwriting Examination
Prerequisite(s): 5023. Theoretical and practical aspects of handwriting as forensic evidence. Production of normal and false handwriting, variables in handwriting production, standards of comparison, identification theories, examination methodologies, expression of conclusions, characterization and validation of examiner skills, legal admissibility of handwriting expertise, and challenges to professional practice.

FRNS 5043*
Technical Aspects of Forensic Document Examination
Prerequisite(s): 5023. Basic theory in visual examination of questioned documents. Visual and color theory, measuring tools, instruments, simple microscopy, and photographic techniques. Technical description, theory, operation and practical use of various instrumentation used in the field such as the Electrostatic Detection Apparatus (ESDA) and Video Spectral Comparator (VSC).

FRNS 5053*
The Historical Aspects of Forensic Document Examination
Prerequisite(s): Graduate standing. This course presents historical aspects of forensic document examination. It covers development of handwriting, the acceptance of document examination expertise in Britain and North American, the early luminaries and famous cases.

FRNS 5063*
Scientific Writing and Presentation
Develops scientific and individual writing abilities, especially relative to thesis development around a scientific question. Explores organization and design of various types of scientific writing; grammar and usage challenges for scientists; and aspects of presenting findings, including slide/poster design.

FRNS 5073*
Quality Assurance in Forensic Science
Prerequisite(s): Admission to program. Preparation for the forensic scientist to develop and implement quality assurance and quality control procedures to ensure the excellence of a laboratory. Preparation of laboratory procedures ad policies, use of appropriate standards and controls, and validation methods for establishing an effective quality assurance program in the laboratory.

FRNS 5081*
Scientific Method and Investigation
Prerequisite(s): Admission to the program. Introduction to structure and essence of the scientific method and how investigations are conducted. Manner in which ethics has an impact on the scientist, especially in the use of humans and animals as subjects of scientific research.

FRNS 5213*
Molecular Biology for the Forensic Scientist
Prerequisite(s): Admission to the program. Develops a solid foundation of knowledge in molecular biology for understanding the concepts of genetic marker analysis, especially DNA typing.

FRNS 5223*
Forensic Biology
Prerequisite(s): 5013 and 5213 or Instructor permission. Covers derivation of forensic evidence from biological sources for criminal and civil investigations. Includes progression of laboratory testing to identify human body fluid and its source, detection and characterization of stains or fluids and genetic marker testing.

FRNS 5242*
Population Genetics for the Forensic Scientist
Prerequisite(s): 5513. Population genetics relevant to DNA analysis technologies to identify perpetrators of crime. Includes foundation of statistical knowledge in forensic DNA analysis and family relatedness testing, history and application of statistical and population genetic theory to assigning weight to matches in DNA profiles for the court.

FRNS 5282*
Methods in Forensic Biology and Forensic Toxicology
Lab 4. Prerequisite(s): Permission of instructor. Advanced-level laboratory course in which students apply knowledge from earlier course work in a hands-on setting and employ fundamental techniques and methodologies pertinent to forensic biology and forensic toxicology.

FRNS 5313*
Forensic Engineering and Technology
Lab 2. Prerequisite(s): 5013; college-level chemistry and biology; knowledge of physics, calculus, and spreadsheet calculations. Review of disciplines of chemistry, biology, physics, math and computer science as regularly applied in support of forensic engineering and technology analysis. Case studies ranging from complex "multi-event" accidents to small but individually serious accidents.

FRNS 5413*
Forensic Pathology and Medicine
Prerequisite(s): Consent of instructor. Medico-legal investigation of death and injury due to natural causes, accidents and violence. Transportation injuries, homicides, suicides, blunt- or sharp-force injuries, gunshot wounds, asphyxia, drowning, and thermal and electrical injuries. Pediatric deaths; rape investigation; injury analysis; interpretive toxicology; identification by dental means; anthropologic studies for determining age, sex and race; and conducting of independent medical examinations. Demonstrations and data analysis from actual cases. Review of current guidelines for knowledge, procedures, quality control/assurance, and certification/accreditation from national standards boards and scientific/technical working groups.

FRNS 5513*
Forensic Bioscience
Prerequisite(s): 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 material. Working knowledge of how toxic compounds affect 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.

FRNS 5523*
Forensic Toxicology
Introduction of fundamental aspects of forensic toxicology and emphasis on major subfields of postmortem forensic toxicology, human performance toxicology and forensic drug testing. Examination of methodologies and analyses associated with there three major subfields.

FRNS 5533*
Drug Toxicity
Introduces fundamental aspects of abused drugs from a toxicological perspective and examines major disciplines of toxicology. Also covers basic principles of toxicology applied to different classes of commonly abused drugs.

FRNS 5613*
Criminalistics and Evidence Analysis
Lab 2. Prerequisite(s): Admission to program. Introduction to techniques and tools used for crime scene investigations and analysis of evidence. Introduction to the forensic laboratory, its operation and function, forensically applied scientific concepts, analytical instrumentation and microscopy, and documentation, collection and preservation of physical evidence. Review of FBI-sanctioned working group guidelines for evidence gathering, evidence handling, quality control and accreditation.

FRNS 5622*
Advanced Criminalistics
Lab 4. Prerequisite(s): 5073, 5613, 5653 and basic course work in specialty. Application of strategies/techniques for effective crime scene investigation in laboratory or mock crime scene setting. Covers the duties of the first officer at the crime scene, the crime scene investigator/evidence collector, and analysis of evidence in the forensic laboratory. Builds on concepts from prerequisite courses for hands-on exercises.

FRNS 5653*
Scientific Evidence
Prerequisite(s): Admission to program. Review of ways that the law, particularly the law of evidence, affects the work of the forensic scientist. The beginning of the case, most often the crime scene, through the legal process, through trial and including appeals and motions for a new trial. Legal doctrines of interest to the forensic scientist, such as chain of custody, work product privileges, laying of the proper foundation, exhibits, and the standards necessary to obtain a new trial.

FRNS 5713*
Forensic Psychology
Lab 2. Prerequisite(s): Consent of faculty. Introduction to the relationship between the disciplines of law and psychology via examination and contrast of the issues at the interface of both disciplines. Various legal terminology that calls for psychological input; legal and ethical responsibilities of forensic psychologists, criminal behavior, punishment and deterrence, violence and mental illness, competency to stand trial, the insanity defense, eyewitness testimony, the death penalty, and polygraph testing. Exploration of the role of legal and mental health systems in social control, impact of psychological knowledge on functioning of the legal system. Examination of psychological topics and paradigms relevant to study of particular legal subsystems or topics.

FRNS 5723*
Advanced Forensic Psychology
Prerequisite(s): 5013 & 5713. Expands on topics covered in FRNS 5713. Covers function of the mental health professional in criminal cases, nature and impact of mental illness on individual life and freedom, reasons behind crimes, gender differences in the criminal justice system, and laws pertinent for mental health professionals.

FRNS 5913*
Forensic Accounting and Fraud Investigation
Prerequisite(s): 5013. Introduction of concepts and tools used in the fields of forensic accounting and financial fraud investigations. Issues of alter ego, constructive trusts, fraudulent conveyances, accounting liability, business valuations, lost profits, damages, marital dissolution issues and bankruptcy. Aspects of fraud investigation, including overview of fraud in U.S., types and methods of fraud perpetration, red flags of fraud perpetrators, money laundering, and international fraud investigations. *(Upon completion student will have an understanding of accounting methods used in a litigation services/ fraud investigation environment and knowledge of basic requirements for drafting expert reports in accordance with Federal Rules of Civil Procedure.)*

FRNS 6010*
Forensic Specialization
1-3 credits, max 15. Prerequisite(s): 5013. Preparation for advanced research study in a specialty area of forensics. 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 campuses may be used to satisfy requirements for this course with the consent of the program director.

FRNS 6043*
Forensic Management and Organizational Development
Prerequisite(s): 5013. Application of managerial and organizational leadership skills to the demands of forensic sciences, including attention to the human resource, relations and development issues. Inter-agency cooperation, quality control and assurance, certification and accreditation issues, and internal security.

French (FREN)

FREN 1115
Elementary French I
Lab 1.5. Main elements of grammar and pronunciation, with work on the four basic skills of listening comprehension, speaking, reading and writing.

FREN 1225
Elementary French II
Lab 1.5. Prerequisite(s): 1115 or equivalent. Continuation of 1115.

FREN 2112
(I)Intermediate Reading and Conversation I
Lab 1. Prerequisite(s): 1225 or equivalent competence. (May have been gained in high school) Reading and discussion of simpler French texts, mostly cultural. *May be taken concurrently with other 2000-level French courses.*

FREN 2113
Intermediate French I
Lab 1. Prerequisite(s): 1225 or equivalent competence. (May have been gained in high school.) Review and further presentation of grammar and pronunciation; consolidation of basic skills, with additional emphasis on writing. *May be taken concurrently with other 2000-level French courses.*

FREN 2232
(I)Intermediate Reading and Conversation II
Lab 1. Prerequisite(s): 2112 or equivalent competence. (May have been gained in high school.) Reading and discussion of more advanced French texts, mostly literary. *May be taken concurrently with other 2000-level French courses.*

FREN 2233
Intermediate French II
Lab 1. Prerequisite(s): 2113 or equivalent competence. (May have been gained in high school.) Continuation of 2113. *May be taken concurrently with other 2000-level French courses.*

FREN 3073
French Conversation
Prerequisite(s): 2232 and 2233 or equivalent. Colloquial speech, with discussion of French newspapers and magazines. Practice in brief public address in French.

FREN 3203
Advanced Written Expression
Prerequisite(s): 20 hours of French or equivalent. Practice in composition and stylistics, designed to bring students up to a high level of proficiency in writing.

FREN 3213
Advanced Grammar
Prerequisite(s): 20 hours or equivalent proficiency. Conceptual framework and presentation of the finer points of French grammar.

FREN 3343
Business French
Prerequisite(s): 2232 and 2233 or equivalent. Applied French for students in commercial and technical fields. Overview and strategies of business and economic climate in France.

FREN 3463
Advanced Diction and Phonetics
Lab 1. Prerequisite(s): 2232 and 2233 or equivalent. Required course for teacher certification. French speech sounds and intonation patterns, with practice to improve the student's pronunciation.

FREN 3853
Introduction to Analysis of French Literature
Prerequisite(s): 2232 and 2233 or equivalent. Close reading of shorter texts in a variety of literary genres, with presentation of French versification and literary terminology.

FREN 4153
History of French Literature I
Prerequisite(s): 20 credit hours of French or equivalent. Historical survey of French literature before 1700, with reading of representative texts.

FREN 4163
History of French Literature II
Prerequisite(s): 20 credit hours of French or equivalent. Historical survey of French literature of the eighteenth century, with reading of representative texts.

FREN 4173
History of French Literature III
Prerequisite(s): 20 credit hours of French or equivalent. Historical survey of French literature of the nineteenth century, with reading of representative texts.

FREN 4183
History of French Literature IV
Prerequisite(s): 20 credit hours of French or equivalent. Historical survey of French literature of the twentieth century, with reading of representative texts.

FREN 4333
Background of Modern French Civilization
Prerequisite(s): 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.

FREN 4550
Directed Studies in French
1-3 credits, max 3, Lab 1-2. Prerequisite(s): 20 credit hours of French or equivalent. Individual or group study of French language or literature.

FREN 4573
Modern French Theater
Prerequisite(s): 20 credit hours of French or equivalent. Analysis of French plays from the 19th and 20th centuries.

FREN 5110*
Advanced Studies in French
1-3 credits, max 9. Prerequisite(s): 15 credit hours of upper-division French. Discussion or research in specialized topics.

General Engineering (GENG)

GENG 4010
Senior Design Project
2-4 credits, max 4. Prerequisite(s): Senior standing in general engineering. Capstone design project through independent application of engineering principles and concepts from the disciplines covered in earlier course work.

General Technology (GENT)

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.

GENT 1223
Manufacturing Processes
Lab 3. Basic methods and processes of fabrication with emphasis on manufacturing operations, metrology and conventional machining.

GENT 2323
Statics
Prerequisite(s): MATH 1613, 2123 and PHYS 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.

GENT 2650
Technical Projects
1-4 credits, max 4. Prerequisite(s): Completion of three semesters' work in a technical institute curriculum. Special projects assigned by advisers with the approval of the director. A comprehensive written report must be prepared and an oral examination may also be required.

GENT 3123
Applied Analysis for Technology
Prerequisite(s): MATH 2133 or equivalent. Applications of elements of matrix algebra, ordinary differential equations, and infinite series to problems in engineering technology.

GENT 3323
Strength of Materials
Prerequisite(s): 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.

GENT 3433
Basic Thermodynamics
Prerequisite(s): MATH 2123. Basic scientific principles of energy and the behavior of substances as related to engines and systems. Gas laws, vapors and engine cycles.

GENT 4433
Heat Transfer
Prerequisite(s): MATH 2123 or equivalent. Conduction, convection, radiation, condensation and boiling heat transfer. Heat exchangers. Prediction of heat transfer rates. Retardation and enhancement of heat transfer.

Genetics (GENE)

GENE 5102*
Molecular Genetics
Prerequisite(s): BIOC 3653 or 3014 and one course in genetics or consent of instructor. An introduction to molecular genetics on the graduate level.

Geography (GEOG)

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.

GEOG 1114
(L,N)Physical Geography
Lab 2. Distribution and analysis of natural features of the earth. Landforms, soils, minerals, water, climates, flora and fauna. Emphasis on human-environment relations where appropriate.

GEOG 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.

GEOG 2323
Introduction to Remote Sensing
Lab 2. Basic introduction to remote sensing focusing on image processing, sensor characteristics, and image classification. Lab assignments provide students with hands-on experience with common techniques and computer packages.

GEOG 2343
Introduction to Geographic Information Systems
Lab 2. Survey of a variety of resource management and socioeconomic applications using geographic information systems (GIS) technology.

GEOG 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.

GEOG 3033
(N)Meteorology
A non-quantitative introduction to weather. Physical elements that cause and influence weather. Interpretation of weather maps and satellite imagery.

GEOG 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, POLS 3053 & RUSS 3053)

GEOG 3063
Economic Meteorology
Economic impact of weather ranging from consumer spending to agriculture and energy commodity markets. Specific weather events, and their associated economic impact, weather and climate forecasting and methods for eliminating weather risk.

GEOG 3123
(D,S)Urban Geography
Locational aspects of urbanization; functions of and relations among cities and between cities and rural areas; internal structure of urban areas.

GEOG 3133
(I,S)Political Geography
Political structures, relationships and geopolitical implications of location, boundaries, culture and the natural environment of nations and states. Global patterns of political behavior, political history, international law and geostrategy.

GEOG 3153
(S)Conservation of Natural Resources
Problems and corrective methods of conservation of land, water, forests, wildlife, minerals and people.

GEOG 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.

GEOG 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.

GEOG 3183
Transportation Geography
Basic concepts and theories of transportation geography, selected transportation models and analysis methods related to spatial interactions, network analysis, allocation, and urban transportation planning.

GEOG 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.

GEOG 3333
Spatial Analysis
Prerequisite(s): STAT 2013. The utility and application of modeling and statistics to spatial problem solving. The role of quantitative methods in geographic research.

GEOG 3703
(S)Geography of Oklahoma
Geographic interpretation of physical, economic, historical and scenic features.

GEOG 3713
(D,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.

GEOG 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.

GEOG 3733
(I,S)Geography of Russia and its Neighbors
A regional analysis encompassing cultural, economic and physical features.

GEOG 3743
(I,S)Geography of Latin America
A real distribution and analysis of physical, cultural and economic features of Latin America.

GEOG 3753
(I,S)Geography of Asia
Systematic interpretation of significant spatial patterns of man and natural environment. (Exclusive of the USSR.)

GEOG 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 (debate) on development, government and conflict in Africa.

GEOG 3783
(I,S)Geography of the Middle East and Southwest Asia
A regional analysis of the Arab, Persian and Turkic lands, including the biophysical environment, agriculture, resource use, cultural patterns, urbanization, economic development, hydropolitics and conflict.

GEOG 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.

GEOG 3910
Applied Geographical Topics
1-3 credits, max 6. Specialized physical, human, regional, or technical issues and trends in geography.

GEOG 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.

GEOG 4053
(N)Geography of Biotic Resources
Distribution of plants and animals and processes causing distribution. Human impact on biotic resources considered along with policy and management practices.

GEOG 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.

GEOG 4113*
Cultural and Political Ecology
Focus on the relationship between culture and environment, people and place and how environments are politicized. Competing theories of human-environment interactions throughout history. The first half of the course focuses on theories of human agency, diffusion, migration, adaptation, decision-making and agricultural change. The second part of the course focuses on cultural landscapes, perception, and politicized environments to explain current environmental issues.

GEOG 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.

GEOG 4163
Resource Management in the National Parks
Contemporary resource management issues in US 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.*

GEOG 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 US and international scene.

GEOG 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.

GEOG 4233
Human Dimensions of Global Environmental Change
Discusses the current global environmental science research agendas called for by the international community, explores the arguments set forth regarding global environmental change, and looks at the current explanations and theories explaining the human dimensions of land-use/cover-change (lucc). Special emphasis is on alternative, competing visions, and needs of developing countries within the context of economic development and global environmental change. *Meets with 5233. No credit for students with credit in 5233.*

GEOG 4253
(H,D)Geographic Perspectives on
American Women's Travel Accounts Then and Now
Examination of American women's travel writing both past and contemporary to understand social practices involving both geography and gender associated with travel and tourism. Topics include: geographic imaginaries, identities, social norms and transgressions, constructing the "Other" and the tourist "gaze," ideas of "home" and "away,"and mobilities of women, situating these ideas with place and "race."

GEOG 4303*
Applications of the Global Positioning System in Field Research
Prerequisite(s): 2343. Theory and applications of the Global Positioning System (GPS), focusing on accuracy issues in field data collection and integration with geographic information systems (GIS). Use of both recreation and mapping grade receivers.

GEOG 4313*
Field Techniques and Geodata Collection
Modern concepts and techniques for geographical analysis and research, including data acquisition and manipulation from field and secondary sources. Field trips.

GEOG 4323*
Computer Cartography
Lab 2. Prerequisite(s): 2343 or consent of instructor. Fundamentals of map compilation and design using computers. Thematic mapping of both socioeconomic and natural resource information. Discussion and application of various map input techniques involving digitizers, scanners, and global positioning system receivers. 2-D and 3-D terrain representation.

GEOG 4333
Remote Sensing
Lab 2. Prerequisite: 2323. Intermediate course in remote sensing focusing on image processing techniques and their applications. Includes enhancements, vegetation indices, transformations, and classifications. Discussions will include applications to resource management, advanced image classifications and accuracy assessments. Hands-on exposure to various image processing techniques using current image processing software. *Meets with 5333. No credit for students with credit in 5333.*

GEOG 4343
Geographic Information Systems: Resource Management Application
Lab 2. Prerequisite(s): 2343. Provides a theoretical and practical understanding of geographic information systems and its applications in natural resource management. Introduces industry popular GIS software for spatial and aspatial data analysis. Explores specific conditions, requirements, and processing considerations that allow geospatial data to be manipulated for problem solving. *Meets with 5323. No credit for students with credit in 5323.*

GEOG 4353*
Geographic Information Systems: Socioeconomic Applications
Lab 2. Prerequisite(s): 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.

GEOG 4373*
Spatial Analysis of Public Health
Prerequisite(s): 2343. Qualitative and quantitative analysis of public health issues from two geographic perspectives: human environment and spatial. Topics include medical geography, disease mapping, spatial data for public health, and basics and applications of spatial statistics, geographic information system and remote sensing. Lectures are combined with case studies and lab illustrations throughout the course.

GEOG 4510
Senior Project
1-3 credits, max 3, Lab 1-3. Prerequisite(s): Senior standing and consent of instructor. Individually designed projects involving laboratory work, field work, library research or a combination of these.

GEOG 4910
Topics in Geography
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Specialized physical, social and methodological topics in geography.

GEOG 4930
Readings in Geography
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Directed readings on selected topics, regions or methods in geography.

GEOG 4940
Undergraduate Cooperative Education Internship
1-3 credits, max 3. Prerequisite(s): Consent of departmental internship coordinator and undergraduate committee. Practical experience in applying geographical concepts and tools to business or governmental problems. Emphasis on educational aspects of applying discipline-related tools to real-world problems. *Credit not available for regular employment positions; must have fixed start/end dates.*

GEOG 4993
Senior Honors Thesis
Prerequisite(s): 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.

GEOG 5000*
Thesis
1-6 credits, max 6. Prerequisite(s): Consent of adviser or major professor. Open only to students working on the master's degree in geography.

GEOG 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.

GEOG 5113*
Landscape Ecology
Prerequisite(s): 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.

GEOG 5123*
International Resource Management
Prerequisite(s): Graduate standing. Spatial perspectives on the assessment and management of natural resources. The role of resources in world trade, security and international environmental concerns.

GEOG 5140*
Cultural and Historical Geography Seminar
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Development and critical analysis of research and theory in cultural and historical geography.

GEOG 5163*
Resource Management in the National Parks
Contemporary resource management issues in US 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.*

GEOG 5183*
Topics in Transportation Geography
Examination of a selected set of advanced topics in transportation geography, including network analysis, facility location problems, intelligent transportation systems and geographic information systems and logistics.

GEOG 5203*
Writing Across the Discipline: Geographic Theses and Dissertations
Prerequisite(s): Permission of instructor. Addresses writing issues specific to the social sciences, including identifying an audience, finding a voice, engaging with a theoretical framework, organizing data, understanding differences in presenting quantitative and qualitative evidence and effectively communicating both, pacing in an argument, crafting creative introductions and persuasive conclusions, and compiling an effective bibliography.

GEOG 5233*
Human Dimensions of Global Environmental Change
Discusses the current global environmental science research agendas called for by the international community, explores the arguments set forth regarding global environmental change, and looks at the current explanations and theories explaining the human dimensions of land-use/cover-change (lucc). Special emphasis is on alternative, competing visions, and needs of developing countries within the context of economic development and global environmental change. *Meets with 4233. No credit for students with credit in 4233.*

GEOG 5243*
Geography of the World's Indigenous Peoples
Prerequisite(s): Graduate standing and consent of instructor. A regional survey of indigenous assertions of cultural, political and economic self-determination 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.

GEOG 5303*
Geographical Analysis I
Prerequisite(s): One course in statistics. Application of models and statistics to geographic problem solving.

GEOG 5323*
Geographic Information Systems: Resource Management Application
Lab 2. Prerequisite(s): 2343. Provides a theoretical and practical understanding of geographic information systems and its applications in natural resource management. Introduces industry popular GIS software for spatial and aspatial data analysis. Explores specific conditions, requirements, and processing considerations that allow geospatial data to be manipulated for problem solving. *Meets with 4343. No credit for students with credit in 4343.*

GEOG 5333*
Remote Sensing
Lab 2. Prerequisite(s): Consent of instructor. Intermediate course in remote sensing focusing on image processing techniques and their applications. Includes enhancements, vegetation indices, transformations, and classifications. Discussions will include applications to resource management, advanced image classifications and accuracy assessments. Hands-on exposure to various image processing techniques using current image processing software. *Meets with 4333. No credit for students with credit in 4333.*

GEOG 5343*
Advanced Geographic Information
Systems: Resource Management Applications
Lab 2. Prerequisite(s): 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.

GEOG 5353*
Advanced Geographic Information
Systems: Socioeconomic Applications
Lab 2. Prerequisite(s): 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.

GEOG 5363*
Enterprise Geographic Information Systems
Prerequisite(s): 4353 or equivalent. Basic setup and creation of online geodatabases and Internet mapping services as would be used in a large scale GIS operation or enterprise. Geodatabase design and Internet mapservice website development.

GEOG 5393*
Remote Sensing of Water Resources
Prerequisite(s): 2323 or 4333. Advanced theories and techniques of remote sensing applied to various issues in water resources management. Sensor characteristics, theoretical algorithms, digital image processing, and field methods to extract information of multiple aspects valuable for both hydrological modeling and decision-making. Advantages and limitations of remote sensing compared to traditional methods will be explored.

GEOG 5403*
Current Geographic Research
Prerequisite(s): Graduate standing in geography. Review of recent literature in light of current human and physical geography research themes.

GEOG 5413*
History and Philosophy of Geography
Prerequisite(s): Graduate standing in geography. Identification and evaluation of major themes in geographical research and teaching.

GEOG 5450*
Seminar in Geography
1-6 credits, max 6. Prerequisite(s): Graduate standing in geography or consent of instructor. Specialized topics in geography.

GEOG 5510*
Research Problems in Geography
1-3 credits, max 6. Prerequisite(s): Consent of instructor.

GEOG 5940*
Graduate Cooperative Education Internship
1-3 credits, max 3. Prerequisite(s): Consent of departmental internship coordinator and graduate committee. Practical experience in applying geographical concepts and tools to business or governmental problems. Emphasis on educational aspects of applying discipline-related tools to real-world problems. Credit not available for regular employment positions; must have fixed start/end dates.

GEOG 6000*
Doctoral Dissertation Research
1-12 credits, max 30. Prerequisite(s): Admission to candidacy and consent of major professor.

GEOG 6013*
Seminar in Quaternary Paleoecology
Prerequisite(s): 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.

GEOG 6110*
Seminar in Cultural and Political Ecology
3 credits, max 6. Prerequisite(s): Graduate standing in geography or consent of instructor. Study of the relationship between culture and environment and competing theories of human-environment interactions. Traces the roots of cultural ecology starting with classic ecological systems and adaptation theory, to criticisms leading to the development of "political" and "hybrid" ecologies. Course focuses on Marxist influences, inequalities of third world development, gender and resource management, social and environmental movements, indigenous knowledge, natural disasters and environmental vulnerability.

GEOG 6120*
Seminar in Urban Geography
3 credits, max 6. Prerequisite(s): 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.

GEOG 6130*
Seminar in Political Geography
3 credits, max 6. Prerequisite(s): 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.

GEOG 6180*
Seminar in Transportation Geography
3 credits, max 6. Prerequisite(s): Graduate standing. Examination of transportation systems, emphasizing their effects on trade, land use, location issues, and development. Review of trends, problems, and methods related to transport issues.

GEOG 6210*
Seminar in Historical Geography
3 credits, max 6. Prerequisite(s): Graduate standing. Current epistemological issues and archival methodologies in historical geography.

GEOG 6303*
Geographic Analysis II
Prerequisite(s): 5303. Advanced methods of spatial analysis, including spatial autocorrelation, geographically weighted regression and related spatial analysis methods.

GEOG 6313*
Advanced Geodata Collection
Prerequisite(s): 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.

GEOG 6333*
Advanced Techniques in Image Analysis/GIS
Prerequisite(s): 4333 or 5333. Advanced techniques and applications of image processing and geographic information systems (GIS). Special topics include image registration, georeferencing, advanced image enhancements, advanced classifications, and accuracy assessments. Specific issues and problems pertaining to data capture, preprocessing and analysis of semester-long projects will be discussed.

GEOG 6910*
Topics in Geography
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Specialized physical, social and methodological topics in geography.

GEOG 6930*
Readings in Geography
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Directed readings on selected topics, regions or methods in geography.

Geology (GEOL)

GEOL 1014
(L,N)Geology and Human Affairs
Lab 2. The influence of geology and related earth sciences on the human environment. Energy and material resources, beneficial and hazardous natural processes, and the planetary and biological evolution of earth. Lab investigations environmentally oriented.

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 pre-college science and math is recommended. Field trip required.*

GEOL 1224
Evolution of the Earth
Lab 2. Prerequisite(s): 1014 or 1114 or BIOL 1114. A survey of the physical and biological history of the Earth from the coalescence of the solar system to the present. *Field trips required.*

GEOL 1613
Inquiry-based Earth Science
Lab 3. Prerequisite(s): CHEM 1413 and PHYS 1313 recommended. Natural earth systems and their influence on the human environment. Essential aspects of astronomy, meteorology, hydrology and geology. Taught using inquiry methods. Intended for prospective elementary teachers as a model that can be adapted for use in the classroom. *Field trip required.*

GEOL 2254
Practical Mineralogy
Lab 2. Prerequisite(s): 1014 or 1114 and CHEM 1314. 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.*

GEOL 2364
Elementary Petrology
Lab 3. Prerequisite(s): 2254. Origin, occurrence and classification of rocks; hand-specimen identification. *Field trips required.*

GEOL 3004
Earth Science for Teachers
Lab 3. Prerequisite(s): 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.*

GEOL 3014
Structural Geology
Lab 3. Prerequisite(s): 1224, PHYS 2014 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.*

GEOL 3034*
Principles of Stratigraphy and Sedimentology
Lab 3. Prerequisite(s): 1224. Principles of stratigraphy and their applications. Laboratory emphasizes realistic practical problems undertaken in the field and in the laboratory. *Field trips required. Non-majors may receive graduate credit.*

GEOL 3043
(N)Scenic Geologic Regions
Prerequisite(s): 1014 or equivalent recommended. The geologic characteristics of national parks and scenic regions in North America and throughout the world.

GEOL 3073*
Geomorphology
Lab 2. Prerequisite(s): 1114 and MATH 2144 or concurrent enrollment. 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.*

GEOL 3103
Paleontology
Lab 3. Prerequisite(s): 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.*

GEOL 3503
Environmental Geology
Prerequisite(s): 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.*

GEOL 3546*
Field Geology
Lab 12. Prerequisite(s): 2364, 3014, 3034, 3073. Six weeks of field methods in geology. *Required of all geology majors. Transportation and room and board fees required.*

GEOL 4023*
Petroleum Geology
Prerequisite(s): 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.*

GEOL 4030
Geologic Field Investigation
1-3 credits, max 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. No credit for students who have credit in 5030.*

GEOL 4103*
Geophysical Methods
Lab 2. Prerequisite(s): PHYS 2014 and 2114; upper-division standing; MATH 2103 recommended. An overview of geophysical methods and their applications to exploration, environmental and engineering problems. Seismic reflection and refraction methods, gravity, magnetic, resistivity and electromagnetic methods. *A field trip required.*

GEOL 4203*
Seismic Interpretation
Examination of the reflection seismic interpretation methods with emphasis on the oil and gas industry. Both structural and stratigraphic methods. Hands-on interpretation using a standard industry software package.

GEOL 4213*
Plate Tectonics
Prerequisite(s): 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 Cordillerans. *Field trip required.*

GEOL 4300
Geology Colloquium
1 credit, max 2. Prerequisite(s): 15 credit hours in geology and junior status. Discussion of selected topics in the geological sciences with emphasis on professional presentation practices.

GEOL 4403*
Geochemistry
Lab 2. Prerequisite(s): 1014 or 1114 or consent of instructor; CHEM 1314; CHEM 1515 or concurrent enrollment; MATH 1513 or above. Application of chemical principles to geological processes. Processes affecting the composition of surface and ground waters.

GEOL 4453
Hydrogeology
Prerequisite(s): PHYS 2114. The water cycle and ground-water systems as well as general problems related to ground-water occurrence, quantity, quality and pollution. *Field trip required.*

GEOL 4463*
Physical Hydrogeology
Lab 2. Prerequisite(s): 4453 or similar; PHYS 2114. Physical ground-water 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.*

GEOL 4513
Marine Geology
Prerequisite(s): CHEM 1314 or equivalent; PHYS 1114 or 2014 or equivalent; GEOL 3034 or equivalent. Comprehensive examination of the geology of the oceans. Topics include techniques of data collection and interpretation, physical oceanography, origin of marine sediments, marine tectonics and ocean history. *No credit for students who have previously taken 5513.*

GEOL 4663*
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.

GEOL 4990*
Special Problems in Earth Science
1-8 credits, max 8. Prerequisite(s): 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.*

GEOL 4993
Senior Honors Thesis
Prerequisite(s): 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.

GEOL 5000*
Thesis
1-6 credits, max 6. Prerequisite(s): Approval of graduate committee. Work toward master's thesis in geology.

GEOL 5030*
Geologic Field Investigation
1-3 credits, max 3. One to three weeks of required field study at sites of geological interest and significance. Emphasis will be placed on applicability to graduate research. *Field trip charges apply. No credit for students who have credit in 4030.*

GEOL 5050*
Problems in Economic Geology
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Individually-designed problems in economic geology. *Field trips may be required.*

GEOL 5073*
Fluvial Geomorphology
Prerequisite(s): 3073 or consent of instructor. Landforms and processes related to the action of running water in stream channels and on hillslopes. *Field trips required.*

GEOL 5083*
Geology of Antarctica
Prerequisite(s): 3034 and 3073 or 4513 or equivalents; permission of instructor. Survey of the geology of Antarctica with an emphasis on its glacial history. Focus is on the marine record but will also review some of the terrestrial records of glacial history. The course will include a research cruise to Antarctica.

GEOL 5100*
Problems in Hydrogeology
1-4 credits, max 8. Prerequisite(s): 4453. Advanced problems in hydrogeology with emphasis on quantitative methods. *Field trips may be required.*

GEOL 5183*
Advanced Paleontology
Lab 3. Prerequisite(s): 3103 or equivalent. In depth study of selected fossil groups with emphasis on marine micropaleontology. Student projects on assigned fossil groups with presentation of results both orally and in writing. *Field trips required.*

GEOL 5203*
Structural Styles in Oil and Gas Exploration
Lab 2. Prerequisite(s): 3014. The theoretical, experimental and descriptive approach to structural styles formed by different tectonic stresses (i.e., extensional, contractional, strike-slip and salt tectonics) and their importance in oil and gas exploration. *Field trips required.*

GEOL 5223*
Advanced Methods in Structural Geology
Lab 3. Prerequisite(s): 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.*

GEOL 5233*
Trace Elements in Hydrogeology
Lab 2. Prerequisite(s): 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, pe-pH stability fields, adsorption and other parameters that affect element mobility. Introduction to thermodynamic water-equilibrium computer programs.

GEOL 5243*
Research Methods and Techniques in Sedimentology and Stratigraphy
Methods and techniques for solving practical scientific problems in sedimentary rocks and stratigraphy. Scientific method, definition of a research problem, sampling. Techniques for characterizing sedimentary rocks focused on rock mineralogy/texture, porosity/permeability and associations/stacking patterns of stratigraphic sequences.

GEOL 5253*
Petrology and Diagenesis of Clastic Rocks
Lab 3. Prerequisite(s): 2364, 3034. Examination of petrology and depositional facies of sandstones and shales. Identification of detrital and diagenetic constituents and determination of paragenetic sequence of diagenetic events. The effect of burial and thermal history on reservoir quality. *Field trips required.*

GEOL 5263*
Electron Microprobe Analysis
Lab 2. Prerequisite(s): CHEM 1515, PHYS 2414, or GEOL 2254. Practical course for operators of the electron microprobe. Basic principles of X-ray microanalysis and hands-on training using the electron microprobe.

GEOL 5273*
Depositional Systems
Prerequisite(s): 3034, 3546. Examination of the processes within depositional environments and the facies they form. Focus on the environmental interpretation of rocks, cores and seismic profiles based on their composition, texture, character, stacking pattern and sedimentary structures. Emphasis on clastic systems. *Field trips required.*

GEOL 5283*
Subsurface Geologic Methods
Lab 2. Prerequisite(s): 3014, 3034. Use of subsurface geologic information from cores and well logs to prepare maps and identify oil and gas prospects. *Field trips required.*

GEOL 5303*
Applied Geophysics
Lab 3. Prerequisite(s): PHYS 1214. Principles of exploration geophysics with emphasis on the petroleum and mineral industries. *Field trips required.*

GEOL 5353*
Advanced Well Log Analysis
Lab 3. Prerequisite(s): 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.*

GEOL 5363*
Carbonate Sedimentology and Petrology
Lab 2. Prerequisite(s): 2364 and 4403. Systematic study of carbonate and associated sedimentary rocks including depositional environments, stratigraphic occurrence, and diagenesis. Application of petrographic, geochemical and field methods. *Field trips required.*

GEOL 5383*
Sequence Stratigraphy
Lab 2. Prerequisite(s): 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.*

GEOL 5443*
Environmental Geophysics
Lab 2. Geological 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 refraction methods. *Field trip required.*

GEOL 5453*
Advanced Hydrogeology
Lab 3. Prerequisite(s): 4453, CS 2113 or equivalent, MATH 2144, MATH 2153 and 2163 or equivalent. Advanced quantitative techniques used to address ground-water 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.*

GEOL 5503*
Advanced Environmental Geology
Prerequisite(s): 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.*

GEOL 5513*
Marine Geology
Prerequisite(s): CHEM 1314 or equivalent; PHYS 1114 or 2014 or equivalent; GEOL 3034 or equivalent. Comprehensive examination of the geology of the oceans. Topics include techniques of data collection and interpretation, physical oceanography, origin of marine sediments, marine tectonics and ocean history. *No credit for students with credit in 4513.*

GEOL 5523*
Environmental Organic Geochemistry
Prerequisite(s): CHEM 1314 and 1515 or equivalent; GEOL 3034 or equivalent; GEOL 4403 or equivalent or permission of instructor. Introduction to some environmental aspects of organic geochemistry. Soils and sediments as pollutant receptors, sources of pollutants and selected aspects of environmental health.

GEOL 5533*
Organic Geochemistry
Prerequisite(s): CHEM 1314 and 1515 or equivalent; GEOL 3034 or equivalent. Chemistry of organic matter in sediments and rocks with an emphasis on marine and petroleum systems.

GEOL 5553*
Environmental Geochemistry
Lab 3. Prerequisite(s): Introductory chemistry. Origin and evolution of natural water quality. Distribution and mobility of elements in the secondary environment. Computational methods for the interpretation of water analyses.

GEOL 5603*
Basin Evolution
Prerequisite(s): 3014, 3034, 4403. Advanced topics in sedimentary basin studies, including tectonics, sequence stratigraphy, facies analysis, regional diagenesis, thermal evolution, regional hydrogeology, and distribution of natural resources.

GEOL 5710*
Advanced Studies in Geology
1-4 credits, max 8. Prerequisite(s): Consent of instructor. Individual library, laboratory and/or field projects on facets of geology not covered by existing courses. *Field trips may be required.*

GEOL 5773*
Planetary Geology
Lab 2. Prerequisite(s): GEOL 1114; upper-division standing in the natural sciences; ASTR 1014 recommended. Geophysics 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.*

German (GRMN)

GRMN 1115
Elementary German I
Lab 1.5. Main elements of grammar and pronunciation, with work on the four basic skills of listening comprehension, speaking, reading and writing.

GRMN 1225
Elementary German II
Lab 1.5. Prerequisite(s): 1115 or equivalent. Continuation of 1115.

GRMN 2112
(I)Intermediate Conversation and Composition I
Lab 1. Prerequisite(s): 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*.

GRMN 2113
(I)First Readings in German
Prerequisite(s): 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.*

GRMN 2222
(I)Intermediate Conversation and Composition II
Lab 1. Prerequisite(s): 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*.

GRMN 2223
(I)Introduction to German Literature
Prerequisite(s): 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.*

GRMN 3013
(I)German for Reading Requirements I
Reading in the humanities and the sciences. Translation from German to English.

GRMN 3023
(I)German for Reading Requirements II
Prerequisite(s): 3013 or equivalent. Intermediate and advanced reading in the humanities and sciences. Translation from German to English.

GRMN 3333
Modern Germany
Prerequisite(s): 20 credit hours of German or equivalent. The major cultural, social and political forces that have shaped the Germany of today.

GRMN 3343
Business German
Lab 1. Prerequisite(s): 2222 and 2223 or equivalent. Introduction to business practices and economic environment in Germany. Study of specialized vocabulary.

GRMN 3463
Advanced Diction and Phonetics
Lab 1. Prerequisite(s): 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.*

GRMN 3803
Advanced Conversation
Lab 1. Prerequisite(s): 2222 and 2223 or equivalent. Colloquial speech forms and sentence structure. Practice in brief public address in German.

GRMN 3813
Advanced Grammar and Composition
Prerequisite(s): 2222 and 2223 or equivalent. Practice in original composition in German. Problematic points of German grammar and stylistics.

GRMN 3902
Orientation to Internship Abroad
Lab 1. Prerequisite(s): 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.

GRMN 3903
Internship Abroad
Lab TBA. Prerequisite(s): 2222 and 2223 or equivalent. Practical studies in a German-speaking country. Supervised research papers and reports and oral testing during and following the practicum.

GRMN 4153
Survey of German Literature I
Prerequisite(s): 20 credit hours of German or equivalent. German literature from the beginning to 1785.

GRMN 4163
Survey of German Literature II
Prerequisite(s): 20 credit hours of German or equivalent. German literature from 1785 to the present.

GRMN 4333
Backgrounds of Modern German Civilization
Prerequisite(s): 20 credit hours of German or equivalent. Historical, cultural, political and literary trends in the formation of German civilization. Capstone course.

GRMN 4513
The Age of Goethe
Prerequisite(s): 20 credit hours of German or equivalent. Principal figures of German Classicism and Romanticism.

GRMN 4523
19th Century German Literature
Prerequisite(s): 20 hours or equivalent proficiency. Prose, lyric and drama from Romanticism to Naturalism.

GRMN 4543
20th Century German Literature
Prerequisite(s): 20 credit hours of German or equivalent. Main currents in German literature from Naturalism until present day.

GRMN 4550
Studies in German
1-3 credits, max 9. Prerequisite(s): 20 credit hours of German or equivalent competence. Reading and discussion of vital subjects in German.

Graduate (GRAD)

GRAD 5880*
Graduate Traveling Scholar
1-24 credits, max 24. Prerequisite(s): Graduate degree candidate. Credit will vary depending on the program of each traveling scholar. Enrollment of graduate traveling scholars in academic or research courses.

GRAD 5992*
Succeeding in the Professoriate
Prerequisite(s): Graduate standing and permission of Director of College Teaching Certificate program. Preparation for doctoral students who wish to pursue careers in academia. Focuses on university-level teaching and scholarship. Serves as foundation course for doctoral students in the University Faculty Preparation Certificate program.

GRAD 6010*
Research or Intern Practicum
1-9 credits, max 12. Prerequisite(s): Graduate standing. Graduate-level internship program for public administration, service or research. Blends the theoretical and absolute phase of the academic with practical on-the-job experience.

GRAD 6913*
College Teaching Apprenticeship
Lab 6. Prerequisite(s): 5992 and enrollment in College Teaching Certificate program; EPSY 5463 or 6613; EDLE 6713 or 6583. Other EPSY/EDLE courses may be approved by Coordinator of program. Faculty member mentors doctoral student in instructing a university-level course.

GRAD 6921*
College Teaching Practicum
Lab 2. Prerequisite(s): 6913. Student acts as instructor of record for an undergraduate course under the mentorship of a faculty member appropriate to the course taught.

Greek (GREK)

GREK 1113
Elementary Classical Greek I
Grammar and vocabulary of ancient Greek.

GREK 1223
Elementary Classical Greek II
Prerequisite(s): 1113 or equivalent. A continuation of 1113. Grammar and readings of classical Greek authors.

GREK 2113
Elementary Classical Greek III
Prerequisite(s): 1223 or equivalent. A continuation of 1223. Grammar and readings of classical Greek authors.

GREK 2213
Intermediate Readings
Prerequisite(s): 2113 or equivalent. An introduction to a variety of classical authors to increase reading facility and grammatical comprehension.

GREK 3330
Advanced Readings
1-6 credits, max 9. Prerequisite(s): 2213. Prose authors, epic poetry, drama, Koine Greek and religious texts.

Health and Human Performance (HHP)

HHP 1713
Introduction to Athletic Training
Lab 1. Prerequisite(s): Admission to the athletic training program. An introduction to the profession of athletic training. The principles of injury prevention and care relative to athletic injuries and development of essential skills and competencies needed to perform selected athletic training procedures. Theory-based course with required laboratory experiences.

HHP 1753
Introduction to Physical Education
The nature, scope and significance of physical education. Historical and philosophical foundations, major sub-disciplines and their interrelationships, and career opportunities.

HHP 1812
Pedagogy of Outdoor Activities
Prerequisite(s): 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.

HHP 1822
Pedagogy of Rhythm and Movement
Prerequisite(s): 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.

HHP 1832
Pedagogy of Sports Skills
Prerequisite(s): 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.

HHP 1842
Pedagogy of Fitness and Wellness
Prerequisite(s): 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.

HHP 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.

HHP 2222
Introduction to Health Aspects of Gerontology
An introductory course of the physical and physiological aspects of aging combined with common pathology and intervention.

HHP 2323
Drugs and Society
Impact of recreational use of drugs on society. Topics will include stimulant, depressant, and hallucinogenic recreational drugs, erogenic substances and current research regarding addiction. Particular focus will be given to current trends of substance use and abuse. *Cannot be substituted for HHP 3913.*

HHP 2451
Athletic Training Practicum
Lab 1. Prerequisite(s): Full admission into athletic training program. Directed observation in supervised introductory laboratory and clinical experiences in athletic training.

HHP 2461
Athletic Training Practicum II
Lab 1. Prerequisite(s): Successful completion of 2451, 2844. Directed observation in supervised introductory laboratory and clinical experiences in athletic training.

HHP 2553
Basic Athletic Injury Management
Prerequisite(s): 2654. Identification of emergency medical situations and application of basic care for injury occuring in school and athletic setting.

HHP 2602
First Aid
Lab 2. A competency- and performance-based first aid course.

HHP 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.

HHP 2654
Applied Anatomy
Lab 2. Prerequisite(s): BIOL 1114. 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. Lab sections will be structured around specific content area for students' discipline.

HHP 2664
Mechanism and Management of Musculoskeletal Pathology
Appropriate prevention of injury and administration of medical care. Didactic theory and practical experience regarding many aspects of health care. Preparation for future health-care professionals to identify and care for injury occurring during physical activity.

HHP 2712
Psychomotor Development
Prerequisite(s): HHP and LEIS majors and minors only. Fundamental aspects of motor development for infants, children, youth and adults.

HHP 2733
Procedures in Athletic Training
Lab 1. Prerequisite(s): 1713, 2654, 2663. Introduction to the psychomotor skills required in the profession of athletic training. Procedures relative to injuries and development of essential skills and competencies needed to perform selected athletic training procedures. Theory-based course with required lab experience.

HHP 2802
Medical Terminology for the Health Professions
Basic knowledge and understanding of medical language and terminology used in allied health and health professions.

HHP 2844
Assessment of Lower-extremity Injuries
Lab 1. Prerequisite(s): 2654, 2663, 2773. Advanced knowledge and skills related to the recognition, assessment and appropriate medical referral of injuries to the spine and lower extremities.

HHP 2854
Assessment of Upper-extremity Injuries
Lab 1. Prerequisite(s): 2654, 2663, 2733, 2844. Advanced knowledge and skills related to the recognition, assessment and appropriate medical referral of injuries to the spine and upper extremities.

HHP 2902
Therapeutic Modalities for Injury I
Lab 1. Prerequisite(s): 2654, 2663, CHEM 1314 and concurrent enrollment ZOOL 3204. Discussion and application of common thermal and mechanical interventions used in the treatment of acute and chronic injuries to the musculoskeletal systems.

HHP 3010
Health and Human Performance Workshop
1-3 credits, max 6. Concentrated study of selected areas of health and human performance, including problems in instruction and administration not usually addressed in the undergraduate curriculum.

HHP 3114
Physiology of Exercise
Lab 2. Prerequisite(s): 2654, MATH 1513, ZOOL 3204. 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.

HHP 3223
Motor Learning
An in-depth study of motor learning and motor performance. Special emphasis on skilled performance, motor learning theory, motor abilities and individual differences in motor learning.

HHP 3233
General Medical Concepts
Prerequisite(s): 2654, 2663, and ZOOL 3204, CHEM 1314, HHP 3673. Specific pathologies, medical conditions, and possible avenues for treatment of non-orthopedic conditions. Based in current medical research, theory and practical outcomes.

HHP 3431
Early Laboratory and Clinical Experiences in Physical Education
Lab 1. Prerequisite(s): 1753 and declaration of intention to pursue a program in Professional Education. The initial pre-professional clinical experience for schools, kindergarten through grade twelve, with primary duties including assisting in physical education classes. *Required for full admission to Professional Education. Graded on a pass-fail basis.*

HHP 3451
Athletic Training Practicum III
Lab 1. Prerequisite(s): Successful completion of 2461, 3904. Directed observation in supervised intermediate laboratory and clinical experiences in athletic training.

HHP 3461
Athletic Training Practicum IV
Lab 1. Prerequisite(s): Successful completion of 3451, 3924. Directed observation in supervised intermediate laboratory and clinical experiences in athletic training.

HHP 3613
Community Health
Prerequisite(s): 2.75 major GPA, 2.50 overall GPA, 2213, 2603 or consent of instructor. A survey of issues impacting the health of populations from a community health perspective.

HHP 3623
School Health Programs
Prerequisite(s): 2603. The identity and relationships of school health instruction, services and environments.

HHP 3643
Health Behavior Theory
Prerequisite(s): Full admission to HEP and junior standing or consent of instructor. Survey of biopsychosocial behavioral models to determine basis for health risk behaviors, with emphasis on determinants of health/risk behavior and exploring health behavior theories across age, sex, ethnicity, culture and socio-economic status.

HHP 3663
Biomechanics
Prerequisite(s): 2654. 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.

HHP 3673
Pathology and Pharmacology in Sports Medicine
Prerequisite(s): 2663, CHEM 1314, ZOOL 3204. Principles of cellular inflammation, immunopathology, tissue growth and circulation. Examination of physiological drug activity in the body, drug disposition and pharmacokinetics in sports medicine.

HHP 3723
Principles of Epidemiology
Prerequisite(s): Full admission to HEP and junior standing or consent of instructor. Survey of epidemiological principles as they relate to the planning of both community and consumer-focused health promotion and disease prevention programs.

HHP 3753
Methods in Teaching Elementary Physical Education
Prerequisite(s): 1753, 1812, 1822, 1832, 2712, and 3430. 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.

HHP 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.

HHP 3773
Methods in Teaching Secondary Physical Education
Prerequisite(s): 1753, 1812, 1822, 1832, 3430. Instructional styles, implementation of behavioral goals and objectives through unit and lesson preparation, teaching methods and classroom management.

HHP 3902
Therapeutic Modalities for Injury II
- Effective Spring '09 **- Lab 1.** Prerequisite(s): 2902. Discussion and application of common electronic and physiologic devices used in the treatment of acute and chronic injuries to the musculoskeletal systems.

HHP 3904
Therapeutic Modalities for Athletic Injuries
- Effective through Fall '08. **Lab 1.** Prerequisite(s): 2654, 2663, CHEM 1314, ZOOL 3204 or concurrent enrollment. Discussion and application of common electronic and physiologic devices used in the treatment of acute and chronic athletic injuries to the musculoskeletal systems.

HHP 3913
Alcohol and Drug Education
Prerequisite(s): Full admission to HEP and junior standing or consent of instructor. Examines social, psychological, pharmacological, and cultural aspects of drug use, misuse, and abuse. In addition, the mehods, materials, and theories of drug abuse prevention in the school and community will be explored.

HHP 3924
Rehabilitation of Athletic Injuries
Lab 1. Prerequisite(s): 2654, 2663, 3904. Scientific methods used in therapeutic exercise and rehabilitation of injuries. Investigation of mechanisms of injury, anatomical structures involved and methodological approach in designing rehabilitative programs.

HHP 4010
Directed Study
1-3 credits, max 6. Prerequisite(s): 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.

HHP 4233
Health and Human Sexuality
Prerequisite(s): Full admission to HEP and junior standing or consent of instructor. The study of human sexuality as it relates to the health and well-being of individuals in the community, college, school or worksite settings.

HHP 4243
Research Methods in Athletic Training
Prerequisite(s): STAT 2013. Interactive study of importance and process of conducting ethical research in athletic training and the healthcare professions. Emphasis placed on research design, ethics, collection of data, and the dissemination of results.

HHP 4451
Athletic Training Practicum V
Lab 1. Prerequisite(s): Successful completion of 3461. Directed observation in supervised advanced laboratory and clinical experiences in athletic training.

HHP 4461
Athletic Training Practicum VI
Lab 1. Prerequisite(s): Successful completion of 3233, 4451. Directed observation in supervised advanced laboratory and clinical experiences in athletic training.

HHP 4480
Internship in Health and Human Performance
1-12 credits, max 12. Prerequisite(s): 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.*

HHP 4530
International Athletic Training
1-3 credits, max 6. Explore and experience the techniques of prevention and care of athletic injuries in a culture outside of the United States. *Course must be taken in two different countries to count as second time credit.*

HHP 4533
Psychosocial Issues in Health Education/Promotion
Prerequisite(s): Full admission to HEP and senior standing or consent of instructor. Psychosocial issues as they relate to the practice of health education/promotion. Personal and professional applications of the course material will be emphasized.

HHP 4643
Methods in School and Community Health Education
Prerequisite(s): 3623; full admission to Professional Education. Conceptual approach to health education through a variety of teaching methodologies.

HHP 4723
Measurement and Evaluation in Health and Physical Education
Prerequisite(s): Full admission to professional education. Evaluation techniques commonly used by physical educators and health professionals to measure knowledge, attitudes, sport skill proficiency and physical fitness.

HHP 4733
Administration and Program Design in Physical Education and Athletics
Prerequisite(s): 3753, 3773 or concurrent enrollment; full admission to professional education. Design and management of physical education (K-12) and athletic programs.

HHP 4773
Principles of Exercise Testing and Prescription
Prerequisite(s): 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.

HHP 4783*
Health Issues in Gerontology
Prerequisite(s): 2603, or consent of instructor. An in-depth study of physiological aspects, special health concerns, chronic illnesses and services as applied to gerontology.

HHP 4793*
Adapted Physical Education
Prerequisite(s): 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.

HHP 4901
Rehabilitation Seminar
Prerequisite(s): 2844, 2854, 3673, 3904, 3924 and 4451. Capstone course using patient problems to develop clinical decision-making incorporating preceding course work in pathology assessment, therapeutic modalities, exercise and pharmacology.

HHP 4902
Pre-internship Seminar
Prerequisite(s): Full admission to HEP, last semester prior to 4990 or consent of instructor. Capstone course for the health promotion program. Preparation for the health internship experience.

HHP 4933
Administration and Organization of Athletic Training Programs
Prerequisite(s): 4451. The administration and organization of athletic training programs including planning and implementation, certification procedures, code of professional practice, safety standards and resource management.

HHP 4973
Program Design in HEP
Prerequisite(s): Full admission to HEP and senior standing or consent of instructor. A survey of program design principles, including theoretical foundations, planning, marketing, delivering and evaluating.

HHP 4983*
Current Issues in Athletic Training
Prerequisite(s): 3663, 4451 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.

HHP 4990*
Internship in Health Promotion
1-12 credits, max 12. Prerequisite(s): Last semester; senior standing with cumulative GPA of 2.50. Supervised field work experience in health promotion or health-related settings. *Graded on a pass-fail basis.*

HHP 5000*
Master's Thesis
1-6 credits, max 6. Independent research required of candidates for master's degree. Credit awarded upon completion of thesis.

HHP 5010*
Seminar
1-2 credits, max 4. Selected topics from the profession not covered in other courses. Presentation and critique of research proposals and results.

HHP 5020*
Health and Human Performance Workshop
1-3 credits, max 6. Workshop in selected areas of health and human performance.

HHP 5030*
Field Problems in Health and Human Performance
1-3 credits, max 6. Individual investigations of issues in the areas of health and human performance.

HHP 5053*
Research Design in Leisure, Health and Human Performance
Prerequisite(s): PSYC 5303 or STAT 5013. Research design with applicability toward leisure, health and human performance. Conceptual understanding of theory, tools and processes involved in designing research.

HHP 5073*
Psychological Aspects of Sport
Psychological foundations of sport emphasizing performance enhancement by athletes through psychological training techniques.

HHP 5113*
Psychological Aspects of Health
Examination of the interactions of biological, psychological, social, and spiritual factors as they impact human health and disease.

HHP 5233*
Sexuality and Health
The study of human sexuality as it relates to the health and well-being of individuals in the community, college, school, and worksite settings. Particular emphasis will be on examining, developing, or modifying new programming related to sexuality and health.

HHP 5523*
Current Readings in Health
Contemporary research, literature, projections and views as applied to total health and well-being.

HHP 5530*
International Athletic Training
1-3 credits, max 6. Explore and experience the techniques of prevention and care of athletic injuries in a culture outside of the United States. *Course must be taken in two different countries to count as second time credit.*

HHP 5593*
Human Electrocardiographic Interpretation
Prerequisite(s): 3114 or consent of instructor. Knowledge concerning the collection and interpretation of the electrocardiogram (EKG) and its relationship to heart anatomy, physiology and electrophysiology.

HHP 5613*
Cardiac Rehabilitation
Prerequisite(s): 2653 and 3114 or equivalent. Factors involved in cardiovascular disease. History, implementation and administration of cardiac rehabilitation programs.

HHP 5663*
Philosophical Foundations of Health Education and Promotion
Exploration of key concepts, philosophies, ethical principles, historical events, theories/models, and responsibilities and competencies of health education and promotion of professionals.

HHP 5683*
Theoretical Applications in Health Education and Promotion
- Effective Spring '09 - Prerequisite(s): 5663. Theories and concepts related to health science and exploration of the application of theories to health education practice and research.

HHP 5733*
Motor Learning
Research in psychology and physical education relevant to the understanding of the nature and basis of motor skill learning.

HHP 5823*
Advanced Applied Anatomy
Prerequisite(s): 2653. Structure and movement of the human body with emphasis on the relationship of physical activity to musculoskeletal and neurological factors.

HHP 5853*
Stress Testing and Exercise Prescription I
Prerequisite(s): 3114, 5593. Theory and practice in resting and exercise EKG, stress test protocols and exercise prescription.

HHP 5863*
Stress Testing and Exercise Prescription II
Prerequisite(s): 5853. Theoretical aspects of evaluating functional capacity through stress testing with the development of exercise prescription for special populations with physiological limitations imposed by age, disease, heredity and environment.

HHP 5873*
Human Bioenergetics
Prerequisite(s): 3114. Human energy production, utilization and storage in response to exercise.

HHP 5894*
Biochemistry of Exercise Lab Methods
Lab 2. Prerequisite(s): Consent of the instructor. Practice using basic laboratory skills which can be applied to sophisticated techniques in biochemical analysis. General biochemistry as it relates to exercise metabolism, laboratory procedures, calculations, common lab problems and solutions and laboratory safety procedures.

HHP 5973*
Program Design in Health Education and Promotion
A survey of program design principles, including assessing, theoretical foundations, planning and marketing.

HHP 5983*
Health Promotion Program Implementation and Evaluation
Prerequisite(s): 5973. An intensive overview of principles of health promotion program implementation and evaluation with special emphasis on application.

HHP 6000*
Doctoral Dissertation
1-25 credits, max 25. Required of all candidates for the Doctor of Philosophy degree. Credit is given upon completion of the dissertation.

HHP 6010*
Independent Study in Health and Human Performance
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Supervised readings, research or independent study of trends and issues related to the areas of health and human performance.

HHP 6013*
Professional Issues in Health and Human Performance
Introduction of doctoral students to the major areas of higher education relevant to professional preparation in health and human performance curricula. Issues of higher education, roles of the educator, curriculum development, implementation and management, instructional strategies and accreditation.

HHP 6020*
Research Colloquium
1-3 credits, max 3. Exploration and presentation of selected topics and research in health and human performance.

HHP 6023*
Special Topics in Health and Human Performance
Prerequisite(s): Admission to the Graduate College. Special topics related to health and human performance. Investigation, discussion and analysis of contemporary topics.

HHP 6053*
Advanced Research in Health and Human Performance
Prerequisite(s): 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.

HHP 6063*
Statistical Computing and Proposal Writing
Prerequisite(s): Consent of instructor. Instruction in the use of SPSS using a personal computer. Preparation of research proposals.

HHP 6723*
Curriculum Development in Health, Leisure and Human Performance
Prerequisite(s): 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)

HIST 1010
Studies in American History
1-2 credits, max 2. Special study in American history to allow transfer students to fulfill general education requirements as established by Regents' policy.

HIST 1020
Freshman Historical Research Methods
1-3 credits, max 3. Prerequisite(s): Requires consent of instructor. For lower-division students interested in learning research methods in history while working on a research project with an individual faculty member. *Preference given to students in A&S Freshman Research Seminar.*

HIST 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.*

HIST 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.*

HIST 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.*

HIST 1613
(H)Western Civilization to 1500
History of western civilization from ancient world to Reformation.

HIST 1623
(H)Western Civilization After 1500
History of western civilization from Reformation to present.

HIST 1713
(H)Survey of Eastern Civilization
History of three eastern civilizations (East Asia, South Asia and West Asia) from pre-history to the 18th century. Special attention to their origins, development, and contributions to the evolution of world civilization.

HIST 2323
Oklahoma History
Early exploration and establishment of Indian Territory; the rise and demise of the Five Indian Nations; and the organization and development of the 41st state to the present. *Required of all candidates for teacher's licensure/certification in social studies.*

HIST 2333
(H)American Thought and Culture: Survey
Survey of American religious, philosophical, artistic, and scientific ideas and their impact on culture and values.

HIST 2343
(H)Religion in America
Survey of the history of religion in America and its impact on social reform, politics, and intellectual life.

HIST 3013
(H)Ancient Egypt and Israel
The Ancient Near East with a focus on Egyptian and Israelite history, from the earliest times to the 5th century B.C.

HIST 3023
(H)Ancient Greece
The Greek world from the Bronze Age through Alexander the Great with special emphasis on politics, culture and institutions of Classical Greece.

HIST 3033
(H)Ancient Rome
Political, social, economic and cultural history of the Roman Republic and Empire.

HIST 3043
(H)Ancient Mesopotamia: Iraq, Iran & Syria from 4000-333 B.C.
From the birth of civilization to the end of the Persian Empire, this course examines the history, archaeology and cultures of the fertile crescent.

HIST 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 GEOG 3053, POLS 3053 & RUSS 3053)

HIST 3113
(H,I)Germany Since 1815
Creation of a centralized state in Germany; impact of World War I and the subsequent failure of the Weimar Republic; rise of national socialism, totalitarianism, and the Third Reich; German experience in WWII, repression of minorities, and the Holocaust; post-war Germany and modern reunification.

HIST 3133
(H)African Diaspora History
Introduction to the origin, development, and maturation of the African Diaspora in the Americas and the Caribbean, from the transatlantic slave trade to the mid-20th century. Emphasis is placed on a critical reading and discussion of a selection of essays, historiographies and primary materials on diasporic and transnational experiences and identities of Africans, African descendents, and Caribbean transmigrants.

HIST 3153
(H)Russia to 1861
Political, institutional, societal and economic development of Russia from the Kievan period to the Great Reforms.

HIST 3163
(H,I)Russia Since 1861
Modernizations of Russia in the 19th and 20th centuries. Great reforms and their effects and the 1917 revolutions and their consequences.

HIST 3203
(H)Early Medieval Europe, 325-1000
Early Middle Ages in Europe with emphasis on political, economical, religious, and social developments. Considerations of Europe's interactions with Byzantium and Islam.

HIST 3233
(H)Later Medieval Europe, 1000-1450
High and Late Middle Ages in the Europe with emphasis on political, economic, religious, and social developments. Considerations of Europe's interactions with Byzantium and Islam.

HIST 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.

HIST 3253
Absolutism and Enlightenment, 1648-1789
Political, economic, social, intellectual and religious transformation of Europe between the Peace of Westphalia and the French Revolution.

HIST 3263
(H)Modern Europe, 1815-1914
Impact of modernization on the character of European society. Factors that transformed the Continent into a battle ground in the 20th century.

HIST 3273
(H,I)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.

HIST 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."

HIST 3333
(H,I)History of the Second World War
Problems leading to World War II with their international implications and consideration of the war years.

HIST 3343
(H,I)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.

HIST 3363
(H)Popular Religion in the West, 1300-1700
The study of the religious experience of both lay people and clergy between 1300 and 1700, when their religious worldview underwent fundamental challenges and changes. The effort to understand the relationship between the secular world and the supernatural will be explored through devotional ideas, practices and religious rituals.

HIST 3373
(H)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.

HIST 3383
(H)Tudor-Stuart England
History of England from the War of the Roses through the coming of the House of Hanover in 1714. Development of the centralized state, parliamentary reaction, reorientation of the English society and economy and the English Reformation.

HIST 3403
(H)East Asia to 1800
Traditional Chinese civilization and its impact on Japan, Korea and Southeast Asia.

HIST 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.

HIST 3423
(H,I)Modern Japan
Modernization process in Japan since 1868.

HIST 3433
(H,I)Modern China
Response of China to the West since 1840, with stress on economic, social and intellectual currents.

HIST 3443
(H)Gender Relations in Chinese History
Men's and women's social, cultural, religious, political, economic, family, and sexual experiences in Chinese history; particularly women's own voices and efforts in pursuing their own goals and aspirations.

HIST 3453
(H)Colonial Latin America
Impact on the Indian cultures of Spanish and Portuguese conquerors, priests, administrators and entrepreneurs in the creation of a new society. Class structure, 18th century reforms, and independence movements.

HIST 3463
(H,I)Modern Latin America
Latin America republics emphasizing the dictators and the liberal reform movements of the 19th century. US involvement and the recent social revolutions of the 20th century.

HIST 3483
(H)Reformation Europe, 1517-1648
Development and impact of religious reform movements, overseas expansion, statebuilding, the Scientific Revolution, and the Thirty Years' War on European civilization.

HIST 3493
(H,I)Scandinavia since 1500
Exploration of Scandinavia from 1500 to the present. Focus on key historical and contemporary questions such as the spread of Lutheran reform, Sweden and Denmark as major European powers, the growth of nationalism and Scandinavian identity, industrialization, the welfare state, and multiculturalism.

HIST 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.

HIST 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.

HIST 3543
(H,I)Israel & Palestine in Modern Times
History of 19th and 20th century Palestine, Zionism and the founding of modern Israel. The Palestine-Israeli conflict in local and regional perspectives.

HIST 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.

HIST 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.

HIST 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.

HIST 3633
(H)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.

HIST 3643
(H)The Jacksonian Era, 1828-1850
Development of a modern political system and an entrepreneurial economy; social reform; territorial expansion; and sectionalism.

HIST 3653
(S)Civil War and Reconstruction, 1850-1877
Causes, decisive events, personalities and consequences of the disruption and reunion of the United States.

HIST 3663
(H)Robber Barons and Reformers: US 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.

HIST 3673
(D,H)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.

HIST 3683
(D,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.

HIST 3693
(H)The Modern West
Social, political, economic changes that define the twentieth-century American West.

HIST 3753
(H)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.

HIST 3763
(D,H)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 Apache, Comanche and other southwestern tribes, and the emergence of the modern Southwest.

HIST 3773
(S)Old South
Social, political and industrial conditions in the South before the Civil War.

HIST 3793
(H)Indians in America
American Indian from Columbus to the present, emphasizing tribal reaction to European and United States cultural contract and government policy.

HIST 3913
(H)History of Medicine
Historical growth of medicine and its relationship to the society in which it develops. Scientific problems, cultural, religious and medicine.

HIST 3963
(H)Ideas and Ideologies in Modern Europe
Prerequisite(s): 1623. Intellectual and ideological developments in modern Europe, including political, social, and cultural foundations and impact on modern Europe.

HIST 3980
Studies in History
1-3 credits, max 9. Presented for general audiences. *Not intended for history majors.*

HIST 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. *No credit for students with credit in 5063.*

HIST 4153
(D,H)African American History, 1619-1865
Overview of the history of African Americans from the onset of slavery and the slave trade to the Civil War. Topics include: African background; interaction between Africans, Indians and Europeans; development of slavery; forms of resistance; rise of the abolitionist movement; and conditions of free blacks.

HIST 4163
(D,H)African American History, 1865-1954
Major issues and actions from the beginning of the Civil War to the 1954 Supreme Court decision. Focus on political and social history: transition from slavery to emancipation and Reconstruction; the Age of Booker T. Washington; urban migrations, rise of the ghettoes; the ideologies and movements from integration to black nationalism.

HIST 4173
(D,H)Black Intellectual History
Examines the nature of black social and political thought from the early 18th to the mid-20th century and the contributions made by black intellectuals to discussions of race, citizenship and nationality. Emphasis is placed on topics of abolitionism, labor movements, populism, socialism, pan-Africanism, feminism, and the civil rights movement.

HIST 4253
(H)American Foreign Relations to 1917
American experience in foreign relations from colonial times to World War I.

HIST 4273
(H)American Foreign Relations Since 1917
America's emergence as the decisive factor in the world balance of power.

HIST 4353
(H)American Military History
Civil-military relations, the military implications of American foreign policy, and the impact of technological advances on warfare since colonial times.

HIST 4463
(H)American Cultural History to 1865
American society in nonpolitical aspects: sections, classes, national culture and social structure, immigration, education, religion, reform, world influences; ends with Civil War.

HIST 4483
(H)American Cultural History since 1865
Continuation of 4463; may be taken independently. Emphasis on nonpolitical aspects of American society and thought and on world influences.

HIST 4503
(H)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.

HIST 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)***

HIST 4523
(H)American Environmental History
Examination of the changing ways society (from Native American to post-industrial) has defined, interpreted, valued, and used nature.

HIST 4543
(H,I)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.

HIST 4553
(D,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.

HIST 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.

HIST 4573
Women in Western Civilization
Women in the development of Western Civilization from the earliest times to the present.

HIST 4903
Senior Seminar
Prerequisite(s): 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.

HIST 4980*
Topics in History
1-3 credits, max 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.

HIST 4990
Undergraduate Internship
1-6 credits, max 6. Prerequisite(s): Consent of instructor. History related internship experience designed to introduce majors to career possibilities.

HIST 4993
Senior Honors Thesis
Prerequisite(s): 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.

HIST 5000*
Thesis
1-6 credits, max 6.

HIST 5021*
Teaching History at the College Level
Survey of objectives and methods in the teaching of history at the college level.

HIST 5023*
Historical Methods
Methods of historical research and the writing of history.

HIST 5030*
Applied History Internship
3-6 credits, max 6. Prerequisite(s): Consent of graduate committee. Supervised practical experience in applied history.

HIST 5033*
Introduction to Public History
Prerequisite(s): Graduate student standing. Introduction to theory and practice of public history. Includes public history careers, public history as a field in the discipline, and the public perception and use of the past.

HIST 5053*
Museum Studies
Prerequisite(s): Graduate student standing. Introduction to museum theory and practice, especially as it pertains to history museums and sites.

HIST 5063*
Historic Preservation
Prerequisite(s): Graduate student standing. 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. *No credit for students with credit in 4063.*

HIST 5120*
Reading Seminar in American History
3 credits, max 15. Historiographical and bibliographical study of special areas of American history.

HIST 5140*
Reading Seminar in European and World History
3 credits, max 15. Historiographical and bibliographical study of special areas of European and World history.

HIST 5220*
Research Seminar in American History
3 credits, max 15. Research in selected problems in American history.

HIST 5240*
Research Seminar in European and World History
3 credits, max 15. Research in selected problems in European and World history.

HIST 6000*
Doctoral Dissertation
1-19 credits, max 30. Prerequisite(s): Admission to candidacy. Advanced research in history.

HIST 6023*
Historiography
Major writers of history, historical schools and patterns of developments in historical interpretation from the earliest times to present.

HIST 6100*
Directed Readings in History
1-3 credits, max 36. Prerequisite(s): Graduate student standing. Readings in selected topics in history to develop factual knowledge, analytical skills, and interpretive understanding.

HIST 6120*
Creative Component
1-3 credits, max 36. Research in designated topic in History resulting in the preparation of a major paper demonstrating historigraphical and bibliographical command of subject. *Required for students in Plan III of MA program.*

HIST 6130*
Graduate Studies in History
3 credits, max 39. Prerequisite(s): Graduate student standing. Graduate-level work under taken in association with upper-division lecture courses. Added component ordinarily entails a graduate-level research paper or historiographical essay of substantial length.

Honors College (HONR)

HONR 1000
Introductory Honors Topics
1-3 credits, max 6. Prerequisite(s): 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.

HONR 1013
(H)The Ancient World
Prerequisite(s): 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 and discussion format. For the Honors student. *No credit for students with prior credit in HONR 2113.*

HONR 1023
(H)The Middle Ages and Renaissance
Prerequisite(s): 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.*

HONR 1033
(H)The Early Modern World
Prerequisite(s): 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.*

HONR 1043
(H)The Twentieth Century
Prerequisite(s): 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.*

HONR 1093
(A)Patterns and Symmetry in Mathematics
Prerequisite(s): Honors Program participation. Tesselations, or repetitive patterns in the plane and in space, and the symmetries, or rigid motions, that preserve them. Illustrations from art, architecture, science, and nature. For the Honors student.

HONR 2013
(S)Honors Law and Legal Institutions
Prerequisite(s): Honors Program participation. An introduction to law in American society with reference to its European origins; its political, economic, psychological, and sociological dimensions; and the substantive law in selected areas. Introduction to legal reasoning and legal research techniques. For the Honors student.

HONR 2063
(H)Ethical Issues Across Cultural Perspectives
Prerequisite(s): Honors Program participation. An introduction to reasoned methods of evaluating ideas and arguments as they pertain to ethical issues from a global perspective. Concepts including obligation, justice, and ethnicity from Lao Tzu, Maimonides, Kant, and Indian wisdom stories. Environmentalism, technology, and cultural knowledge. Team-taught by faculty from appropriate disciplines in a lecture and discussion format. For the Honors student.

HONR 2514
(L,N)Honors Scientific Inquiry
Lab 2. Prerequisite(s): Honors Program participation. A team-taught interdisciplinary course dealing with philosophy of science and the application of the scientific method in the natural and social sciences. Selected topics that involve interdisciplinary scientific inquiry. For the Honors student.

HONR 3000
Advanced Honors Topics
1-3 credits, max 6. Prerequisite(s): Honors Program participation, junior standing. Topical study in various disciplines taught by faculty from the undergraduate colleges for junior and senior students in the University Honors Program.

HONR 3013
(H,I)Holocaust Studies Seminar
Prerequisite(s): Junior standing, Honors Program participation. An interdisciplinary study of one of the problematic events of human history—the Holocaust. Addresses questions of good and evil, divinity and humanity, and truth and responsibility that arise from this event. For the Honors student.

HONR 3023
(H,I)Contemporary Cultures of the Western World
Prerequisite(s): Honors College participation. Interdisciplinary examination of selected cultures of Europe and the western hemisphere. Emphasis will be on identification of main characteristics of "Western" culture and their manifestations in a variety of modern societies on both sides of the Atlantic Ocean. Key values, institutions, and practices will be examined to illustrate the twin themes of commonalities and cultural diversity. *The course is team taught by faculty from appropriate disciplines in a lecture and discussion format.*

HONR 3043
(D,S)Contemporary Cultures of the United States
Prerequiste(s): Honors Program participation. Interdisciplinary study of racial and ethnic diversity in the United States in context of social, political, and economic systems to promote knowledge of racial and ethnic minority groups in the United States and appreciation of their contributions to the mosaic of contemporary American life. Team-taught by faculty from appropriate disciplines in a lecture and discussion format.

HONR 3053
(H,D)Biology, Race, and Gender
Prerequisite(s): Honors College participation. Critical interdisciplinary investigation of relationships between biological theory (especially Darwinism) and social and ethical issues. Attention to views of alleged biological aspects of perceived racial and gender differences and attempts to implement these views socially, legally, and medically in the United States and elsewhere.

HONR 4993*
Honors Creative Component
Prerequisite(s): Honors Program participation, senior standing. A guided creative component for students completing the requirements for college or departmental honors awards leading to an honors thesis, project or report under the direction of a faculty member from one of the undergraduate colleges, with a second faculty reader and oral examination.

Horticulture (HORT)

HORT 1003
Home Horticulture
Offered by correspondence only. An introduction to horticultural practices for the home gardener. Planning and care of home grounds, home orchards and vegetable gardens; selection, use and care of indoor plants. *Non-majors only. Credit will not substitute for required courses.*

HORT 1013
(L,N)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.

HORT 2010
Internship in Horticulture
1-6 credits, max 6. Prerequisite(s): 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.*

HORT 2513
Herbaceous Plant Materials
Lab 2. Identification, cultural requirements, and use of ornamental garden and indoor herbaceous plants.

HORT 2613
Woody Plant Materials
Lab 2. Identification, cultural requirements, and use of ornamental woody plants including deciduous and evergreen trees, shrubs and vines.

HORT 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.

HORT 3013
Arboriculture
Lab 2. Prerequisite(s): 2613 or NREM 2134 and SOIL 2124. Theory and practice of selecting, planting and maintaining trees, shrubs and vines in the landscape.

HORT 3084
Plant Propagation
Lab 2. Prerequisite(s): 1013 or PLNT 1213, BIOL 1404 and SOIL 2124. Principles and practices involved in propagation of plants. Anatomical, morphological and physiological aspects of sexual and asexual methods of regeneration and their importance.

HORT 3113
Greenhouse Management
Lab 3. Prerequisite(s): 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.

HORT 3153
Turf Management
Prerequisite(s): 1013, SOIL 2124 and 2 hours plant science. Selection, establishment and maintenance of grass species and other plant materials for special use areas.

HORT 3213
Fruit and Nut Production
Prerequisite(s): 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.*

HORT 3253
Personnel and Financial Management for Horticulture
Prerequisite(s): 1013 or LA 1013 and one upper division HORT or LA course. Preparing and executing an operational budget in a horticultural service industry and methods for maintaining an effective work force.

HORT 3433*
Commercial Vegetable Production
Prerequisite(s): 1013, SOIL 2124 and BIOL 1404. Commercial production and marketing of vegetable crops.

HORT 3513
Landscape Irrigation
Lab 2. Prerequisite(s): 1013 or LA 1013. Basics of landscape irrigation with an emphasis on residential irrigation design, maintenance and installation.

HORT 3612
Bidding and Estimating
Prerequisite(s): 1013 or LA 1013 or NREM 1114 or PLNT 1213. Bid preparation and job cost estimation for landscape related projects including quantity take-offs, plant material and hardscape estimates, budgeting and pricing.

HORT 4313*
Commercial Flower Production and Marketing
Lab 3. Prerequisite(s): 3113. Commercial production of cut flower, pot plant and bedding plant crops. Application of plant physiological principles to crop culture, crop production costs and marketing.

HORT 4453*
Turfgrass Physiology and Ecology
Prerequisite(s): 3153, BOT 1404. A study of the relationship between turf physiology and modern turf management practices. Concepts of stand ecology with emphasis on species dominance in stressful environments.

HORT 4543*
Nursery Production
Lab 2. Prerequisite(s): 2613 and SOIL 2124. Commercial production of field- and container-grown woody ornamental crops.

HORT 4713*
Public Garden Management
Lab 4. Prerequisite(s): 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.*

HORT 4773
Applied Landscape Planning
Lab 3. Prerequisite(s): 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.*

HORT 4990*
Horticultural Problems
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Problems related to pomology, olericulture, nursery production, landscape design, or the culture, sales and arrangement of flowers.

HORT 5000*
Research and Thesis
1-6 credits, max 6. Research on thesis problems required of master's degree candidates.

HORT 5020*
Graduate Seminar
1-2 credits. Prerequisite(s): Graduate standing. Proposal and results seminars for graduate programs.

HORT 5110*
Advanced Horticultural Problems
1-12 credits, max 20. Selected research problems in horticulture, floriculture, landscape design; nursery production, olericulture and pomology.

HORT 5133*
Temperature Stress Physiology
Prerequisite(s): BIOC 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.

HORT 5233*
Experimental Horticulture
Methods of conducting research with horticultural crops, including organization and plans, field plot techniques and analysis of data.

HORT 5412*
Mineral Nutrition in Horticultural Crops
Prerequisite(s): BOT 3463, SOIL 4234. Fertilizer use and plant response in horticultural crops.

HORT 5422*
Flowering and Fruiting in Horticultural Crops
Prerequisite(s): BOT 3463. Environmental, chemical and cultural factors affecting the flowering and fruiting of horticultural crops.

HORT 5433*
Postharvest Physiology
Prerequisite(s): BOT 3463 and 3460. Physiological causes for post-harvest changes in horticultural crops (ripening and senescence) and the basis for certain postharvest treatments (precooling at harvest, controlled atmosphere storage, refrigeration, and packaging techniques). Commodity-specific postharvest phenomena.

HORT 5443*
Basic Laboratory Experimentation
Lab 3. Principles and theory of safe laboratory practice and experimentation. Techniques for developing and optimizing plant sample acquisition, extraction and analysis protocols. Theory of operation and maintenance of common laboratory instrumentation (pH measurement, solid and liquid analytical measurement, temperature measurement, spectrophotometry, HPLC, GC). Laboratory provides hands-on experience for integrated protocol development and instrument use.

HORT 6000*
Research and Thesis
1-12 credits, max 20 for crop science; max 24 for environmental science; max 30 for plant science. Research on thesis problems required of candidates for the PhD in crop science.

Hotel and Restaurant Administration (HRAD)

HRAD 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 hospitality industry on an international basis, ethical issues and career opportunities.

HRAD 1114
Introduction to Professional Food Preparation and Sanitation
Lab 3. Prerequisite(s): 1103 or NSCI 2111 or concurrent enrollment, restricted to HRAD and NSCI majors. Techniques and theories of food preparation and sanitation including use and selection of equipment, quality controls, presentation, and nutrient relationships based on food preparation systems. The theory and practice of food safety and sanitation.

HRAD 2125
Service Management in Hospitality Operations
Lab 4. Prerequisite(s): 1103 or concurrent enrollment, restricted to HRAD and NSCI majors. Analysis and development of service management skills for the hospitality industry, including leadership behavior, motivation; communication training, staffing and professionalism with an emphasis on fine dining.

HRAD 2283
Hospitality Industry Financial Analysis
Prerequisite(s): 1103 or NSCI 2111 or concurrent enrollment, ACCT 2103 with a minmum grade of C, MATH 1483 or 1513, STAT 2013, 2023 or 2053. Theory and practice of hospitality accounting with emphasis in planning and control of revenue and expenses, analysis of financial reports, budgeting, and managerial accounting concepts specific to the hospitality industry.

HRAD 2533
Hospitality Information Technology
Prerequisite(s): 1103 or concurrent enrollment. Overview of computer system components, file structure, operating systems, word processing, spreadsheets, and databases utilized in the hospitality industry. The interaction between technology, oral, and written communication at all levels of hospitality organizations.

HRAD 2771
Hospitality Speakers Series
Prerequisite(s): 1103 or concurrent enrollment. Seminars presented by distinguished hospitality industry professionals. Current issues and implications for the future of the hospitality and service industries.
(Same course as 3771 & 4771)

HRAD 3120
Special Events Management
1-3 credits, max 6. Prerequisite(s): 1103 or concurrent enrollment, restricted to HRAD majors. 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. Additional focus on catering through hotels, restaurants or private companies.

HRAD 3193
Hospitality Training Program Development
Prerequisite(s): 1103 or concurrent enrollment, 30 credit hours completed. 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.

HRAD 3213
Hospitality Management and Organizations
Prerequisite(s): 1103 or NSCI 2111 or concurrent enrollment, restricted to HRAD and NSCI majors, 30 credit hours completed. Function and methods of management as related to the hospitality industry. Management principles and analysis. Decision-making skills as applied to hospitality management system organizations, interpersonal relationships, and production systems.

HRAD 3223
(I)International Travel and Tourism
Prerequisite(s): 1103 or concurrent enrollment. 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. International travel industry financial management, technology, economic planning and policy formulation.

HRAD 3330
On-campus Internship
1-3 credits, max 6. Prerequisite(s): HRAD 2125, 3213 or consent of instructor. Supervised experience in an approved 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.

HRAD 3344
Fine Dining and Theme Restaurant Management
Lab 4.5. Prerequisite(s): 1103 or concurrent enrollment, 1114, 2125, junior standing. Management applications to theme and fine dining restaurants; lab practice in Ranchers Club teaching restaurant.

HRAD 3363
Hotel Operations
Lab 2. Prerequisite(s): 1103 or concurrent enrollment. The organization and administration of hotel operations including front desk operations, housekeeping, laundry, sales/marketing, management and other positions common to hotel operations. Includes a laboratory experience in The Atherton Hotel at OSU.

HRAD 3403
Lodging Services Management
Prerequisite(s): 1103 or concurrent enrollment. The organization and management of guest services in lodging properties. Examination of the principles of concierge, bell staff, retail outlets and business services.

HRAD 3411
Hospitality Pre-internship Seminar
1 credit, max 3. Prerequisite(s): 1103 or concurrent enrollment, 30 credit hours completed. Skills requisite to completion of a directed, practical, management-related experience in a work situation within the hospitality industry.

HRAD 3443
Hospitality Industry Internship
Prerequisite(s): 1103 or concurrent enrollment, 1114, 2125, 3213, 3363, 3411 and 45 credit hours completed. Supervised experience in an approved work situation related to a future career in the hospitality industry. Management and supervisory experience in multiple aspects of a hospitality organization.

HRAD 3473
Mechanical Equipment and Facility Management
Prerequisite(s): 1103 or concurrent enrollment, 30 credit hours completed. Fundamentals of building mechanical systems, maintenance and facilities management. The theory and interaction of illumination electric wiring, plumbing, heating, ventilation, air conditioning systems. Principles of facility management in the hospitality industry related to coordination of the physical space with guest services.

HRAD 3553
Purchasing in the Hospitality and Food Service Industries
Prerequisite(s): 1103 or NSCI 2111 or concurrent enrollment, 30 credit hours completed. Procurement of food, supplies, and services utilized in the hospitality and food service industries. Food and nonfood materials management of the purchasing process and communication. Specification writing, menu analysis and costing.

HRAD 3573
Franchising and Quick Service Restaurant Management
Prerequisite(s): 1103 or concurrent enrollment. Study of the history and transformation of hospitality industry chains. The organization of chains, fundamentals of franchising, sales and growth, evaluation of franchise financial performance, and unit ownership characteristics. Quick service restaurant organization, guest services, cost controls, sanitation, personnel management, purchasing, marketing, and time management.

HRAD 3623
Hospitality Industry Revenue and Cost Controls
Prerequisite(s): 1103 or concurrent enrollment, 2283, ACCT 2103. Strategies for the identification and management of revenue and cost controls in the hospitality industry. The different characteristics of hospitality revenues and costs and their relationship to products and services.

HRAD 3663
Hotel Food and Beverage Operations
Prerequisite(s): 1103 or concurrent enrollment, 30 credit hours completed. Examination of the products, production techniques, presentation, and service styles of hotel food and beverage operations. Planning, producing and marketing hotel food and beverage services.

HRAD 3721
Overview of Beverages in the Hospitality Industry
Prerequisite(s): Proof of minimum age 21. Overview of the international dimensions, history, classifications, production techniques, distribution, and quality factors of beverages such as wines, distilled spirits, beers, and non-alcoholic beverages used in the hospitality industry. Responsible alcohol beverage service and management techniques.

HRAD 3783
Hospitality Industry Human Resources Management
Prerequisite(s): 1103 or concurrent enrollment, 30 credit hours completed. Theories and practices used for personnel management in the hospitality and services industries. The organization of a human resources department, hiring, discipline, compensation, job analysis and performance evaluation.

HRAD 3943
Lodging Property Management
Prerequisite(s): 1103 or concurrent enrollment, 3363 or concurrent enrollment. The organization, duties, and administration of hotel support departments. The various jobs in lodging housekeeping, engineering, security, and convention and meeting services. Facilities management, purchasing, and furnishing, fixtures and equipment concepts.

HRAD 4090*
International Hospitality Studies
1-18 credits, max 18. Prerequisite(s): 1103 or concurrent enrollment, 45 credit hours completed. Participation in a hospitality educational experience outside of the US. The international aspects of the hospitality industry especially in the country or countries included in the experience. Development of an understanding of local, regional and national customs and cultures through experiential learning.

HRAD 4103*
Hospitality Law and Ethics
Prerequisite(s): 1103 or concurrent enrollment, 30 credit hours completed. 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 environment, and fundamental principles of tort and contract law.

HRAD 4120*
Special Events Management
1-3 credits, max 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.

HRAD 4163*
Hospitality Marketing
Prerequisite(s): 1103 or concurrent enrollment, 30 credit hours completed. Strategies for marketing and decision-making in the hospitality industry. Customer identification, consumer behavior, competition, and product, promotion, placement and pricing strategy.

HRAD 4213*
Hospitality Sales and Catering
Prerequisite(s): 1103 or concurrent enrollment. Fundamentals of sales and catering including the sales department, publicity and advertisement, 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.

HRAD 4293*
Hospitality Small Business Development
Prerequisite(s): 1103 or concurrent enrollment, 2283, 3213, 45 credit hours completed. 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.

HRAD 4333*
Hospitality and Tourism Financing
Prerequisite(s): 1103 or concurrent enrollment, 2283, ACCT 2103, 30 credit hours completed. 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.

HRAD 4343
Fine Dining and Theme Restaurant Professional Practicum
Lab 4.5. Prerequisite(s): 1103 or concurrent enrollment, 3344 and application process successfully completed. Restaurant production or service professional applying management theory to in-depth practice.

HRAD 4365
Food Production Management
Lab 5. Prerequisite(s): 1103 or NSCI 2111 or concurrent enrollment, 1114, 2125, 3213 or MGMT 3013, 2283 or ACCT 2103, restricted to HRAD and NSCI majors, 60 credit hours completed. Organizing, purchasing, costing, recipe development, preparation, and service of food. Emphasis on the management of the process, budgeting, marketing and food safety.

HRAD 4413*
Hospitality Information Systems
Prerequisite(s): 1103 or concurrent enrollment, 2125, 2533 and 3363. Conceptional analysis of hospitality technology systems such as food and beverage service, housekeeping, sales, property management, personnel, accounting, front office, and inter- and intra-departmental functions. The ethical implications of technology.

HRAD 4443*
Advanced Hospitality Management Internship
Prerequisite(s): 1103 or concurrent enrollment, 2125, 2533, 3213, 3363 or 3943, 3443, 75 credit hours completed. 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.

HRAD 4523*
Integrated Capstone Seminar
Prerequisite(s): 1103 or concurrent enrollment, 3213 or MGMT 3013, 75 credit hours completed. 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.

HRAD 4561*
Hospitality Management Seminar
Prerequisite(s): 1103 or concurrent enrollment, 45 credit hours completed. 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.

HRAD 4573*
Non-commercial, Institutional and
Contract Services in the Hospitality Industry
Prerequisite(s): 1103 or concurrent enrollment, 45 credit hours completed. 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.

HRAD 4723
International Beverage Education
Prerequisite(s): Proof of minimum age 21. Emphasis on the international dimensions of the history, classifications, 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.

HRAD 4771*
Hospitality Industry Speakers Colloquium
Prerequisite(s): 1103 or concurrent enrollment. Seminars presented by distinguished hospitality industry professionals. Current issues and implications for the future of the hospitality and service industries.
(Same course as 2771 & 3771)

HRAD 4783*
Critical Issues In the Hospitality and Tourism Industry
Prerequisite(s): 1103 or concurrent enrollment, 45 credit hours completed. Breadth of vision and broad perspective of contemporary issues in the management, of hospitality and tourism industry organizations. Awareness of societal, economic, cultural, and international issues and their impact on hospitality and tourism organizations.

HRAD 4833*
Casino and Gaming Management
Prerequisite(s): 1103 or concurrent enrollment, 50 credit hours completed, ACCT 2103, HRAD 2283, 3213, 3783. Focus on the management of casino and gaming operations including the history and trends of gaming, current issues, cultural influences and social consequences of casino, lottery and pari-mutual segments. Also theory and practice in the analysis of gaming operations in the areas of casino management, marketing, accounting/controls, security, human resources and law.

HRAD 4850*
Special Unit Course in Hotel and Restaurant Administration
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Special unit of study related to specific problems in the hospitality industry.

HRAD 4900
Honors Creative Component
1-3 credits, max 3. Prerequisite(s): 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.

HRAD 4983*
Conference and Meeting Planning
Prerequisite(s): 1103 or concurrent enrollment, 45 credit hours completed. Planning and implementing conferences, teleconferences, conventions, special events, seminars and symposia. Designing, promoting, managing and evaluating educational events, contract management.

HRAD 5000*
Master's Thesis
1-6 credits, max 6. Prerequisite(s): Graduate standing and consent of adviser. Individual research interests in hospitality administration fulfilling the requirements for the MS degree.

HRAD 5030*
Master's Creative Component and Independent Study
1-3 credits, max 3. Prerequisite(s): Graduate standing and consent of instructor. Individual research and study having relevance to the hospitality field and a positive impact on the hospitality industry.

HRAD 5111*
Hospitality Graduate Studies and Research
Systematic introduction to the competencies of graduate education and research in hospitality and tourism education and administration.

HRAD 5213*
Hospitality and Tourism Management
In-depth study of hospitality and tourism management including theory, research, operations and practical experience. Emphasis on lodging operations systems, commercial food service systems, and tourism. Analysis and synthesis of a comprehensive management philosophy consistent with theory.

HRAD 5233*
Convention and Special Event Management
Meeting and event design, working with industry suppliers, on-site management, post-event analysis, computers and technology, and meetings documentation.

HRAD 5243*
Retailing and Franchising in the Hospitality Industry
Entrepreneurial perspective of growth and performance of commercial and noncommercial food service and health care organizations. Challenges relative to operations management, convenience stores, quick service operations, procurement, price analysis, communication, efficient customer response, capital and human resources, competition, governmental influence, and decision-making process.

HRAD 5253*
Critical Issues in Gaming
Focuses on current issues, advanced research and the theoretical constructs of the gaming industry and includes exploration of current issues, cultural influences and social consequences of casino, lottery, racing and pari-mutual segments. Students will also gain theoretical knowledge and learn to apply research skills in the analysis of gaming operations in the areas of casino management, marketing, accounting/controls, security, human resources and law.

HRAD 5313*
Hospitality and Tourism Information Technology
Conceptual analysis of the technology used in the hospitality industry. Investigation of technology applications, ethical implications of technology and system development practice.

HRAD 5323*
Hospitality Accounting and Finance
Understanding the role of the accounting and financial function in hospitality firms. Learn how to read hospitality financial statements, to use analytic concepts as managerial tools to examine the profitability of hospitality firms and to make superior capital investment decisions, and to become familiar with major financial instruments and concepts.

HRAD 5413*
Employee Development Issues in the Hospitality Industry
Recent theories and research in human resource management, employee development, and labor issues affecting the hospitality and tourism industry in maintaining a productive workforce.

HRAD 5423*
Hospitality Customer Development Strategies
Prerequisite(s): Undergraduate marketing course. The concepts and strategies of hospitality and tourism marketing and customer development.

HRAD 5513*
Contemporary Issues in Hospitality and Tourism
Analysis of major and current issues confronting the hospitality and tourism industry.

HRAD 5613*
Service Quality in Hospitality and Tourism Management
Study of contemporary management principles in the hospitality industry. Service improvement and customer satisfaction in the hospitality industry through the use of total quality management. How service industries such as hospitality can use business techniques such as continuous improvement, employee involvement, measurement and organizational change to improve unit operations.

HRAD 5813*
Research Methods in Hospitality and Tourism Administration
Prerequisite(s): REMS 5953 or STAT 5013. Scientific methods and current research methodologies as applied to problems in hospitality and tourism administration. Proposal planning, research design, statistical use and interpretation, and research reporting.

HRAD 5850*
Special Topics in the Hospitality Industry
1-3 credits, max 9. Special topics related to the hospitality industry. A problem-solving technique to design the research model and investigative procedures. Presentations to faculty, students and industry professionals at specialized workshops with research, instructional and industry project components.

HRAD 5870*
Problems in the Hospitality Industry
1-3 credits, max 9. Special recurring problems in the hospitality industry. Broad perspective of these issues and their application to the industry. Critical thinking skills to solve operational dilemmas.

HRAD 6000*
Doctoral Thesis
1-12 credits, max 30. Prerequisite(s): Consent of major professor. Research in hospitality administration for the PhD degree.

HRAD 6113*
Hospitality and Tourism Education
Theoretical and practical components of hospitality and tourism education with emphasis on universities, community colleges and vocational schools.

HRAD 6213*
Advanced Hospitality Purchasing
Development of supply chain management systems for hospitality businesses. Management of hospitality procurement operations.

HRAD 6313*
Tourism Policy and Planning
Examination of current international and national tourism policies, planning and development perspectives and the economic impact.

HRAD 6413*
Leadership in a Diverse Society
Comparing and critiquing leadership and diversity research, theories and practices society. Development of models for future professional practice that integrate leadership an diversity principles.

HRAD 6513*
Hotel and Restaurant Planning and Development
Theories and practices related to the acquisition, development and investment in hospitality-oriented real estate. The undertaking of site analysis, feasibility studies and building construction. Acquisitions, financing alternatives and management contract options. Current trends in hotel investing.

HRAD 6613*
Advanced Research Methodology in Hospitality and Tourism
Advanced research methodologies in hospitality and tourism. Essential concepts in contemporary research, examination of multivariate data analysis techniques in hospitality and tourism research. Development of individual research projects.

HRAD 6680*
Seminar in Food Service Management
1-3 credits, max 9. Examination of research, practice, and future trends in food service management issues from a strategic perspective.

HRAD 6780*
Seminar in Lodging Management
1-3 credits, max 9. Examination of lodging management issues from a strategic perspective. Latest developments in research, practice, and future trends in the lodging industry.

HRAD 6880*
Seminar in Travel and Tourism Management
1-3 credits, max 9. Study of the latest developments in travel and tourism research and management.

Human Development and Family Science (HDFS)

HDFS 1101
Relationships 101
An applied course designed to actively involved students in the exploration of topics which influence the development of positive relationships. Topics include gender differences, relationship principles, family of origin and personal needs. Application to personal and professional settings.

HDFS 1112
Introduction to Human Development and Family Science
Exploration of the philosophy of human development and family sciences grounded in a model of policy, education and practice. *Professional field experience required.*

HDFS 2113
(S)Lifespan Human Development
Study of human development within diverse family systems. Taught from a life span perspective.

HDFS 2114
(S)Lifespan Human Development: Honors
Prerequisite(s): Honors students only. Honors course critically examining the study of human development within diverse family systems. Taught from a lifespan perspective.

HDFS 2211
Early Field Experience in Primary Education
Lab 3. Prerequisite(s): 1112 and 2113. The initial preprofessional clinical experience in schools, grades 1 through 3. *Required for full admission to Professional Education.*

HDFS 2213
Human Sexuality and the Family
Sexual development emphasizing personal adjustment and interaction with family and culture.

HDFS 2223
Foundations in Early Childhood
Lab 3. Prerequisite(s): 1112 and 2113. Introduction to early childhood. Historical background of the profession and its future. Opportunities in early childhood as a professional. Developing an awareness of appropriate contexts for learning through realistic experiences in the early childhood classroom. Professional Education requirements introduced.

HDFS 2233
Development of Creative Expression, Play and Motor Skills in Early Childhood
Prerequisite(s): 2113 and one child development course. Consideration of appropriate experiences in the areas of play, art, music and motor skills for young children from birth through eight years of age with an emphasis upon such experiences as a curricular base in early educational group settings. Observation and participation experiences with young children.

HDFS 2243
Infant-Toddler Programming
Lab 3. Prerequisite(s): 2113, 3413. Program planning, implementation and evaluation of developmentally appropriate programs for infants and toddlers. Directed observation and participation in infant and toddler programs.

HDFS 2850
Special Unit Courses in HDFS
1-6 credits, max 6. Various units taught by specialists in Human Development and Family Science.

HDFS 3001
HDFS Speaker Series Colloquium
Prerequisite(s): 1112, 2113. Seminars presented by distinguished professionals in the Human Development and Family Science field. Current issues and implications within the profession of HDFS are addressed.

HDFS 3013
(S)Early Adulthood
Prerequisite(s): 2113. Study of the unique characteristics of development during early adulthood. Theories of adult development with emphasis on application to program development and providing services for adults.

HDFS 3103
Social Development and Social Studies in Early Childhood
Prerequisite(s): Concurrent enrollment in 3201, 3213, and 3223; full admission to Professional Education. Application of theories of cognitive development to developmentally appropriate curriculum in social studies.

HDFS 3113
Non-normative Development
Prerequisite(s): 2113. The intersection of biological and environmental influences on atypical development across the life span in multiple contexts in early development. Assumes a basic knowledge of the cultural diversity in normative human development and the research methods employed in human development. Directed observation in non-normative settings.

HDFS 3123
(S)Parenting
Prerequisite(s): 2113 or other life-span development course. 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.

HDFS 3201
Field Experience in Primary Education II
Prerequisite(s): Concurrent enrollment in 3203, 3213, and 3223; full admission to Professional Education. Supervised observation and participation in classrooms through third grade. *Concurrent course work in literacy, mathematics, social studies, and science.*

HDFS 3203
(I)Children's Play: A World Perspective
Prerequisite(s): 2113 or equivalent. An examination of children's play in contemporary international cultures. Play in children from birth through late childhood will be reviewed; social and cognitive outcomes will be analyzed as related to complex, modern world systems.

HDFS 3213
Literacy Development in Early Childhood Education
Prerequisite(s): 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.

HDFS 3223
Mathematics and Science in Early Childhood
Prerequisite(s): Concurrent enrollment in 3201, 3203 and 3213 and full admission to Professional Education. Application of theories of cognitive development to developmentally appropriate curriculum in mathematics and physical and natural sciences.

HDFS 3233
Guidance and Discipline in Programs for Young Children
Prerequisite(s): 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.

HDFS 3243
Preparation for Field Experience in
Pre-kindergarten-Kindergarten Education
Prerequisite(s): 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.

HDFS 3246
Internship in Early Childhood
Education in Pre-kindergarten-Kindergarten
Prerequisite(s): Concurrent enrollment in 3233 and 3243, full admission to Professional Education. Supervised teaching experience in pre-school settings through kindergarten. *Graded on a pass-fail basis.*

HDFS 3413
(S)Infant and Child Development
Prerequisite(s): 2113. 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.

HDFS 3423
(S)Adolescent Development in Family Contexts
Prerequisite(s): 2113. 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.

HDFS 3433
(S)Relationship Development and Marriage
Theory and research on the formation and development of interpersonal relationships from dating through courtship and marriage.

HDFS 3443
(S)Family Dynamics
Prerequisite(s): 2113. Applying family theories and current research to the examination of dynamics of diverse families across the life course and within the social context.

HDFS 3453
Management of Human Service Programs
Prerequisite(s): 1112, 2113, 3433, 3443. Designing and managing human service programs: planning, needs assessment, program hypothesis, developing human resources, budget management, monitoring and evaluation. Emphasis on accountability.

HDFS 3513
Introduction to Research Methods
Prerequisite(s): 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.

HDFS 3523
Professional Skills in Human Services
Prerequisite(s): 1112, 2113, 3433. Development of professional skills for the human services. Intakes, interviewing, reporting, program marketing, case management, advocacy, facilitating change, community collaboration and using databases.

HDFS 3533
Observation and Assessment
Prerequisite(s): 2113. Examination of individual and family interaction through observation and assessment techniques in multiple contexts.

HDFS 4000
Senior Thesis
1-6 credits, max 6. Prerequisite(s): 4743, STAT 2013, senior standing, consent of instructor. Supervised research for the bachelor's degree.

HDFS 4223
Field Experience Preparation in Primary
Prerequisite(s): 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.

HDFS 4226
Internship in Early Childhood Education in Primary
Prerequisite(s): Concurrent enrollment in 4223 and 4333, and full admission to Professional Education. Supervised teaching experience in grades 1-3. *Graded on a pass-fail basis.*

HDFS 4333
Early Childhood Capstone
Prerequisite(s): 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.

HDFS 4411
Ethics and Aging
Interdisciplinary review of ethical issues for the aging population. Individuals will have an opportunity to review various ethical issues from legal, psychological, social, and financial perspectives. Enrollment requires attendance of the one-day, Oklahoma Ethics and Aging Conference.

HDFS 4413
(S)Adulthood and Aging
Prerequisite(s): 2113. 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.

HDFS 4423
Family Risk and Resilience
Prerequisite(s): 3443. Examination of selected theoretical approaches; areas of family risk; protective factors; individual and family qualities relating to resilience; and prevention and intervention strategies.

HDFS 4433*
Family Life Education
Prerequisite(s): 2113, 3123, 3433, senior standing. Philosophy and principles of family life education. Planning, implementing, and evaluating family life programs in community and education settings. Field experience.

HDFS 4443
(S)Fatherhood: Developmental, Social and Historical Perspectives
Developmental, social and historical perspectives of fatherhood. Context and contemporary issues relating to fatherhood in the US, the contribution of involved fathering to men's adult development, the roles and responsibilities of fathers, skills for effective fathering, and father and child interaction in relation to both father and child adjustment and well being.

HDFS 4473
Policy, Law and Advocacy
Prerequisite(s): 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.

HDFS 4521
HDFS Child and Family Services: Pre-internship
Prerequisite(s): 1112, 3523, 3533, senior standing, consent of advisor and instructor. Preparatory workshop for HDFS Child and Family Services internship. *Must be taken in the semester immediately prior to enrolling in HDFS 4525 internship.*

HDFS 4525
Internship in Child and Family Services
Prerequisite(s): 1112, 3523, 3533, 4521, senior standing, consent of adviser and instructor. Supervised field experience applying HDFS knowledge and skill base. Must complete application for internship. *Must have completed 4521 in the semester immediately prior to internship.*

HDFS 4533
Critical Issues in Human Development and Family Science
Prerequisite(s): 3453 and senior standing. An examination of the place of family relations and child development in the context of broader themes. An exploration of the students' specialization and its implications for an educated life.

HDFS 4543
(S)Family and Interpersonal Relationships in Adulthood
Prerequisite(s): 2113. Analysis of the aging process as it relates to relationships across the lifespan. Special emphasis on multigenerational family issues, peer relationships, and transitions associated with normative and non-normative life experiences.

HDFS 4673
Theories and Issues in Family Relationships
Prerequisite(s): 3753. Introduction to family theories. Current research and issues related to family dynamics, relationships, and crises within the context of the family system.

HDFS 4713
Families and Work
Addresses the implications of parents' employment for the family, the well-being of employed adults, and child/adolescent development. Human developmental, psychological, economic, and sociological theories and research on work-family issues are examined, with a particular focus on dual-earner families, low-income jobs and the working poor, and workplace and social policy relevant to work and family issues.

HDFS 4750
Special Problems in HDFS
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Various units of work related to specific issues in family relations and child development.

HDFS 4793
(S)The Family: A World Perspective
Family structure and interaction that transcend specific cultures or nationalities; examination of specific cultural and international family forms, their social issues and relevant services to meet their needs.

HDFS 4813
Dying, Death and Bereavement
Physical, psychological, emotional and social aspects to dying and death across the life course. Examination of human experiences with and responses to dying and death within various contexts such as family, medical and cultural.

HDFS 4850
Special Unit Courses in Family Relations, Child Development and Early Childhood Education
1-6 credits, max 6. Various units taught by specialists in the field.
(Same course as 5470*)

HDFS 4900
Honors Creative Component
1-3 credits, max 3. Prerequisite(s): 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.

HDFS 5000*
Master's Thesis
1-6 credits, max 6. Research in FRCD for MS degree.

HDFS 5110*
Directed Study in HDFS
1-9 credits, max 9. Prerequisite(s): 5253, 5293, 5513 or 5523 and consent of instructor. Directed individual study in human development and family science.

HDFS 5112*
Computer Applications in HDFS Research
Creating variable codebooks, data coding, data entry, variable specifications and data manipulation, merging files, and basic analysis using SPSS software. No computer experience necessary.

HDFS 5133*
Research Methods in Human Development and Family Science
Research processes, design, and methods in human development and family science. Application of research tools and methods to investigate theoretical, empirically-based, or field-based research issues in individual and relationship competence in diverse contexts. Development of a research proposal.

HDFS 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 scholarship on parenting to parent education and child guidance.

HDFS 5153*
Policy in Human Development and Family Science
Critical analysis of approaches to and models of policy in Human Development and Family Science. Examination of policy analysis and evaluation, development, advocacy, and implementation of state and federal policy and legislation.

HDFS 5173*
Program Evaluation and Assessment in Human Development and Family Science
Principles and processes of program evaluation and assessment in Human Development and Family Science programs.

HDFS 5183*
Practicum in Developmental and Family Sciences Research
Prerequisite(s): Admission to graduate study in HDFS, nine hours of graduate credit in HDFS, and consent of instructor. Supervised research experiences in human development and family sciences.

HDFS 5190*
Teaching Practicum
1-3 credits, max 3. Prerequisite(s): Six hours of graduate course work and consent of instructor. Teaching human development and family sciences; content and techniques.

HDFS 5203*
Family Systems
Research and theory related to family functioning throughout the life cycle, especially financial decision making during crisis and conflict. Factors that shape family values, attitudes and behaviors from a multicultural perspective. New and emerging issues critical to family functioning.

HDFS 5213*
Child Behavior and Development
Prerequisite(s): Consent of instructor. Current issues in child development beyond infancy explored within the context of recent research. Contrasting theoretical and methodological approaches critically evaluated.

HDFS 5223*
Theories of Child Behavior and Development
Prerequisite(s): Six 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.

HDFS 5243*
Infant Behavior and Development
Survey of research and theory pertaining to infant development, including behavioral genetics, perception, cognition and learning, social and emotional development, and assessment.

HDFS 5253*
Theory and Research: Social and Emotional Development
Research and theory pertaining to social and emotional development, including attachment and family context, social interaction, friendships and temperament. Incorporates applications to policy and practice.

HDFS 5263*
Theory and Research: Cognitive and Language Development
Research and theory pertaining to cognitive and language development including environmental influences and family influences, attention and memory, problem solving, and social cognition. Incorporates applications to policy and practice.

HDFS 5273*
Development Assessment
Prerequisite(s): Consent of instructor. Study and application of formal assessment tools across the life span. Supervised practice in administration, scoring, and interpretation of individual tests.

HDFS 5283*
Developmental Disabilities
Recent theories and research related to developmental disabilities, including both physical and mental handicapping conditions and their impact on human development.

HDFS 5290*
Practicum
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Supervised experience in various settings relevant to human development and family sciences.

HDFS 5293*
Developmental Contexts of Normative Behavior Problems
Examines the theory and research regarding biological, developmental and contextual factors associated with normative behavior problems. Contexts include families, neighborhoods, peers and schools. A lifespan perspective examining the origins and course of individual patterns of maladaptation, such as aggression, delinquency, social withdrawal, anxiety and depression. Addresses prevention of and intervention with normative adjustment difficulties.

HDFS 5323*
Observation in Early Childhood Education
Systematic observation of young children informs and transforms early childhood curriculum. Skills, attitudes and dispositions necessary to become an astute observer of children. In-depth reflection on student observations will demonstrate how observation informs teaching and learning.

HDFS 5333*
Theoretical Foundations in Early Childhood Curriculum
Implications of child development theory and research for planning educational programs and learning experiences appropriate for young children.

HDFS 5343*
Assessment Within Early Childhood Programs
Prerequisite(s): 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.

HDFS 5353*
Diversity in Early Childhood
Exploration and critical review of the state of early childhood programming with emphasis on research, theory, and policy making that bear on current diversity and multicultural issues in practice.

HDFS 5363*
Learning Environments
Personal, empirical and theoretical foundation for curriculum development and program models for children through third grade emphasizing individual differences, equipment and materials, physical facilities and space, teacher roles and philosophical objectives.

HDFS 5373*
Early Childhood Administration
Examination of the administration, management, and supervision of programs for young children. Legal, social, and economic conditions affecting programs.

HDFS 5400*
Professional Seminar in Gerontology
3 credits, max 3. An integrative experience for gerontology students designed to be taken near the end of the degree program. By applying knowledge gained in earlier course work, students strengthen skills in ethical decision-making and behavior, applying these skills in gerontology-related areas such as advocacy, professionalism, family and workplace issues. Students from a variety of professions bring their unique perspectives to bear on topics of common interest. *Web-based instruction.*

HDFS 5403*
Perspectives in Gerontology
An overview of current aging issues including current focus of gerontology theory and research; critical social and political issues in aging, the interdisciplinary focus of gerontology, current career opportunities, and aging in the future. *Web-based instruction.*

HDFS 5411*
Ethics and Aging
Analysis of ethical issues for the aging population. Critical examination of various ethical issues from legal, psychological, social, and financial perspectives. Enrollment requires attendance of the one-day, Oklahoma Ethics and Aging Conference.

HDFS 5413*
Adult Development and Aging
The biological, psychological and social factors associated with aging. Web-based instruction.

HDFS 5423*
Research Perspectives in Gerontology
Current research knowledge related to gerontology and the aging process. Critical study of classic and current research.

HDFS 5433*
Theories of Aging
Addresses the historical, contemporary and interdisciplinary basis of aging theory. Biological, psychological, sociological and human developmental conceptualizations of aging are critically assessed. Emphasis is placed on conceptual models, as well as theoretical development and application within gerontological research and the field of aging.

HDFS 5443*
Attachment in Later Life
Draws upon past and current knowledge research and theoretical conceptualizations of attachment in late and very late adulthood. Attachment is addressed as an individual, interpersonal, contextual and spiritual resource of late life development. In particular, emphasis is placed on adult attachment typology, attachment to place, caregiver attachment and spiritual attachment. Critical assessment of attachment concepts and theory, methodological and measurement concerns and associated developmental outcomes of well-being.

HDFS 5453*
Aging in the Medical Context
Orients students to the unique issues related to health and the health system for individuals in later life. A particular focus is placed on health programs, the role of medical personnel and tasks of family members as older persons face health issues and decisions.

HDFS 5470*
Developments and Innovations in Family Relations, Child Development and Early Childhood
1-9 credits, max 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.
(Same course as 4850*)

HDFS 5493*
Aging and Families
Theories and research related to individual and family adjustments in later life affecting older persons and their intergenerational relationships. Critical issues include marriage, divorce and remarriage, adult children and their parents, grandparenting, and alternative family forms.

HDFS 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.

HDFS 5523*
Family Theory
Theoretical frameworks and processes in family science. Overview of the interface between theory, research, and application in family science.

HDFS 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.

HDFS 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, implementation and evaluation.

HDFS 5563*
Management of Family and Community Service Programs
Functions of management applied to programs and services for children and families. Program planning, personnel decisions, resource development, marketing, community engagement, employee development, and evaluation.

HDFS 5573*
Adolescent in Family Context
Physical, social, emotional and intellectual development of adolescents within the context of family relationships. Exploration of research and theory as it relates to adolescent development and parent-adolescent relationships.

HDFS 5583*
Human Sexuality
Multiple aspects of human sexuality including physiological and psychosexual development and response, sexual relationships, and sexual dysfunction.

HDFS 5603*
Pre-practicum in Marriage and Family Therapy: Counseling Skills
Prerequisite(s): Admission to the marriage and family therapy specialization and consent of instructor. Pre-clinical experience for students in the marriage and family therapy (MFT) specialization, emphasizing counseling skills and structured observations.

HDFS 5612*
Pre-practicum in Marriage and Family Therapy: Group Processes
Prerequisite(s): 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.

HDFS 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.

HDFS 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 theory and clinical practice.

HDFS 5633*
Couples Treatment in Marriage and Family Therapy
Prerequisite(s): Graduate standing or consent of instructor. Focus on assessment of couples and the systemic interventions available to address common couple issues. Pre-marriage, divorce and remarriage, sexuality, domestic violence, infidelity, and gender.

HDFS 5643*
Child and Adolescent Treatment in Marriage and Family Therapy
Prerequisite(s): Graduate standing or consent of instructor. An overview of the issues surrounding children and adolescents in marriage and family therapy including child abuse and neglect, drug abuse, oppositional behaviors, ADHD, and family structures and hierarchies. Assessment and treatment methods. Strategies for engaging families.

HDFS 5653*
Systemic Approaches to Psychopathology and Psychopharmacology
Prerequisite(s): 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.

HDFS 5663*
Professionalism and Ethics in Marriage and Family Therapy
Prerequisite(s): Graduate standing and consent of instructor. The development of the professional attitude and identity of a marriage and family therapist. The AAMFT Code of Ethics, family law, ethnicity, and gender issues, as related to the practice and profession of marriage and family therapy.

HDFS 5690*
Marriage and Family Therapy Practicum
1-3 credits, max 18. Prerequisite(s): Admission to the marriage and family therapy program and consent of instructor. Supervised clinical experience for students in the marriage and family therapy specialization.

HDFS 5693*
Child Treatment Practicum in Marriage and Family Therapy
Prerequisite(s): Admission to the marriage and family therapy program and consent of instructor. Supervised clinical experience focusing on the treatment of children within a family context.

HDFS 5750*
Seminar in Human Development and Family Science
1-9 credits, max 9. Current research in human development and family science. Critical study of classic and current research.

HDFS 5753*
Management of Volunteer Programs
This course is designed for education, health and human services professionals who have responsibility for involving volunteer personnel in achieving program goals. The course will include an overview of trends and issues in volunteering, management and leadership strategies for maximizing volunteer effectiveness, and strategies for evaluating volunteer service.

HDFS 5813*
Practicum in Child and Family Services
Prerequisite(s): Admission to graduate study in HDFS, 9 hours of graduate credit in HDFS, and consent of instructor. Supervised experiences in child and family service settings.

HDFS 6000*
Doctoral Thesis
1-12 credits, max 30. Prerequisite(s): Consent of instructor. Research in human environmental sciences for the PhD degree under supervision of a graduate faculty member.

HDFS 6101*
Doctoral Seminar in Human Development and Family Science
Prerequisite(s): 5253, 5293, 5513, 5523 or equivalent and consent of instructor. Selected topics in human development and family science focusing on current research, theory or application.

HDFS 6110*
Doctoral Seminar in Human Development and Family Science
1-9 credits, max 9. Prerequisite(s): 5253, 5293, 5513, 5523 or equivalent and consent of instructor. Doctoral level directed individual study in human development and family sciences.

HDFS 6123*
Advanced Research in Individual and Relationship Competence
Prerequisite(s): 5133 or equivalent, 5253 or 5293, and 5513 or 5523. Integration of current research and theory in human development and family science to address current issues in individual and relationship competence.

HDFS 6133*
Advanced Research Methods in Human Development and Family Science
Prerequisite(s): One course in research methods and one in statistics. Research design and analysis of data appropriate to the areas of human development and family science.

HDFS 6143*
Structural Equation Modeling for HDFS Applications
Prerequisite(s): 6133, REMS 6013 or equivalents. Introduction to structural equation modeling (SEM) with applications to longitudinal and grouped data typical of research in Human Development and Family Science. Includes elementary matrix algebra, measurement models (factor analysis), and latent path models, such as growth curve models. Applications using appropriate statistical software.

HDFS 6153*
Advanced Statistical Procedures for Human Development and Family Science
Prerequisite(s): 6133 and REMS 6013 or equivalents. Introduction to advanced statistical methods for analyzing longitudinal and grouped data. Multilevel modeling is emphasized, with brief introductions to other advanced statistical procedures, such as survival analysis and developmental trajectory analysis. Models include occasions nested within persons and persons nested within groups. Applications using appropriate statistical software.

HDFS 6190*
Research Internship
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Special research studies under the supervision of a graduate faculty member.

HDFS 6223*
Advanced Human Development Theory
Prerequisite(s): 5253 or 5293. Critical analysis of selected child development theories using primary source material with demonstration of application to development, research and practice.

HDFS 6283*
Seminar in Human Development
Prerequisite(s): 5253. Selected topics in human development with special attention given to recent research literature and current theory.

HDFS 6363*
Theories and Research in Early Communication Development
Prerequisite(s): 5253, 5293 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.

HDFS 6523*
Advanced Family Theory
Prerequisite(s): 5523. Family theory process, including logic, theory construction, and relating conceptual orientations to current research areas.

HDFS 6553*
Marital and Couple Relationships
In-depth analysis of historical and contemporary research on developmental and relational processes in marital and couple relationships. Emphasis on research and theory addressing the nature, dynamics and developmental course of committed couple relationships.

HDFS 6580*
Seminar in Family Sciences
1-6 credits, max 6. Prerequisite(s): 5513 or consent of instructor. Current research and theory in the family area; selected topics.

HDFS 6613*
Contemporary Issues in Marriage and Family Therapy
Prerequisite(s): Admission to marriage and family therapy specialization. Critical issues facing students in the marriage and family therapy (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.

Human Environmental Sciences (HES)

HES 1112
Human Environmental Sciences Freshman Experience
Experiences that effectively facilitate transition from high school to the College of HES at OSU. Introduction to the developmental advising process to ensure a successful adviser/advisee partnership. Career development through connections among the student's major curriculum, general education courses, career goals, and eventual careers. Analysis of case scenarios. *Required of all first semester freshmen in HES.*

HES 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.

HES 2510
HES Freshman Research Seminar
1-3 credits, max 6. Prerequisite(s): College of Human Environmental Sciences major; Admission to the Freshman Research Scholars program. Seminar for College of Human Environmental Sciences' freshmen participating in the Freshman Research Scholars Program. Includes exploration of what "research" means in a variety of settings and introduces basic research skills and processes.

HES 3002
Leadership and Collaboration in the Workplace
Prerequisite(s): Junior standing in a major in the College of Human Environmental Sciences. Exploration of personal and workplace leadership, conflict resolution, workplace diversity and ethics. Development of transferable skills and emotional intelligence. Generation of personal mission statements. Current leadership and collaboration strategies, issues and terminology.

HES 3080
International Experience
1-18 credits, max 36. Prerequisite(s): Consent of associate dean. Participation in a formal or informal educational experience outside of the USA.

HES 3090
(I)Study Abroad
1-18 credits, max 36. Prerequisite(s): 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.

HES 3112
Human Environmental Sciences First-Year Transfer Experience
Experiences that effectively facilitate transition from high school to the College of HES at OSU. Introduction to the developmental advising process to ensure a successful adviser/advisee partnership. Career development through connections among the student's major curriculum, general education courses, career goals, and eventual careers. Analysis of case scenarios. *Required of all first semester transfer students in HES.*

HES 4000
Honors Seminar in Human Environmental Sciences
1-6 credits, max 6. Prerequisite(s): 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 strategies and national resources. Dialogue and debate from multiple perspectives with emphasis on verbal and written expression.

HES 5110*
Directed Studies in Human Environmental Sciences
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Directed individual study in Human Environmental Sciences.

HES 5240*
Master's Creative Component
1-6 credits, max 6. Prerequisite(s): Consent of associate dean. An in-depth application of theoretical models and philosophies related to area of specialization.

HES 5253*
Family Economics
Issues related to the economics of families, household production, and human capital development; economics of crises 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.

HES 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 US. Current and emerging issues, as well as current research and theory relative to financial systems. Web-based instruction.

HES 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.

HES 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.*

HES 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.*

HES 5533*
Economics of Aging and Public Policy
Policy development in the contest of the economic status of the elderly populations. Retirement planning and the retirement decision; Social Security and public transfer programs for the elderly; intrafamily transfers to or from the elderly; private pensions; financing medical care for the elderly; prospects and issues for the future. *Web-based instruction.*

HES 5543*
Environments and Aging
Special needs of older people and attributes of physical environments that support these needs including attention to the "meaning of and attachment to home." Application of knowledge to design and management of housing, institutional settings, neighborhoods and communities. Environment-person fit; aging-in-place, assisted living and long-term care; and therapeutic environments. *Web-based instruction.*

HES 5553*
Insurance Planning for Families
Study of risk management concepts, tools, and strategies for individuals and families, including life insurance; property and casualty insurance; liability insurance; accident, disability, health, and long-term care insurance; and government-subsidized programs. Current and emerging issues and ethical considerations. Relationships between investment options and employee/employer benefit plan choices. *Web-based instruction.*

HES 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.*

HES 5633*
Program Evaluation and Research Methods in Gerontology
Overview of program evaluation, research methods and grant writing in gerontology. Application of quantitative and qualitative methods in professional settings. Web-based instruction.

HES 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.

HES 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.

HES 5803*
Case Studies in Family Financial Planning
Prerequisite(s): 5303, 5403, 5453, 5553, 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.

HES 6993*
Graduate Seminar in Human Environmental Sciences
1-3 credits, max 3. Prerequisite(s): Consent of instructor. Analysis of philosophy, critical issues, current developments and interrelationships among elements in human environmental sciences.

Human Resources and Adult Education (HRAE)

HRAE 4010*
Occupational and Adult Education Workshop
1-3 credits, max 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.

HRAE 4023*
Training and Development in the Workplace
Introduction to the field of training and development. Definitions, history, roles and models. Connection between learning and performance in the workplace.

HRAE 5000*
Thesis or Report
2-10 credits, max 10. Students studying for a master's degree may enroll in this course 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.*

HRAE 5010*
Seminar
1-3 credits, max 6. Graduate student seminars focusing on current and critical issues and common problems relevant to occupational and adult education.

HRAE 5223*
Organization and Administration of Adult Education
Organizational procedures and administrative practices for effective planning, implementation and management of adult and continuing education programs. Analyses of legislation, finances and community groups that influence and impact upon adult and continuing education programs.

HRAE 5233*
Needs Analysis
Techniques of conducting organizational analyses of human performance problems, including surveys, interviews, records analysis, group interaction, and task analysis.

HRAE 5340*
Special Problems
1-6 credits, max 6. Directed independent study of special topics involving assigned readings, library research, field work or a combination of these.

HRAE 5433*
Instructional Design for Training
Design and development of training to address performance problems in organizations, business and industry. In-depth study of a systematic approach to training for performance.

HRAE 5533*
Human Resource Development
Introduction to training and development, including history and nature of the field, trainer roles, needs analysis, program development, evaluation, and techniques of conducting training.

HRAE 5633*
Technology Application in Human Resource Development
The practice, theory, and research related to human resource development applications for technology and background information on specific technology-related topics. Development of technology applications.

HRAE 5703*
Adult Learning in Diverse Settings
The study of adult learning in diverse geographic and cultural settings. Interaction with experts in the field and reflection upon their experiences after returning from travel.

HRAE 5720*
Workshop
1-3 credits, max 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.

HRAE 5730*
Special Topics in Human Resource Development
1-3 credits, max 6. The practice, theory and research related to a current topic in human resource development.

HRAE 5833*
Global Consulting
The consulting process, including contract, entry, diagnosis, response, disengagement, closure and ethical considerations. The competencies of successful consultants and trainers in the international environment, including cultural adaptations of self and of training materials.

HRAE 5880*
Internship
3-6 credits, max 6. Supervised experience working in business, industry, human service or education settings.

HRAE 6000*
Doctoral Dissertation
2-10 credits, max 15. Required of all candidates for the Doctor of Education degree in adult education and human resource development.

HRAE 6103*
Foundations of Lifelong Learning
The definitions, historical and philosophical development, and the scope and function of lifelong learning.

HRAE 6110*
Graduate Readings in
Adult Education and Human Resource Development
1-6 credits, max 6. Prerequisite(s): Consent of supervising professor. Supervised readings of significant literature not included in regularly scheduled courses.

HRAE 6203*
Managing Adult Education Research
Analysis and application of techniques necessary for managing research projects in diverse agencies with adult learners. Practice with computer-based programs. Data sets from adult education research projects.

HRAE 6213*
Lifelong Learning and Performance
Lifelong learning theory within the context of applications in formal and informal settings in the community as well as in the workplace. Synthesis of research findings on changes of cognitive performance due to aging and analysis of recent literature on participation in adult education and training.

HRAE 6223*
Current Research in Adult Education
Analysis of the major research trends in the field of adult education. Recent research studies in the field.

HRAE 6233*
Critical Issues in Adult Education
Exploration of current issues of concern to adult educators from diverse settings.

HRAE 6330*
Special Topics in Adult Education
1-3 credits, max 9. Prerequisite(s): 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.

HRAE 6340*
Independent Study in Human Resources and Adult Education
1-3 credits, max 9. Directed independent study for doctoral students involved in a research-based project.

HRAE 6533*
Organization Development
Seminar examining the field of organization development. Emergence of the field, diagnosis, performance, change management, the client and the consultation.

HRAE 6633*
Advanced Human Resource Development
Prerequisite(s): 5533. Scholarly critique of organizations as adaptive systems and the role human resource development plays in organization, process and individual performance.

HRAE 6871*
Doctoral Seminar: Level 1
Orientation to doctoral program in HRAE. *May be taken prior to program application; required of all applicants.*

HRAE 6880*
Internship in Human Resources and Adult Education
1-8 credits, max 8. 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.

HRAE 6881*
Doctoral Seminar: Level 2
Preparation of the required tentative proposal for dissertation and the comprehensive doctoral examination. *Required for HRAE doctoral candidates.*

Industrial Engineering and Management (IEM)

IEM 2903
Manufacturing and Service Systems and Tools I
Prerequisite(s): ENGR 1111; MATH 2144. Introduction to definition, design, operation, and improvement of systems that produce goods and services. Case studies featuring classical and contemporary issues in industrial engineering and management. Issues include system effectiveness and efficiency in meeting customer needs, demands and expectations. Introduction to computer-aided tools useful in documentation, analysis, and modeling within contemporary organizations.

IEM 3103
Introduction to Probabilistic Modeling
Prerequisite(s): MATH 2153. Introduction to concepts and models of randomness, which support industrial engineering and engineering management analyses and decision-making. Includes probability models, statistical models and distributions, Markov processes and Little's Law.

IEM 3303
Manufacturing Processes
Lab 3. Prerequisite(s): ENGR 1322 and ENSC 3313. Manufacturing processes used to transform new materials including metals and non-metals into finished goods. Traditional and nontraditional manufacturing processes. Introduction to CAD/CAM. Basic process selection. Metrology and measurement fundamentals.

IEM 3403
Collaborative Engineering Project Management
Prerequisite(s): 2903, 3703. Engineering management and group issues involved in project planning, implementation and topics addressed include project management methodologies and software; teamwork structures, processes, and collaborative technologies; process management, leadership and other team roles.

IEM 3503
Engineering Economic Analysis
Prerequisite(s): MATH 2153. Development and use of time value of money models. 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-life projects. Replacement, breakeven and minimum cost analyses. Depreciation and depletion methods and their effect on corporate income taxes, leading to after-tax cash flow analysis. Introduction to financial reports.

IEM 3513
Economic Decision Analysis
Prerequisite(s): MATH 2123. Quantitative evaluation of investment alternatives for non-engineering majors. The role of interest in economic equivalence and in formulating economic comparisons based on present worth, annual equivalent, rate of return and payout criteria. Accounting, depreciation and income tax considerations. Benefit-cost and cost-effectiveness analysis. Cost estimation and allowance for variance in estimates. *Not available for credit in industrial engineering curriculum.*

IEM 3523
Engineering Cost Information and Control Systems
Prerequisite(s): MATH 2144. Introduction to basic accounting concepts and operating characteristics of accounting systems relevant to engineering analysis and decision making. Principles of financial and managerial accounting, activity based costing, taxes and depreciation. Emphasis on interpretation and use of accounting information for decision-making.

IEM 3703
Manufacturing and Service Systems and Tools II
Prerequisite(s): ENGR 1111, MATH 2144. Introduction to definition, design, operation, and improvement of systems that produce goods and services. Case studies featuring classical and contemporary issues in industrial engineering and management. Issues include system effectiveness and efficiency in meeting customer needs, demands and expectations. Introduction to computer-aided tools useful in documentation, analysis, and modeling within contemporary organizations.

IEM 3813
Work Design, Ergonomics, and Human Performance
Lab 3. Prerequisite(s): 3103. Evaluation and design of work systems and processes employing humans. Emphasis on simultaneously achieving high productivity and employee health, safety and satisfaction.

IEM 4010*
Industrial Engineering Projects
1-3 credits, max 6. Prerequisite(s): Consent of school head. Special undergraduate projects and independent study in industrial engineering.

IEM 4013*
Linear Modeling
Prerequisite(s): 3103, MATH 3263. Fundamental methods, models, and computational techniques of linear programming, including transportation and related network models relevant to industrial engineering and engineering management. Practical applications of operations research from manufacturing, service, and government organizations.

IEM 4020
Undergraduate Engineering Practicum
1-3 credits, max 4. Prerequisite(s): 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. 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.

IEM 4103*
Introduction to Quality Control
Prerequisite(s): 3103. Performance excellence in a enterprise, including relationships between industrial engineering and quality control. Statistical quality control concepts to measure, monitor, diagnose, and improve performance at the enterprise level, the operational level, and the project level. Quantitative and qualitative quality tools to solve problems and capture opportunities for improvement.

IEM 4113*
Industrial Experimentation
Prerequisite(s): 3103. Analytical methods for the purpose of process improvement. Experimental designs including single, blocked and multiple factors. Introduction to fractional factorial designs, central composite designs, and Taguchi robust designs. Data collection , analysis, and interpretation, including graphical methods, confidence intervals, and hypothesis tests. Multiple linear regression analysis methods. Industrial applications.

IEM 4163
Service Systems and Processes
Prerequisite(s): 3103, 3503, 4613. Design and analysis of service systems and processes from the perspective of industrial engineering and engineering management. Application of basic industrial engineering principles and tools applied to service systems. Basics of service quality and productivity, including metrics, measurement and improvement.

IEM 4203*
Facilities and Material Handling System Design
Prerequisite(s): 3303, 3813, 4013, 4713. Design principles and analytical procedures for determining facility location and location of physical assets within a facility. Introduction to material-handling concepts, technologies and methods. Considerations include production processes, product volume, material flow and information flows.

IEM 4323*
Manufacturing Systems and Processes
Lab 2. Prerequisite(s): 3303, 4103. Presentation of advanced concepts and processes in manufacturing. Topics include engineering for product life cycles, automated manufacturing, computer-aided design and manufacturing, real-time quality control and associated sensing, introduction to manufacturing research.

IEM 4413*
Industrial Organization Management
Prerequisite(s): 2903, 3703. Issues, concepts, theories and insights of engineering management and applications emphasizing effective performance.

IEM 4613*
Production Planning and Control Systems
Prerequisite(s): 4013. Concepts of planning and control for production and control systems. Design of operation planning and control systems. Techniques used in demand forecasting, operations planning, inventory control, scheduling, and progress control.

IEM 4713*
Introduction to Systems Simulation Modeling
Lab 2. Prerequisite(s): 4013. Simulation of discrete-event systems, including problem formulation, translation to a computer model, and use of a model for problem solution as well as concepts of random variable selection and generation, model validation and statistical analysis of results.

IEM 4723*
Information Systems Design and Development
Prerequisite(s): 2903, 3703. Information systems development methodologies, modeling methods and software tools for the design and development of information systems. Different phases of system design and implementation. Data modeling using entity-relationship diagrams and process modeling using data flow diagrams, IDEF0 and IDEF3. Introduction to enterprise resource planning systems and their use within different enterprise functional units.

IEM 4733
Engineering Business Processes
Prerequisite(s): 4723. Business-related process fundamentals including functional units, strategy and performance measurement within and between manufacturing and/or service-related operations. Modern enterprise structures such as virtual enterprises and supply chains. Techniques for the design and engineering of intra and inter-enterprise processes; functional and process modeling, qualitative analysis, quantitative analysis, and automation technologies.

IEM 4823*
Industrial Ergonomics
Lab 3. Prerequisite(s): 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.

IEM 4913
Senior Design Projects
Lab 6. Prerequisite(s): 3403, 3503, consent of instructor; IEM majors only. 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. Normally taken during student's last semester of undergraduate work.

IEM 4931
Industrial Engineering and Management Seminar
Prerequisite(s): 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, personal management of time and money, and job-related expectations. Taught by senior faculty; utilizes outside speakers.

IEM 4953
Industrial Assessment and Improvement
Prerequisite(s): Senior standing and consent of instructor. Plant assessment and improvement-based concepts, strategies, and tools for manufacturing operations. Emphasis is on small to medium-sized manufacturing operations. Issues include energy, water, waste, quality, and productivity analysis across the organization from a systems perspective. Justification of improvement projects and measurement of results.

IEM 4990
Selected Topics in Industrial Engineering and Management
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Study of selected contemporary topics in industrial engineering and management, including operations research; quality; manufacturing systems; engineering management; enterprise systems and supply chains; facilities, energy, and environmental management.

IEM 5000*
Research and Thesis
1-6 credits, max 6. Prerequisite(s): Approval of major adviser. Research and thesis for master's students.

IEM 5003*
Statistics and Research Methods
Prerequisite(s): 3103 or STAT 4033 or equivalent. 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.

IEM 5010*
Industrial Engineering Projects
1-6 credits, max 6. Prerequisite(s): Consent of school head and approval of major adviser. Special graduate projects and independent study in industrial engineering.

IEM 5013*
Linear Modeling II
Prerequisite(s): 4013 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 capacited flow networks.

IEM 5020*
Graduate Engineering Practicum
1-3 credits, max 3. Prerequisite(s): Consent of IEM adviser and satisfactory completion of 12 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.*

IEM 5023*
Optimization Applications
Prerequisite(s): 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 & MAE 5703)***

IEM 5030*
Engineering Practice
1-9 credits, max 12. Prerequisite(s): Approval of adviser. 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 adviser. 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.*

IEM 5033*
Linear Optimization
Prerequisite(s): 4013 or equivalent. Algorithms for linear optimization, including linear programming and network optimization. Simplex algorithm to solve deterministic linear optimization models considering maximization and minimization objectives. Degeneracy, alternative optima and no feasible solutions. Revised simplex procedures. Duality theory, economic interpretations, dual simplexing and complementary pivoting. Sensitivity analysis and parametric programming. Interior point methods. Minimum cost, maximum flow, Dijkstra and other network optimization algorithms.

IEM 5043*
Nonlinear Optimization
Prerequisite(s): 5033 or equivalent. Theoretical and practical aspects of nonlinear optimization, integer optimization, and dynamic programming. 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.

IEM 5103*
Breakthrough Quality
Prerequisite(s): 4103 and 4113 or equivalents. Structured, systematic approach and advanced statistical and modeling tools to achieve breakthrough improvement 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.

IEM 5113*
Strategic Quality Leadership
Prerequisite(s): STAT 4013 or equivalent and graduate standing. 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.

IEM 5123*
Service Quality
Prerequisite(s): 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.

IEM 5133*
Stochastic Processes
Prerequisite(s): MATH 2233, MATH 3013, STAT 5123. 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 & MATH 5133)***

IEM 5143*
Reliability and Maintainability
Prerequisite(s): 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.

IEM 5153*
Process Design and Integration
Prerequisite(s): 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.

IEM 5163*
Service Systems and Processes
Prerequisite(s): 3103, 3503, 4613. Design and analysis of service systems and processes from the perspective of industrial engineering and engineering management. Application of basic industrial engineering principles and tools applied to service systems. Basics of service quality and productivity, including metrics, measurement, and improvement.

IEM 5203*
Advanced Facility Location and Layout and Material Handling Systems
Prerequisite(s): 3503, 4013, 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.

IEM 5303*
Computer Integrated Manufacturing
Systems Design for Higher Volume Products
Prerequisite(s): 4613, 3303 or equivalents. Principles and procedures related to the design, implementation, documentation, and control of manufacturing systems focusing on higher volume, lower product variety production systems. Introduction to product life cycle concepts and the application of computer-aided design and computer-aided manufacturing tools to 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. Operational philosophies and applicable systems concepts, especially those relating to line design, analysis, efficiency, and unit production cost reduction.

IEM 5313*
Computer Integrated Manufacturing
Systems Design for Lower Volume Products
Prerequisite(s): 3303, 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.

IEM 5350*
Industrial Engineering Problems
1-6 credits, max 6. Prerequisite(s): Approval of major adviser. A detailed investigation into one area of industrial engineering with a required written report.

IEM 5363*
Management of Cellular Manufacturing Systems
Prerequisite(s): 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, justification and implementation.

IEM 5413*
Managing the Engineering and Technical Function
Prerequisite(s): 4413 or equivalent industrial experience. Advanced study of the engineering and technical organization. Engineering and technical functions, management process, roles, and activities. Individual study of current technical management issues of student interest.

IEM 5503*
Financial and Advanced Capital Investment Analysis
Prerequisite(s): 3503, 4013, STAT 4033 or IEM 3103 or equivalent. An understanding of financial concepts and markets, and an advanced treatment of proper methods of capital project selection under risk and uncertainty. Decision making under capital rationing. Financial environment and valuing securities, representing cash flows, selecting investments, avoiding common pitfalls, evaluating timing consideration, depreciation and corporate taxation, replacement analysis, and incorporating risk and uncertainty.

IEM 5603*
Project Management
Prerequisite(s): 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.

IEM 5613*
Integrated Manufacturing Control Systems
Prerequisite(s): 4613. Advanced treatment of planning and control philosophies and techniques for manufacturing and production systems. Approaches focusing on demand-driven control and achieving competitive advantage through manufacturing. Material requirements planning, capacity planning, shop floor control, master scheduling, production planning and demand management. Just-in-time and the theory of constraints.

IEM 5623*
Project Planning and Control Technologies
Prerequisite(s): 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 implementation issues.

IEM 5633*
Advanced Production Control
Prerequisite(s): 4013, 4613. 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 disaggregation, static 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.

IEM 5703*
Discrete System Simulation
Prerequisite(s): 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 simulation languages and related software tools.

IEM 5713*
Statistical Topics in Simulation Modeling
Prerequisite(s): 4713 or 5703. Statistical analysis 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.

IEM 5723*
Data, Process and Object Modeling
Prerequisite(s): Graduate standing or consent of instructor. Logical and physical models in the analysis, design and improvement of enterprise systems. Structured and object-oriented analysis and design techniques. Data modeling using entity-relationship diagrams and IDEF1x. Data normalization techniques. Process modeling using data flow diagrams, IDEF0, IDEF3, and Petri nets. Object modeling using the unified modeling language (UML).

IEM 5743*
Information Systems and Technology
Prerequisite(s): Graduate standing or consent of instructor. For current and potential engineering and technology managers. Knowledge of 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.

IEM 5753*
Manufacturing Enterprise Modeling
Prerequisite(s): 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.

IEM 5763*
Supply Chain Strategy
Prerequisite(s): 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.

IEM 5773*
Supply Chain Modeling
Prerequisite(s): 4713 or 5703; 5013 or 5033 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.

IEM 5803*
Human Factors
Lab 3. Prerequisite(s): Graduate standing and consent of instructor. Human factors theories and concepts and their impact on job and organization design. Evaluation and analysis of human performance in the workplace. System redesign for improved human-machine interaction.

IEM 5813*
Performance Measurement Systems
Prerequisite(s): 3813, 4413 or equivalents. Strategies and methods to define, measure, and apply individual, group- and organizational-level 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.

IEM 5823*
Performance Management and Improvement
Prerequisite(s): 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.

IEM 5913*
Decision-making Models for Multi-objective Analysis
Prerequisite(s): 4013. 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.

IEM 5923*
Advanced Energy and Water Management
Prerequisite(s): 4953. Continuation of material covered in 4953 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.

IEM 5943*
Hazardous Material and Waste
Prerequisite(s): 3503 or equivalent, CHEM 1414 or 1515 or equivalent. Management of hazardous materials and waste by the generator to reduce operating costs and protect employees. Emphasis on hazard communication program, reducing volume and toxicity, and management activities.

IEM 5953*
Industrial Assessment and Improvement
Prerequisite(s): Senior standing and consent of instructor. Plant assessment and improvement-based concepts, strategies, and tools for manufacturing operations. Small to medium-sized manufacturing operations. Energy, water, waste, quality, and productivity analysis across the organization from a systems perspective. Justification of improvement projects and measurement of results.

IEM 5990*
Special Topics in Industrial Engineering and Management
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Study of selected contemporary topics in industrial engineering and management including operations research; quality and reliability; manufacturing systems; engineering management; enterprise systems and supply chains; facilities, energy, and environmental management.

IEM 6000*
Research and Thesis
1-15 credits, max 30. Prerequisite(s): Approval of major adviser and advisory committee. Independent research for PhD dissertation requirement under direction of a member of the Graduate Faculty.

IEM 6110*
Special Problems in Industrial Engineering
1-6 credits, max 12. Prerequisite(s): 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.

IEM 6123*
Queuing Systems: Theory and Manufacturing Applications
Prerequisite(s): 5003, STAT 4033, 5133 or consent of instructor. Review of probability, stochastic processes, and Markov chains. Single-server and multi-server exponential queuing models. Queuing models with Poisson arrivals and general service times. Product form queuing network models: open and closed network models, mean value analysis algorithms for closed models, and single class and multiclass models. Approximations for general single server queues and non-product form networks. Applications of queuing models in the performance analysis of transfer lines, automatic assembly systems, and flexible manufacturing systems.

IEM 6990*
Advanced Topics in Industrial Engineering and Management
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Study of advanced topics in industrial engineering and management including operations research, quality and reliability, manufacturing systems, engineering management, enterprise systems and supply chains, facilities, energy, and environmental management.

International Studies (INTL)

INTL 5000*
Thesis
1-6 credits, max 6. Prerequisite(s): Graduate standing and consent of adviser. For students studying for a master's degree in international studies under the thesis option.

INTL 5010*
Contemporary Issues in International Studies
1-6 credits, max 6. Prerequisite(s): Graduate standing. Study of contemporary international issues, including news reports, speeches from foreign dignitaries, political leaders and experts in selected international fields.

INTL 5100*
Research in International Studies
3-6 credits, max 6. Prerequisite(s): Graduate standing. Individually supervised research on topic within the student's focus area for the International Studies Program.

INTL 5110*
International Studies Internship
1-6 credits. Prerequisite(s): Graduate standing and consent of Director. Individually supervised internships in international career areas.

INTL 5213*
International Relations, Affairs and Policy
Prerequisite(s): Graduate standing. Research on the mechanics and theories of interaction between economic and political phenomena.
(Same course as POLS 5213*)

INTL 5223*
Culture, History and World Systems
Prerequisite(s): Graduate standing. Study of the impact and influence of culture and history on the development of contemporary world systems with future projections. ***(Same course as SOC 5223*)***

INTL 5233*
Global Competitive Environment
Prerequisite(s): 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*)***

INTL 5243*
Globalization and Culture
Critical assessment of 20th century social scientific theories of development culminating in current theories of globalization. Exploration of capitalism's antecedents, origin, and proliferation. Evaluation of global inequality from a cross-culture perspective. Utility of anthropological theories of culture, ideology and hegemony in assessing local responses to globalization. *No credit for students with credit in ANTH 5243.*

Japanese (JAPN)

JAPN 1115
Elementary Japanese I
Pronunciation, conversation, grammar and reading.

JAPN 1225
Elementary Japanese II
Prerequisite(s): 1115 or equivalent. Reading, the writing system, culture, grammar, conversation.

JAPN 2113
(I)Intermediate Japanese I
Prerequisite(s): 1225 or equivalent proficiency. Oral and written practice of modern Japanese. A continuation of 1225.

JAPN 2223
(I)Intermediate Japanese II
Prerequisite(s): 2113 or equivalent proficiency. A continuation of 2113.

JAPN 3012
Advanced Japanese Conversation I
Prerequisite(s): 2223 or equivalent proficiency. Designed to increase facility and naturalness of delivery in dialogue. Development of general oral and aural proficiency.

JAPN 3112
Advanced Japanese Conversation II
Prerequisite(s): 3012 or equivalent proficiency. Designed to increase facility and naturalness of delivery in dialogue. Development of general oral and aural proficiency.

JAPN 3133
Readings in Japanese I
Prerequisite(s): 2223 or equivalent proficiency. Development of the student's competence in reading a wide variety of materials by contemporary Japanese writers.

JAPN 3333
Readings in Japanese II
Prerequisite(s): 3133. A continuation of 3133.

Journalism and Broadcasting (JB)

JB 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.

JB 2003
Mass Media Style and Structure
Lab 2. Prerequisite(s): ENGL 1213 or 1223 or 1413 with grade of "C" or better. JB majors only. Elementary writing and editing techniques in print, broadcasting and other media.

JB 2013
Principles of Advertising
Prerequisite(s): JB majors only. Process of advertising examined from the perspectives of art, business and communication. Introductory course for 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.

JB 2183
Principles of Public Relations
Prerequisite(s): JB majors only. An introduction to the history, development and current practice of public relations as a process in building relationships between organizations and publics.

JB 2843
Sports and the Media
Prerequisite(s): JB Majors only. How the sports media work and an understanding of the history of sports journalism and sports and culture in America. Also examines sports literature, women in sports, sports media, sports and racial issues.

JB 3013
Advertising Media and Markets
Prerequisite(s): 2003 with "C" or better, 2013 with "C" or better, minimum grade of 70 on Language Exam. Introduction to the strategic use of media. Major principles of media planning and buying, audience measurement, media re-search, new media technology, and market segmentation. Television, radio, magazine, newspaper, outdoor and the Internet.

JB 3153
Fundamentals of Audio and Video Production
Lab 2. Prerequisite(s): 2003 with "C" or better, minimum grade of 70 on Language Exam. Theory and practice of basic audio and video production techniques leading to later applications in radio, television and multimedia production.

JB 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.

JB 3263
Reporting
Lab 2. Prerequisite(s): 2003 with "C" or better, minimum grade of 70 on Language Exam. Reporting and writing through enterprise techniques for news coverage.

JB 3283
Public Relations Communications Methods
Prerequisite(s): 2003 with "C" or better, 2183 with "C" or better, minimum grade of 70 on Language Exam. An analysis and application course focused on the communications methods and techniques used in the practice of public relations.

JB 3293
Visual Communication
Prerequisite(s): 2003 with "C" or better, minimum grade of 70 on Language Exam. 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.

JB 3313
News Editing I
Lab 2. Prerequisite(s): 3263 with grade "C" or better, minimum grade of 70 on Language Exam. Copy editing, design and headline writing for newspapers and magazines.

JB 3383
Public Relations Management and Strategies
Prerequisite(s): 2003 with grade "C" or better, 2183 with "C" or better, minimum grade of 70 on Language Exam. The practice and techniques of public relations as a management function in business, industry, agriculture, government, education and other fields.

JB 3400
Advertising Internship
1-3 credits, max 3. Prerequisite(s): 3603 or 3803 with grade of "C" or better; minimum grade of 70 on Language Exam; consent of instructor. Internship practice for qualified advertising students who wish creative communications experience beyond that available in the classroom.

JB 3500
News Editorial Internship
1-3 credits, max 3. Prerequisite(s): 3263 with grade of "C" or better; minimum grade of 70 on Language Exam; consent of instructor. Internship practice for qualified news editorial students who wish creative communications experience beyond that available in the classroom.

JB 3553
Broadcast News Writing I
Lab 3. Prerequisite(s): 3153 with "C" or better, 3263 with "C" or better, minimum grade of 70 on Language Exam. 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.

JB 3600
Public Relations Internship
1-3 credits, max 3. Prerequisite(s): 2003 with grade of "C" or better; 2183 with grade of "C" or better; minimum grade of 70 on Language Exam; consent of instructor. Internship practice for qualified public relations students who wish creative communications experience beyond that available in the classroom.

JB 3603
Advertising Copywriting
Lab 2. Prerequisite(s): 2003 with "C" or better, 2013 with "C" or better, minimum grade of 70 on Language Exam. An examination of the language of advertising. In-depth skills development in commercial writing for print, broadcast, and direct mail.

JB 3623
Internet Communications
Lab 2. Prerequisite(s): 2003 with "C" or better, minimum grade of 70 on Language Exam. Theoretical and practical understanding of how the Internet is changing the way mass media and media-related organizations communicate with audiences.

JB 3753
Graphic Communication
Lab 2. Prerequisite(s): 2003 with "C" or better, minimum grade of 70 on Language Exam. Creative and practical aspects of typography, layout and design, and production of printed communication.

JB 3783
Sports Public Relations
Prerequisite(s): 2843 and 3283 with grade of "C" or better; , minimum grade of 70 on Language Exam. Exploration of the role practitioners play in the sports industry focusing on the role of promotion in all aspects of sports, fundamentals of sports publicity and promotional campaigns.

JB 3803
Advertising Layout and Design
Lab 2. Prerequisite(s): 2003 with grade of "C" or better; 2013 with grade of "C" or better; minimum grade of 70 on Language Exam. A comprehensive look at the design of print advertising, magazine, outdoor, direct mail, and others. Lab component offers hands-on instruction and skills development.

JB 3823
Photography I
Lab 2. Prerequisite(s): 2003 with a grade of "C" or better, minimum grade of 70 on Language Exam. Expression of visual communications through photography. Creating and producing photographs using digital equipment and understanding lenses, exposures, color and composition. Manipulation, color and tone correction of photography using photo-editing software. For students who want an elementary understanding of photography or to prepare for advanced work in photography or photojournalism.

JB 3853
Sports Writing
Lab 2. Prerequisite(s): 2843 and 3263 with grade of "C" or better, minimum grade of 70 on Language Exam. Hands-on experience stressing the basics of sports writing and reporting. Advances, game stories, sidebars, features and columns. A writing intensive lab class.

JB 3873
Audio Production
Lab 2. Prerequisite(s): 3153 with "C" or better, minimum grade of 70 on Language Exam. Theory and practice of communication using electronic media. Students prepare and present materials in a broadcasting situation.

JB 3900
Broadcast Internship
1-3 credits, max 3. Prerequisite(s): 3153 with "C" or better, minimum grade of 70 on Language Exam, and consent of instructor. Preparation and participation in all phases of radio-television and cable through active internship program.

JB 3913
Video Production
Lab 3. Prerequisite(s): 3153 with "C" or better, minimum grade of 70 on Language Exam. Electronic field production and post-production techniques, including videography, lighting, special effects, audio, directing and creative producing. A major emphasis on nonlinear editing and taking projects from conception to completion.

JB 3943
Photojournalism
Lab 2. Prerequisite(s): 2003 with "C" or better, minimum grade of 70 on Language Exam. Theory and practice in the digital techniques of photojournalism. Intermediate concepts of lighting, 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.

JB 4053
Performance in Electronic Sports Media
Lab 2. Prerequisite(s): 2843 and 3153 with grade of "C" or better, minimum grade of 70 on Language Exam; 3553 recommended. Theory and practice of electronic media sports coverage. Emphasis on the role, skills and practices of radio and television sports announcers and electronic sports media journalism.

JB 4123
Public Relations Crisis Communications
Prerequisite(s): 3263 with grade of "C" or better; 3283 with grade of "C" or better; minimum grade of 70 on Language Exam. The nature of organizational crises and the techniques for preparing crisis communications plans for various types of organizations.

JB 4163
Mass Communication Law
Prerequisite(s): 2003 with grade of "C" or better, minimum grade of 70 on Language Exam. Statutes and case decisions in print and broadcast law, including government regulation of broadcasting by the FCC and media relations with other regulatory agencies. *No credit for students with credit in MC 5163.* ***(Same course as MC 5163)***

JB 4223
Media Sales and Marketing
Prerequisite(s): 2003 with grade of "C" or better, minimum grade of 70 on Language Exam. Sales development, pricing, promotion and other aspects of broadcast sales and sales management.

JB 4243
Programs and Audiences
Prerequisite(s): 2003 with grade "C" or better, minimum grade of 70 on Language Exam. 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.

JB 4253
(I)International Mass Communication
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. *No credit for students with credit in MC 5253.* ***(Same course as MC 5253)***

JB 4313
Public Affairs Reporting
Lab 2. Prerequisite(s): 3263 with grade "C" or better, minimum of 70 on Language Exam. Coverage of social problems, people and events in fields of government, business, science, sports and entertainment.

JB 4360
Special Problems in Journalism and Broadcasting
1-3 credits, max 6. Prerequisite(s): 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.

JB 4383
Media Relations
Prerequisite(s): Senior standing, minimum graduation/retention grade point average of 2.5. Strategies for dealing with the news media. Students will gain hands-on experience in conducting media news conferences, pitching story ideas and preparing themselves and other for dealing with news media interviews. *Meets with MC 5383. No credit for students with credit in MC 5383.*

JB 4393
Computer-Assisted Journalism
Lab 2. Prerequisite(s): 3263 with grade "C" or better, minimum grade of 70 on Language Exam, STAT 2013 or 2023 or 2053. 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.

JB 4413
Advanced Reporting and Writing
Prerequisite(s): 4313 with grade "C" or better, minimum grade of 70 on Language Exam. Enhancement of writing style and reporting techniques; evaluation of sources and polling practices, and investigative coverage of newsmakers and events.

JB 4423
News Editing II
Lab 2. Prerequisite(s): 3313 with grade "C" or better, minimum grade of 70 on Language Exam. Advanced copy editing; ethics and legal considerations from an editor's viewpoint; design techniques for newspapers and magazines, including picture editing, introduction to type, makeup and design practices, and special pages.

JB 4433
Feature Writing for Newspapers and Magazines
Prerequisite(s): 15 credit hours of English or journalism. Newspaper features and special articles for general circulation magazines, business and trade journals; sources, materials, markets and other factors pertinent to nonfiction writing.

JB 4493
Advanced Public Relations Media
Lab 2. Prerequisite(s): 3263 with grade "C" or better, 3283 with grade "C" or better, minimum grade of 70 on Language Exam. An advanced application course in planning, researching, writing, editing and designing of materials used in public relations communications.

JB 4520
Specialized Public Relations Applications
3 credits, max 6. Prerequisites: 3283 with grade "C" or better, minimum grade of 70 on Language Exam. Professional public relations at an advanced level. Public relations study of non-profit, corporate, agency, international and other specialized applications. Course content varies by semester. *No credit for students with credit in MC 5520.* ***(Same course as MC 5520)***

JB 4530
Specialized Advertising Applications
3 credits, max 6. Prerequisite(s): 3603 with a "C" or better, 3803 with a "C" or better, minimum grade of 70 on Language Exam. Professional advertising at an advanced level. Special topics courses in areas such as globalization, convergence and the digital realm or scene. Course content varies by semester. *Meets with MC 5530. No credit for students with credit in MC 5530.*

JB 4540
Specialized Broadcast Applications
3 credits, max 6. Prerequisite(s): 3153 with a "C" or better, minimum grade of 70 on Language Exam. Professional broadcast journalism at an advanced level. Special topics in areas such as sports media production, announcing, performance; political, investigative and sports reporting; advanced audio production. Course content varies by semester. *Meets with MC 5540. No credit for students in MC 5540.*

JB 4553
Broadcast News Writing II
Lab 3. Prerequisite(s): 3553 with grade "C" or better, minimum grade of 70 on Language Exam. Advanced broadcast news writing with emphasis on techniques of feature and in-depth reporting for radio, television and cable television. Students work up to two full-time days per semester producing OSU cable news show and serve as writers and anchors.

JB 4560
Specialized News-Editorial Applications
3 credits, max 6. Prerequisite(s): 3263 with a "C" or better, minimum grade of 70 on Language Exam. Professional news-editorial at an advanced level. Special topics in areas such as investigative, political, sports and business reporting; feature, column and editorial writing; advanced layout and design. Course content varies by semester. *Meets with MC 5560. No credit for students with credit in MC 5560.*

JB 4573
Broadcast Documentary
Lab 3. Prerequisite(s): 3553 with grade "C" or better, 3913 with grade "C" or better, minimum grade of 70 on Language Exam. Student-written and produced broadcast and cablecast mini-documentaries; analysis of selected programs.

JB 4603
Integrated Marketing Communications
Prerequisite(s): 2003 with grade "C" or better; 2013 with grade "C" or better or 2183 with grade "C" or better or MKTG 3213 with grade "C" or better; minimum grade of 70 on Language Exam. 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 examine strategies for combining and integrating them into an effective campaign. Theories, models and tools to make better promotional communication decisions. *No credit for students with credit in MC 5603.* ***(Same course as MC 5603)***

JB 4623
Advertising Campaigns
Prerequisite(s): 3013, 3603 and 3803 with grade of "C" or better; minimum grade of 70 on Language Exam. Planning, preparation and presentation of comprehensive advertising and marketing campaigns for national or local clients. Student teams produce all aspects of the campaign, from conception to presentation. Satisfies capstone requirement for advertising majors.

JB 4653
Electronic Media Advertising
Lab 2. Prerequisite(s): 3603 with grade of "C" or better, minimum grade of 70 on Language Exam. A concentrated examination of how advertising is prepared for electronic media, including developing media technologies. Radio, television, web-based streaming and Internet and their unique contribution to advertising.

JB 4663
Professional Portfolio
Lab 2. Prerequisite(s): 2003 with grade of "C" or better, minimum grade of 70 on Language Exam, junior or senior standing. Course is designed to help students polish up and present their design and creative work in an integrated package coupled with personalized identity materials for professional interviews. Emphasis will be on applying advanced visual and graphic communication theories to present an attractive and persuasive portfolio of creative work. It is intended for students who have completed a significant amount of course work in their field and have printed communication samples that they have produced in classes, student media or internships. *Students enrolling in Professional Portfolio are assumed to have an intermediate level of experience with desktop design software packages.*

JB 4733
Responsibility in Mass Communications
Prerequisite(s): 2003 with "C" or better, minimum grade of 70 on Language Exam. Interaction between mass media and society with emphasis upon the communicator's ethics and responsibilities. *Meets with MC 5733. No credit for students with credit in MC 5733.*

JB 4753
Media and Elections
Prerequisite(s): 2003 with "C" or better, minimum grade of 70 on Language Exam. Examination of media's role in the political process with primary emphasis on print and broadcast journalism practices. *Meets with MC 5753. No credit for students with credit in MC 5753.*

JB 4773
Censorship
Prerequisite(s): 2003 with grade of "C" or better, minimum grade of 70 on Language Exam. A critical examination of historical and contemporary occurrences of censorship from legal, philosophical, political, religious and sociological perspectives. The course will explore the definition of censorship, the common elements found in all forms of censorship, the rationalizations and justifications for censorship, and the consequences and unintended results of censorship. *No credit for students with credit in MC 5773.*
(Same course as MC 5773)

JB 4813
Sports Media Production
Lab 2. Prerequisite(s): 2843, 3553 and 3913 with grade of "C" or better, minimum grade 70 on Language Exam. Capstone course in sports broadcast production. Students will learn the pre-production and production requirements for a variety of broadcast sporting events with special emphasis on the theories of sport and implications of those theories on media production.

JB 4843
Public Relations Research and Campaigns
Prerequisite(s): 3263 with grade "C" or better, 3283 with grade "C" or better, minimum grade of 70 on Language Exam. Capstone course requiring public relations students to prepare a public relations campaign involving the public relations process; research, planning, communications and evaluation.

JB 4863
Media Management
Prerequisite(s): 2003 with grade "C" or better, minimum grade of 70 on Language Exam. 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 communications. *No credit for students with credit in MC 5863.* ***(Same course as MC 5863)***

JB 4883
Sports in the Newsroom
Lab 2. Prerequisite(s): 4313 with "C" or better, minimum grade of 70 on Language Exam. Capstone course in print sports journalism. Emphasis on the role of sports and the sports media in American society, ethical considerations, how the sports media reflect our views on gender and race, the modern sports section in American newspapers and management techniques.

JB 4933
Advanced Sports Public Relations
Prerequisite(s): 3263 with "C" or better, 3783 with "C" or better, minimum grade of 70 on Language Exam. Capstone course in sports public relations. Emphasis on the many roles of a sports PR practitioner. Through hands-on experience, students will gain a better understanding of sports PR campaign organization and how to handle athletic media inquiries and news conferences.

JB 4953
Advanced Production Practices
Lab 3. Prerequisite(s): 3913 with grade "C" or better or 4553 with grade "C" or better, minimum grade of 70 on Language Exam. Advanced professional television production. Student produced and directed television programs, including "specials," for distribution on cable or other professional media.

JB 4960
Live Field Production
3 credits, max 6. Prerequisite(s): 3153 with "C" or better, minimum grade of 70 on Language Exam or consent of instructor. Development of a live, in-the-field production from writing the program proposal to an actual broadcast, in a setting that closely mirrors a broadcast environment.

JB 4980
Advertising Competitions
3 credits, max 6. Prerequisite(s): Consent of instructor. Research and construction of a comprehensive communications marketing campaign for the America Advertising Federation National Student Advertising Competition. Student team members must make application for admission.

JB 4993
Senior Honors Thesis
Prerequisite(s): 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 journalism and broadcasting.*

Landscape Architecture (LA)

LA 1013
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/landscape contractor and the need for design and management of outdoor space and structures and the environment.

LA 2213
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.

LA 2223
Landscape Architecture Graphics II
Lab 3. Prerequisite(s): 2213. The application of multimedia color presentation and delineation techniques to more complex plans, drawings and programs.

LA 2323
Computer-aided Design
Lab 2. Prerequisite(s): 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.

LA 2513
(D)Native American Symbolism in Landscape Design
Lab 3. Study of cultural diversity through Native American symbolism and application of these symbols as design elements relating to functional and aesthetic qualities in landscape design.

LA 3010
Internship in Landscape Architecture and Landscape Contracting
1-7 credits, max 10. Prerequisite(s): 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.*

LA 3112
Landscape Architecture Seminar I
Prerequisite(s): 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.*

LA 3314
Landscape Architectural Design I
Lab 8. Prerequisite(s): 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.

LA 3324
Landscape Architectural Design II
Lab 8. Prerequisite(s): 3314. The design of small to medium scale areas with an emphasis on design process, site analysis and computer-aided design applications.

LA 3673
(H)History and Theory of Landscape Architecture
History and historic styles and approaches to landscape architectural design. Past and present landscape design theory.

LA 3682
Professional Practice and Office Procedure
Ethics, office practice and procedure. Contract documents and specifications relating to landscape architecture.

LA 3884
Landscape Architectural Construction I
Lab 4. Prerequisite(s): 2323, MCAG 2313. Review 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 Auto CAD and other computer applications.

LA 3894
Landscape Architectural Construction II
Lab 4. Prerequisite(s): 2323, 3884. Advanced grading and drainage, horizontal and vertical roadway alignment, site layout and dimensioning, construction documents, site utilities, engineering properties of soils, introduction to paving and drainage construction materials, introduction to retaining wall design and site lighting. Semester project covering construction documents, site layout and dimensioning, grading and drainage, cut and fill, site utilities, retaining walls, site lighting and cost estimating utilizing Auto CAD and other computer applications.

LA 4034*
Landscape Planting Design
Lab 4. Prerequisite(s): 3324, HORT 2313 and 2413. Plants in the landscape as aesthetic and functional elements. Environmental enhancement by and for plants. Preparation of planting sketches, plans and specifications.

LA 4050
International Experience in Landscape Architecture
1-3 credits, max 6. Prerequisite(s): Consent of appropriate faculty member. Participation in a formal or informal educational experience related with landscape architecture outside of the USA. *Student must enroll in this course for at least 3 credit hours to fulfill the general education "I" requirement.*

LA 4112
Landscape Architecture Seminar II
Prerequisite(s): 4514. Topics in landscape architecture and related fields, career exploration and job placement. Out-of-state field trips to completed landscape architecture projects. *Required of fifth year students.*

LA 4414*
Landscape Architectural Design III
Lab 8. Prerequisite(s): 3324, 3884. Medium scale site development projects with an emphasis on landforms, structures and computer-aided design applications. *Portfolio must be reviewed and approved in Design II for admittance to the professional phase of the program.*

LA 4424*
Landscape Architectural Design IV
Lab 8. Prerequisite(s): 4414, 4894. Medium-scale complex landscape architectural design projects with emphasis on arrangement and design of landscape elements as they relate to functional and aesthetic qualities. Integration of landscape construction detailing, drawings as part of design presentation, and computer-aided design applications.

LA 4433*
Land Use and Community Planning
Lab 3. Prerequisite(s): 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.

LA 4514*
Landscape Architectural Design V
Lab 8. Prerequisite(s): 4424, 4894. The design of large-scale sites with an emphasis on mixed use developments and computer-aided design applications.

LA 4524*
Landscape Architectural Design VI
Lab 10. Prerequisite(s): 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.

LA 4573*
Recreation Planning
Lab 6. Prerequisite(s): Consent of instructor. Theory and methods for small and large scale area planning with emphasis on natural and cultural resources.

LA 4583*
Landscape Environmental Planning
Lab 6. Prerequisite(s): 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.

LA 4894*
Landscape Architectural Construction III
Lab 4. Prerequisite(s): 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.

LA 4990*
(I)Landscape Architecture Special Problems
1-6 credits, max 12. Prerequisite(s): Consent of appropriate faculty member. Landscape architectural related problems.

LA 5110*
Advanced Special Problems
1-12 credits, max 20. Prerequisite(s): Consent of appropriate faculty member. Specific landscape architectural problems.

Latin (LATN)

LATN 1113
Elementary Latin I
The rudiments of beginning Latin: grammar, vocabulary and elementary readings.

LATN 1223
Elementary Latin II
Prerequisite(s): 1113 or equivalent proficiency. Continuation of 1113. Grammar, vocabulary and readings.

LATN 2113
Elementary Latin III
Prerequisite(s): 1223 or equivalent. A continuation of 1223. Grammar and readings of Latin authors.

LATN 2213
Intermediate Readings
Prerequisite(s): 2113 or equivalent proficiency. Readings from Virgil's Aeneid.

LATN 3330
Advanced Readings in Latin
1-6 credits, max 9. Prerequisite(s): 2213. Prose authors, poetry, and medieval Latin.

Legal Studies in Business (LSB)

LSB 1113
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.

LSB 3010
Special Topics in Legal Studies in Business
1-3 credits, max 6. Prerequisite(s): 3213, prior consent of instructor. Analysis of a contemporary topic in business law. Changing social issues and trends in legal studies in business.

LSB 3213
Legal and Regulatory Environment of Business
Prerequisite(s): 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.

LSB 3323
Law of Commercial Transactions and Debtor-Creditor Relationships
Prerequisite(s): 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.

LSB 4413*
Law of Business Organizations
Prerequisite(s): 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.

LSB 4423*
Employment Law
Prerequisite(s): 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 work place and state workers compensation laws.

LSB 4523*
Law of Real Property
Prerequisite(s): 3213 or equivalent. Nature of real property and of the legal transactions relating thereto. Topics may include deeds and conveyancing, landlord-tenant relationships, mortgages, easements, oil and gas interests, types of estates, joint ownership, and legal descriptions.

LSB 4633
(I)Legal Aspects of International Business Transactions
Prerequisite(s): 3213 or equivalent. Legal aspects of operating a business entity engaged in international commerce. Topics may include: foreign business organizations, US taxation of foreign investors, common clauses in transnational contracts, problems of technology transfer on the international market, anti-trust aspects of international business, and jurisdictional problems in resolving disputes.

LSB 5010*
Research and Independent Studies
1-3 credits, max 10. A workshop arrangement or supervised independent study.

LSB 5163*
Legal Environment of Business
Prerequisite(s): 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.

LSB 5203*
Foundations of Issue and Conflict Management
Provides professionals from all fields with the skills necessary to handle conflicts, solve disputes, influence decisions and develop positive interpersonal relationships. It provides an overview of the alternative dispute resolution processes by utilizing readings, research, discussion and role-playing exercises.

LSB 5213*
Mediation and Facilitation: Theories and Practice
Prerequisite(s): 5203. This course examines the theories, skills, and boundaries of the mediation and facilitation processes, and analyzes the role of the third party neutral in the intervention and resolution conflicts. Ethical, practical and legal constraints are also addressed.

LSB 5223*
Negotiation and Third-Party Dispute Resolution
This course is designed to improve students' personal effectiveness and increase their productivity by drawing on the latest research in the psychology of judgment combined with the art of negotiation and decision-making. Students learn to develop effective strategies and systematic approaches to negotiations and influence opportunities. ***(Same course as MGMT 5713)***

LSB 5233*
Introduction to Arbitration and Litigation
Prerequisite(s): 5203. This course examines the elements and process of arbitration, situations, in which arbitration skills are required, including construction, securities, civil conflicts, labor disputes and commercial contracts. Topics include comparisons to litigation, the role of judicial review and the enforcement of arbitration awards.

LSB 5290*
Seminar in Negotiation and Alternative Dispute Resolution
1-3 credits. Prerequisite(s): Consent of instructor. Individual investigations in the areas of issue and conflict management under the direct supervision of a faculty member.

Leisure (LEIS)

LEIS 1232
Beginning Golf
Lab 2. Theory and practice of basic skills, rules, terminology and etiquette.

LEIS 1242
Beginning Tennis and Racquetball
Lab 2. Theory and practice of tennis and racquetball; basic skills, rules, terminology, and game strategy for singles and doubles play. *No credit for students with credit in 1252.*

LEIS 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.*

LEIS 1322
Bowling
Lab 2. Theory and practice of approaches, deliveries, releases and mechanical principles involved in aiming and follow through.

LEIS 1342
Physical Fitness
Lab 2. Theory and practice of aerobic and weight training activities with learning experiences designed to promote physical fitness.

LEIS 1352
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.

LEIS 1362
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.

LEIS 2112
Rock Climbing
Lab 2. Theory and practice in the basics of technical rock climbing, bouldering and spelunking.

LEIS 2122
Backpacking and Hiking
Lab 2. Theory and practice of outdoor skills and leadership techniques for executing and evaluating a wilderness activity.

LEIS 2322
Recreational Dance
Lab 2. Theory and practice of traditional social dances and a variety of "free style" dance forms.

LEIS 2403
Leisure and Society
The leisure phenomenon, the leisure services industry, and societal views of leisure in the United States. Exploration of personal and social views of leisure and how those views impact individuals, families and social groups.

LEIS 2413
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.

LEIS 2433
Introduction to Therapeutic Recreation
Theory and application of therapeutic recreation with emphasis on types of illnesses and disabilities, delivery systems, programming and services.

LEIS 2443
(D,S)Contemporary Issues in Diversity
Exploration of the primary and secondary dimensions of diversity and their impact on society. Individual and institutional responses to cultural diversity.

LEIS 2463
Laboratory in Leisure Services
Lecture, discussion and experiential learning of recreation and leisure activities. Adapted activities, small and large group games, sports, arts and crafts, music, drama and cultural events. Utilization of areas and facilities for leisure activities and development of activities across the lifespan. *Fee required.*

LEIS 2473
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.

LEIS 3010
Leisure Services Workshop
1-3 credits, max 6. Intensive training program on a specialized topic in leisure services.

LEIS 3313
Camp Operations and Programming
Operations and programming for day and resident camps. Includes all camp settings and camper populations.

LEIS 3413
Therapeutic Recreation and Mental Illness/Developmental Disabilities
Prerequisite(s): 2433. The role of Therapeutic Recreation (TR) specialists in working with individuals diagnosed with mental illness and/or developmental disabilities. Topics include terminology, etiology, prognosis, assessment, and program development in TR.

LEIS 3423
Therapeutic Recreation in Geriatric Practices
Prerequisite(s): 2433. The role of Therapeutic Recreation (TR) specialists working with the geriatric population. Topics include terminology, etiology, prognosis, assessment, and program development in TR.

LEIS 3431
Leisure Services Practicum I
Lab 3. Prerequisite(s): 2413. Supervised practical experience with leadership responsibilities for planning, conducting and evaluating activities and programs. *Graded on a pass-fail basis.*

LEIS 3432
Leisure Services Practicum II
Lab 2. Supervised practical experience with leadership responsibilities for planning, conducting and evaluating activities and programs. *Graded on a pass-fail basis.*

LEIS 3433
Therapeutic Recreation and Physical Disabilities
Prerequisite(s): 2433. The role of Therapeutic Recreation (TR) specialists in the rehabilitation of individuals with physical disabilities. Topics include terminology, etiology, prognosis of specific problems, assessment, and program development in TR.

LEIS 3463
Program Design in Leisure Services
Prerequisite(s): MATH 1513, MATH 1483 or equivalent. Emphasis on organization, supervision, promotion and evaluation of programs.

LEIS 3480
Junior Internship
3-6 credits, max 6. Prerequisite(s): 2413, 2473 and two courses in emphasis area of study (Therapeutic Recreation or Leisure Service Management). Supervised practical experience (minimum 200 to 400 contact hours based upon credit hours enrolled) with leadership responsibilities for planning, conducting and evaluating activities and programs. *Graded on a pass-fail basis.*

LEIS 3491
Pre-internship in Leisure Services
Preparation for internship in therapeutic recreation and leisure services management.

LEIS 4010
Directed Studies in Leisure
1-3 credits, max 6. Prerequisite(s): Consent of instructor and program head. Supervised readings, research or study of trends and issues related to leisure studies.

LEIS 4433
Evaluation of Leisure Services
Prerequisite(s): STAT 2013. Methods, techniques and application of the evaluation process related to a wide variety of leisure service functions: clientele, programs, personnel, facilities and organization.

LEIS 4463*
Areas and Facilities in Leisure Services
Prerequisite(s): 3463 or consent of instructor. Planning, design and development of areas and facilities in leisure service delivery systems.

LEIS 4473*
Outdoor Recreation
Theory and practical application of outdoor recreation concepts with emphasis on philosophies, principles, policies, economics, trends and problems.

LEIS 4480
Internship in Leisure Services
1-9 credits, max 9, Lab 2-18. Prerequisite(s): Last semester senior year with cumulative GPA of 2.5 and 500 approved experience hours. Co-requisite(s): 4483. Supervised field work experience in leisure services management or therapeutic recreation. *Graded on a pass-fail basis. Must be taken concurrently with 4483.*

LEIS 4481
Senior Seminar in Leisure Services
Prerequisite(s): Leisure major; completion of a minimum of 15 hours of Leisure Studies core courses. Culmination of course work in leisure studies. Examination of current issues, professional practices and personal philosophy of leisure.

LEIS 4483
Administrative Documentation in Leisure Services
Prerequisite(s): Last semester senior year with cumulative GPA of 2.5 and 500 approved experience hours. Co-requisite(s): 4480. The academic component to the culminating field experience for all Leisure Studies majors. *Must be taken concurrently with 4480.*

LEIS 4493
Administration of Leisure Services
Decision-making, problem solving, personnel policies, legal issues, fiscal policies and budget procedures related to the delivery of leisure services.

LEIS 4513*
Leisure Education
Prerequisite(s): 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.

LEIS 4553*
Tourism in Recreation Settings
Theory and foundations of the philosophy, principles and practices that associate tourism with recreation agencies and settings.

LEIS 4563*
Entrepreneurial Leisure Services
Prerequisite(s): 3463 or consent of instructor. Introduction to the scope, characteristics and management aspects of the commercial recreation industry from an entrepreneurial perspective.

LEIS 4933*
Advanced Methods in Therapeutic Recreation
Prerequisite(s): 3483 and consent of instructor. Theoretical and practical examination of contemporary implementation procedures used in therapeutic recreation practice.

LEIS 4943*
Grant Writing and Nonprofit Management
Methods and techniques used in grant writing as well as the establishment of a nonprofit agency.

LEIS 5000*
Master's Thesis
1-6 credits, max 6. Prerequisite(s): Consent of major professor. Research in leisure studies for master's degree.

LEIS 5020*
Workshop in Leisure Studies
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Advanced instruction on specialized topic area in leisure studies.

LEIS 5023*
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.

LEIS 5030*
Field Problems in Leisure Studies
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Applied research within the practice of leisure studies.

LEIS 5403*
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.

LEIS 5413*
Organization and Administration of Leisure Services
Systematic approach to problem solving and decision-making for structure, personnel management, finance and program development for leisure service delivery systems.

LEIS 5423*
Supervision and Leadership in Leisure Services
Prerequisite(s): Graduate standing. Administrative supervision and leadership in leisure services delivery systems. An examination of theories and practice as it relates to human, programmatic, and facility resources.

LEIS 5433*
Current Issues in Leisure Services
Prerequisite(s): Admission to the leisure studies program. Current issues related to the leisure services profession. Investigation, discussion and analysis of contemporary issues.

LEIS 5443*
Social Foundations of Leisure Services
Prerequisite(s): Graduate standing. Social, psychological, philosophical and historical foundations of leisure. The impact of social forces on leisure throughout history.

LEIS 5453*
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.

LEIS 5463*
Issues in Therapeutic Recreation
Prerequisite(s): LEIS 2433 or professional experience in therapeutic recreation. Current issues in therapeutic recreation with emphasis on accreditation, certification, licensure, quality assurance and ethics.

LEIS 5473*
Leisure and Aging
Prerequisite(s): 2433 or consent of instructor. Overview of the leisure needs and services for older adults, with emphasis upon the delivery system and leisure interventions.

LEIS 5483*
Therapeutic Recreation for Persons with Physical Disabilities
Prerequisite(s): 3483 or consent of instructor. Role of therapeutic recreation in the treatment and rehabilitation of individuals with physical disabilities, with emphasis on terminology, prognosis, etiology of specific disabilities, program development and assessment.

LEIS 5493*
Therapeutic Recreation in Mental Health and Mental Retardation
Prerequisite(s): 3483 or consent of instructor. Role of therapeutic recreation in mental health with emphasis upon client prognosis and methodologies of treatment programs.

LEIS 6000*
Doctoral Dissertation
1-25 credits, max 25. Required of all candidates for the Doctor of Philosophy degree. Credit is given upon completion of the dissertation.

LEIS 6010*
Independent Study in Leisure Studies
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Supervised readings, research or study of trends and issues related to leisure studies.

LEIS 6013*
Professional Issues in Leisure Studies
Prerequisite(s): Admission to the Graduate College. Introduction to higher education issues relevant to professional preparation in leisure studies curricula, including roles of the educator, curriculum development, implementation and management, instructional strategies and accreditation.

LEIS 6020*
Leisure Research Colloquium
1-3 credits, max 6. Prerequisite(s): Doctoral standing. Exploration and presentation of selected topics and research in leisure studies.

LEIS 6023*
Special Topics in Leisure Studies
Prerequisite(s): Admission to the Graduate College. Special topics related to recreation, parks and leisure studies. Investigation, discussion and analysis of contemporary topics.

LEIS 6043*
Ethical Issues in Health, Leisure, and Human Performance
Prerequisite(s): Admission to the Graduate College. A survey of ethical issues with specific emphasis on health, leisure, and human performance in higher education.

LEIS 6453*
Leisure Behavior
The advanced study of leisure and human behavior. Research related to the understanding of how and why humans engage in leisure.

LEIS 6763*
Management in Health, Leisure, and Human Performance Settings
Prerequisite(s): Admission to the Graduate College. Essential elements of organizational structures, management issues, functions and styles in public, non-profit and private settings in health, leisure and human performance.

Library Science (LBSC)

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.

LBSC 5013*
Library Media Center in the Schools
Effective utilization of the centralized school media center for the teaching-learning process.

LBSC 5113*
Selection of Print and Non-print Materials
Selection, evaluation and use of print and non-print materials including reference materials.

LBSC 5413*
Organization of Information
Basic principles of the organization of information in schools. Information and knowledge organization techniques that exist or are emerging and focuses on standards and tools that are used in educational environments.

LBSC 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.

LBSC 5823*
Administration of School Library Media and Technology Programs
Vision of, planning, organizing, policy making, staffing, budgeting, decision-making and evaluating a standards-based school library media or school technology program.

Management (MGMT)

MGMT 3013
Fundamentals of Management
Survey of management principles and techniques. Examines a variety of issues at individual, team and organizational levels and challenges faced by today's managers.

MGMT 3023
Entrepreneurship Fundamentals
Open to all majors. Exploration of the basic skills and knowledge needed to become a successful entrepreneur. Guest speakers and other materials will be used to prepare students for the challenges and rewards faced by those who own their own businesses.

MGMT 3123
Managing Behavior and Organizations
Prerequisite(s): 3013. Focuses on the complexities of human behavior in organizational settings. Performance expectations and determinants at the individual, team and organizational levels are examined. *Priority enrollment is given to management majors.*

MGMT 3133
Management Performance Development
Prerequisite(s): 3013. The study of personal, interpersonal and group factors relating to managerial performance. An integration of the theory and practice of management.

MGMT 3313
Human Resource Management
Prerequisite(s): 3013. Policies and practices used in personnel management. Focuses upon the functions of a human resource management department.

MGMT 3943
Sports Management
Prerequisite(s): 3013. Basic management skills necessary in the operation of sport organizations. The social, behavioral and managerial foundations of sport management, public relations, finance, economics, budgeting in the sport industry and managing a sports facility.

MGMT 4013
Current Topics in Management and Leadership
Prerequisite(s): 3013. Examination of selected topics representing the most current management and leadership theories and practices.

MGMT 4083*
Corporate and Social Responsibility
Prerequisite(s): 3013. Management of situations to minimize adverse consequences and serve an organization's best interests.

MGMT 4113*
Entrepreneurship
Prerequisite(s): 3013. Examination of the entrepreneurial process from the perspective of the entrepreneur/CEO. In a variety of business settings how product/market strategy, organizational design, and financial management interact to create and grow a business.

MGMT 4123*
Labor Management Relations
Prerequisite(s): 3013. Labor relations and collective bargaining. Negotiation and administration of labor agreements and employee relations in non-union organizations. Modes of impasse resolution.

MGMT 4133*
Compensation Administration
Prerequisite(s): 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.

MGMT 4143*
Preventive Stress Management
Prerequisite(s): 3123. Management to promote eustress (positive stress) and prevent or resolve distress (negative stress) in organizations. Psychophysiology of the stress response and the individual and organizational costs of distress. The principles and methods of preventive stress management.

MGMT 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.

MGMT 4313*
Organization for Action
Prerequisite(s): 3013. A behavioral approach to the study of inter-organizational processes and the implementation strategies of firms. Building on Strategic Management and Human Resource Management, from the behavioral science, the study of the cognitive, social, cultural, and political aspects of strategy implementation in simple and complex organizations.

MGMT 4413
Change Management
Prerequisite(s): 3013. Managing organizational change and redesign. The study of organizational change processes and the enhancement of performance through change management. Study of the body of knowledge and applications in this branch of organizational science.

MGMT 4483*
Entrepreneurship in Science and Technology
Prerequisite(s): Junior standing, ACCT 2103. Fundamental knowledge of entrepreneurship. Advanced business courses in technology commercialization or entrepreneurship. *For non-business majors.*

MGMT 4533*
Leadership Dynamics
Prerequisite(s): MGMT 3013. Leadership applications in business management. Contemporary business 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.

MGMT 4573
Managerial Decision Making
Prerequisite(s): 3013. The goal of this course is to help students become more effective decision-makers. It attempts to provide an understanding of decision-making at two levels - the individual and the group. It examines the mechanisms that underlie decision choices, preferences, and judgments, and through this examination, attempt to discover how to improve decision-making processes.

MGMT 4610
Entrepreneurship Practicum
1-6 credits, max 6. Prerequisite(s): 4113 or BADM 4513. Transfer of knowledge from entrepreneurship course work into practice through hands-on experiences, such as business development consulting projects, management of a venture capital fund and creation of a student-owned business.

MGMT 4613
(I)International Management
Prerequisite(s): 3013 or 3123. Survey of the organization, planning and management of international operations of business firms. Exploration of major cultural, economic and political systems and their effects on the management function.

MGMT 4623*
Small Business Management
Prerequisite(s): 3013 or 3123. Starting and managing a small business.

MGMT 4643*
Managing a Growing Business
Prerequisite(s): 3123, BADM 4513 (concurrent enrollment). The steps involved in managing a high-growth business.

MGMT 4650
Leadership Issues
1-6 credits, max 9. Prerequisite(s): 3013. Examination of leadership issues. Specific topics vary from semester to semester.

MGMT 4653*
Venture Capital and the Business Development Process
Prerequisite(s): 4663. Venture capital investing and the business development process investments. Essentials of the venture capital industry and corporate venturing.

MGMT 4663*
Analysis of Business Opportunities
Prerequisite(s): BADM 4513 (concurrent enrollment). Exploration of the techniques required for locating business opportunities, assessing their feasibility, and evaluating their potential returns.

MGMT 4693*
International Human Resource Management
Prerequisite(s): 3013 required, 3133 preferred and LSB 4423 recommended. A comparison of human resource management policies and practices in the United States with those of major US trading partners. Major human resource functions such as planning, staffing, training, compensation, performance appraisal and labor relations. Human resource policies and practices of China, Japan, Mexico, Canada and other countries.

MGMT 4713*
Negotiation Essentials
Prerequisite(s): 3013. Fundamentals of effective negotiation and dispute resolution practices. Current theory, strategies and tactics. More effective negotiations and how to secure "win-win" solutions.

MGMT 4743
Advanced Sports Management
Prerequisite(s): 3943. This course builds on the material covered in MGMT 3943. More in-depth coverage is given to selected topics related to managing a sports entity.

MGMT 4813*
Staffing Organizations
Prerequisite(s): 3313. Theories and methods of recruiting and selecting employees. Job analysis, human resource planning, recruiting, employment laws, and staffing. Staffing methods such as interviews, references, application blanks, cognitive ability and personality tests and others. Development and critique of a selection plan and conduct of a behavioral interview.

MGMT 4850
Applied Leadership Studies
1-6 credits, max 6. Prerequisite(s): 3013. Structured internship of field project with supporting academic study.

MGMT 4883
(I)Multiple Perspectives in Global Management
Prerequisite(s): 3013 or 3123. View of how multinational corporations and cross-border business transactions have an impact on countries, cultures, employees, and ecological systems.

MGMT 5113*
Management and Organization Theory
Prerequisite(s): Admission to MBA program or consent of MBA director. Contemporary theories of organization. Structure and dynamics of organizational goals and environments.

MGMT 5123*
Contemporary Management Topics
Prerequisite(s): Admission to MBA program or consent of MBA director. Examination of selected topics representing the most current management theories and practices.

MGMT 5213*
Seminar in Organizational Behavior
Prerequisite(s): 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.

MGMT 5223*
Seminar in Human Resource Management
Prerequisite(s): 5113 or consent of instructor. Principles, theories and methods 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.

MGMT 5313*
Project Management
Prerequisite(s): Admission to MBA program or consent of MBA director. The processes and techniques of managing projects in today's business world. The processes of idea generation, needs analysis, implementation, evaluation, and learning. The techniques of team building and conflict resolution in project management.

MGMT 5323*
Teams in Organizations
Prerequisite(s): 5113, admission to MBA program or consent of MBA director. The different ways in which organizations use teams. Many aspects of team development and the skills needed to effectively work in a team environment.

MGMT 5443*
Building the Effective Organization
Prerequisite(s): 5113, 5513 (concurrent enrollment). The steps involved in building a small to mid-sized business into a well-run organization.

MGMT 5453*
Technology Commercialization
Prerequisite(s): Admission to MBA program or consent of MBA director. The steps involved in evaluating and commercializing new technologies. The necessary steps in moving from prototype to product.

MGMT 5533*
Leadership Challenges
Prerequisite(s): 5113, admission to MBA program or consent of MBA director. Contemporary leadership practices. Leadership as a behavior, not as a position. The challenges of leadership, regardless of position.

MGMT 5553*
Management of Technology and Innovation
Prerequisite(s): 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.

MGMT 5563*
Crisis in Organizations
Prerequisite(s): 5113, admission to MBA program or consent of the MBA director. Management and leadership in the face of crisis, from the smallest mom and pop store to the largest multinational corporation.

MGMT 5610*
Advanced Entrepreneurship Practicum
1-6 credits, max 6. Prerequisite(s): 5113 or 5613. Transfer of knowledge from entrepreneurship course work into practice through hands-on experiences, such as business development consulting projects, management of a venture capital fund, and creation of student-owned business.

MGMT 5613*
Business Opportunity Identification and Analysis
Prerequisite(s): Admission to MBA program or consent of MBA director. The techniques required for locating business opportunities, assessing their feasibility, and evaluating their potential returns.

MGMT 5650*
Advanced Entrepreneurship Practicum
1-6 credits, max 6. Prerequisite(s): Consent of the MBA program. This class transfers knowledge from entrepreneurship course work into practice through hands-on experiences, such as business development consulting projects, management of a venture capital fund and creation of a student-owned business.

MGMT 5653*
Business Development and Venture Capital
Prerequisite(s): 5613, admission to MBA program or consent of MBA director. Venture capital investing and the business development process investments. Essentials of the venture capital industry and corporate venturing.

MGMT 5713*
Negotiation and Third-Party Dispute Resolution
This course is designed to improve students' personal effectiveness and increase their productivity by drawing on the latest research in the psychology of judgment combined with the art of negotiation and decision-making. Students learn to develop effective strategies and systematic approaches to negotiations and influence opportunities. ***(Same course as LSB 5223)***

MGMT 5743*
International Negotiations
Prerequisite(s): Admission to MBA program or consent of MBA director. Improvement of negotiation skills and learn how cultural and national issues affect negotiations.

MGMT 6313*
Advanced Organizational Behavior
Prerequisite(s): Doctoral student 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.

MGMT 6323*
Advanced Strategic Management
Prerequisite(s): Doctoral student standing and consent of instructor. Research concerning the content of organizational strategy and the process through which it is formulated and implemented.

MGMT 6333*
Meso Organization Studies
Prerequisite(s): 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.

MGMT 6343*
Contemporary Research in Management I
Prerequisite(s): Doctoral student standing and consent of instructor. Introduction to the research process in management and building a career as a management scholar.

MGMT 6353*
Advanced Methods in Management Research
Prerequisite(s): Doctoral student standing 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.

MGMT 6443*
Contemporary Research in Management II
Prerequisite(s): Doctoral student standing and consent of instructor. Specialized contemporary topics in management for doctoral students.

MGMT 6553*
Structural Equation Modeling Applications in Business
Prerequisite(s): 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)

MSIS 2103
Business Computer Concepts and Applications
Lab 2. Concepts for the design, operation, and use of computer information systems in organizations, including fundamentals of key information technologies, information assurance, and the use of personal computing applications to support problem-solving. Lab-based computer training in fundamental productivity software and Internet tools.

MSIS 2203
Computer Programming for Business
Prerequisite(s): 2103 or equivalent. Computer programming for organizations from the perspective of integrating the Internet into business information systems. Fundamental principles and constructs of programming and applied programming in the business environment.

MSIS 3023
(D)Technology, Diversity and Entrepreneurship
Prerequisite(s): 2103 or consent of instructor. A study of technology, diversity and entrepreneurship. The use of technology as a research tool to study diversity and the opportunities available to diverse groups through entrepreneurship.

MSIS 3033
Information Systems Project Management and Communication
Prerequisite(s): 2103 or equivalent. This class discusses the multi-faceted dimensions critical to successfully leading information systems projects. Topics will include behavioral, strategic, technical, quantitative and communications issues faced by those directing projects.

MSIS 3103
Database Systems Design,
Manipulation and Management for End Users
Prerequisite(s): 2103 or equivalent. Non-MIS (or CS) majors only. Use of computer technology and software to represent, manipulate and manage data. Principles and techniques of logical database design and related database concepts. Analysis, design and implementation of a database system using a relational DBMS. *No credit for students in the MIS or MSCS majors.*

MSIS 3203
Advanced Computer Programming for Business
Prerequisite(s): 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.

MSIS 3223
Operations Management
Prerequisite(s): 2103 and STAT 2023 or equivalent. Introductory examination of the management of processes or systems that create goods and provide services. Management decision-making techniques and their application to problems in production and operations management. Decision analysis, forecasting, facility layout, location planning, quality management, inventory planning, and project management.

MSIS 3233
Management Science Methods
Prerequisite(s): 3223 and calculus. Deterministic operations research techniques applied to the resource allocation and operational problems encountered in accounting, economics, finance, management and marketing. Linear programming, goal programming, integer programming and network models.

MSIS 3243
Managerial Decision Theory
Prerequisite(s): 3223 and calculus. 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 theory, simulation, and inventory models.

MSIS 3303
Systems Analysis and Design
Prerequisite(s): 2203. Systems thinking. Systems analysis and design as a profession. Role of the analyst. Systems development methodologies. Requirements analysis. Use of computer-aided software engineering tools (CASE). Modeling of data, processes, and objects. Logical design, interface design and project management.

MSIS 3363
Advanced Management Information Systems Programming
Prerequisite(s): 2203 or equivalent. Programming tools with applications in industry. Advanced programming procedures, processes and algorithms.

MSIS 3373
File and Data Management for Business
Prerequisite(s): 2203. A survey of business data storage methodologies and approaches and of file management methodologies for business enterprises.

MSIS 3393
Advanced Spreadsheet Modeling and Programming
Prerequisite(s): 2103 and permission of instructor. This class provides students with advanced spreadsheet skills, including the ability to formulate math programming models, simulations, risk analysis, and other business decision-making tools. The class will also provide students with an introduction to spreadsheet programming (VB, macros, etc.), building decision support systems in spreadsheets, etc.

MSIS 4010
(D)Applied Management Science and Information System Studies
1-6 credits, max 6. Prerequisite(s): Consent of department head; MIS and MSCS majors only. Structured internship, field study or independent project with supporting academic study.

MSIS 4013
Database Systems Design, Management, and Administration
Prerequisite(s): 3303 and 3363, MIS and CS Majors only or permission of MSIS department. Theoretical aspects and business of data models and databases. Data security, maintaining database integrity, and database administration in a shared, networked or distributed environment. Related database concepts, including object-oriented databases and web database development. Analysis, design, and implementation of a database system using advanced DBMS tools and high-level languages to retrieve, manipulate data. *Required for MIS or MSCS majors.*

MSIS 4020
Applications Software Tools and Techniques
1-3 credits, max 3. Prerequisite(s): 3303, 2203, permission of instructor. Hands-on experience with selected software-based tool or programming languages such as SAP, SQL, PERT/CPM, etc.

MSIS 4113
Enterprise Systems and Collaborative Commerce
Prerequisite(s): 4013. Current and emerging management and technical concepts, practices, and tools for information integration and re-engineering of organizational processes. The use of enterprise resource planning tools (ERP II), collaborative commerce, supply chain, business intelligence, and e-business.

MSIS 4133
Information Technologies for Electronic Commerce
Prerequisite(s): 4013. The Internet and web-based technologies, systems and applications that allow organizations to overcome the barriers of time and distance for conducting commerce. Scripting and markup languages, web programming tools, and the connectivity technologies for designing and developing electronic commerce and systems.

MSIS 4223
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 the information services and e-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.

MSIS 4233
Applied Information Systems Security
Prerequisite(s): 4523, CS 4283, or ECEN 4283. An investigation into the various technical aspects of attacking and 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. developing electronic commerce and systems.

MSIS 4243
IT Forensics and Auditing
Procedures for identification, preservation and extraction of electronic evidence. Auditing and investigation of network and host system intrusions, analysis and documentation of information gathered, and preparation of expert testimonial evidence. Forensic tools and resources for system administrators and information system security offices. Ethics, law, policy and standards concerning digital evidence.

MSIS 4253
IT Risk Management, Planning, and Mitigation
This course examines factors of risk analysis in information technology and how management can plan to achieve an acceptable level of risk in the face of corporations desiring to open up their networks still further to partners, customers, and mobile workers.

MSIS 4263
Decision Support and Business Intelligence Applications
Prerequisite(s): 3303. Applied knowledge management tools and techniques for organizational decision support. Knowledge-based systems, decision support systems, and data mining techniques such as inductive learning and neural networks.

MSIS 4273
Legal and Ethical Issues in Information Systems
This course reviews the current status of information systems law in regard to rights of privacy, freedom of information, confidentiality, work product protection, copyright, security, legal liability, ethical issues, and a range of additional legal and information policy topics. We will investigate the legal difficulties that technological innovations are causing in all of these areas. Legal options for dealing with the conflicts caused by technological change and likely adaptations of the law over time in response to societal changes will be explored. *No credit for students having completed TCOM 5273.*

MSIS 4283
Operating Systems for Information Assurance
Operating Systems (OS) concepts for security. Vulnerabilities and threats. Security models. User authentication. Smart cards: architectures, technologies, application environments, and case studies. System availability. Software and data integrity. Auditing. Sensitive data confidentiality. Access control. Secure OS development: design principles, design methodologies, security certification. Case studies: Unix/Linus, MS/Windows XP/2000.

MSIS 4363*
Advanced Topics in Systems Development
Prerequisite(s): Senior standing and consent of instructor. Current and emerging advanced topics in information systems development. Development of web-based information systems and groupware systems, advanced object-oriented systems development methodologies and other related emerging topics.

MSIS 4373*
Advanced Topics in Management Information Systems
Prerequisite(s): Senior standing and consent of instructor. Current and emerging advanced topics in the field of management information systems. Advanced network management, advanced electronic commerce issues, international management information systems and legal and regulatory issues in telecommunications.

MSIS 4443*
Computer-based Simulation Systems
Prerequisite(s): 2203 and 3233 or 3243. Discrete-event systems simulation. Modeling of systems to be simulated such as inventory, financial management, data communications, information system problems, or other queuing situations. Collection and numerical analysis of associated data, understanding of simulation as a useful tool in management science and information systems.

MSIS 4523*
Data Communication Systems
Prerequisite(s): Senior standing. Broad coverage of network types and protocols used to drive the diverse voice, video and data needs of today's business. Network vocabulary and the understanding of how telecommunications components function are stressed.

MSIS 4533
Advanced Data Communications
Prerequisite(s): 4523. An applied and in-depth study of voice, video and data networks and technologies. Actual implementation knowledge and experience, using current technologies and equipment.

MSIS 4543
Techniques in Technology Investigation
Prerequisite(s): Consent of department head. Review systems for vulnerabilities and analyze systems that have been breached. Related issues. Hands-on component.

MSIS 4553
Analysis of Risk in Management and Information Systems
Prerequisite(s): Consent of department head. Examination of risk analysis in information technology and how management can plan to achieve an acceptable level of risk in the face of corporations desiring to open up their networks still further to partners, customers and mobile workers.

MSIS 4943
Decision-Making Tools for Sports Management
Prerequisite(s): 3223. This course is designed as an elective for MGMT students enrolled in the Sports Management option. Useful decision tools such as statistical inference, decision analysis, mathematical programming, forecasting and simulation are used to address decisions faced by sports administrators and decisions made during sporting contests. Current 'hot' issues in sports decision-making will also be examined.

MSIS 5020*
Advanced Applications Software Tools
1-3 credits, max 3. Advanced hands-on experience with selected software-based tool or programming languages such SAP, SQL, PERT/CPM, etc. *For graduate credit only.*

MSIS 5033*
Information Systems Project Management
Prerequisite(s): Consent of MS in MIS 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.

MSIS 5123*
Enterprise Resource Planning
Prerequisite(s): Graduate standing, ACCT 5103, and MSIS 5643, or consent of MS in MIS director. 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.

MSIS 5133*
Advanced Information Technologies for Electronic Commerce
Prerequisite(s): Admission to MBA, MSTM, or MS in MIS program, a programming object-oriented language and either 5643 or 4013; or consent of instructor. Information technologies that enable electronic commerce, including data base and web technologies and infrastructure, web software, transaction security, business web models and applications.

MSIS 5223*
Object-oriented Programming Applications for Business
Prerequisite(s): 5643, graduate standing and computer programming proficiency; or consent of MS in MIS director. Object-oriented programming concepts and applications for business in a global environment. Implementation through an appropriate object-oriented programming language.

MSIS 5303*
Quantitative Methods in Business
Prerequisite(s): Admission to the MBA program or consent of MBA director; demonstrated calculus proficiency. Application of quantitative techniques to business problems. Linear programming, transportation and assignment models, goal programming, integer programming, and networks.

MSIS 5313*
Production Operations Management
Prerequisite(s): Admission to MBA program or consent of MBA director and 5303. The management of operations in manufacturing and service organizations. 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.

MSIS 5413*
Advanced Management Science
Prerequisite(s): Admission to MBA program or consent of MBA director. Advanced management science methods, with computer applications. Mathematical programming, simulation, forecasting, queuing, Markov processes.

MSIS 5543*
Advanced File and Data Management for Business
Prerequisite(s): 5603 or equivalent, or consent of MS in MIS director. A design perspective of business data storage methodologies, structures and approaches; and of file management techniques for business enterprises.

MSIS 5600*
Special Projects in Business Information Systems
1-6 credits, max 6. Prerequisite(s): Consent of MS in MIS director. Study of advanced topics not covered directly in other classes or directed study under the supervision of a faculty member.

MSIS 5603*
Introduction to Object-oriented Programming for Business
Prerequisite(s): Admission to MBA, MSTM, or MS in MIS program or consent of instructor. Introduction to elementary 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.

MSIS 5613*
Advanced Production and Operations Management
Prerequisite(s): 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.

MSIS 5623*
Information and Network Technology Management
Prerequisite(s): Admission to MBA program. Integrated view of information and network system technologies. Internet-enabled business and economic models, and emerging managerial and strategic issues faced by organization related to technology adoption. Knowledge management, information security, privacy, decision support systems, technology infrastructure. *Required for the MBA program.*

MSIS 5633*
Business Intelligence Tools and Techniques
Prerequisite(s): Admission to MBA, MSTM, or MS in MIS program or consent of instructor. A comprehensive analysis of contemporary business intelligence tools and techniques used in managerial decision-making, including decision support systems, data and text mining, knowledge management, expert systems, neural networks, and other tools and techniques.

MSIS 5643*
Advanced Database Management
Prerequisite(s): Admission to the MBA, MSTM or MS in MIS program or consent of instructor. Advanced theoretical and practical foundations of database systems. Brief review of classical issues surrounding design, analysis, and implementation of databases. Overview and use of modern database systems. Current and emerging issues in the database field.

MSIS 5653*
Advanced Systems Development
Prerequisite(s): Consent of MS in MIS director, MSTM director or MBA director. Theory and applications for business systems development from an enterprise-wide perspective.

MSIS 5900*
Practicum in Management Information Systems
1-3 credits, max 3. Prerequisites: Consent of director of and admission to the MS in MIS program. Application of MIS-related methods and skills in a business environment. Integration of knowledge through real-world problem solving situations in organizational contexts.

MSIS 6200*
Advanced Topics in Management Information Systems
3-6 credits, max 12. Prerequisite(s): Doctoral student status and consent of instructor. Special advanced topics in management information systems for doctoral students.

MSIS 6300*
Contemporary Topics in MSIS Research
1-6 credits, max 6. Prerequisite(s): Doctoral standing. In-depth study in one or more topics in the MSIS field. An ongoing conversation about major issues in the field. Topics related to any one of the areas within the broad, interdisciplinary field of management science and information systems, such as management information systems, management science, telecommunications, and operations management.

MSIS 6333*
Overview of MSIS Research
Prerequisite(s): Doctoral standing. Recent research studies that fall within the broad, interdisciplinary field of management science and information systems. An introduction to the academic "way of life", focusing on research productivity.

MSIS 6343*
Advanced Methods in MSIS Research
Prerequisite(s): Doctoral standing. Development of advanced methodological skills necessary to carry out research in the chosen area of study within the field of MSIS. Skills related to any one of the areas within the broad, interdisciplinary field of management science and information systems, such as management information systems, management science, telecommunications, and operations management.

Marketing (MKTG)

MKTG 3213
Marketing
Prerequisite(s): Minimum of 45 credit hours. Marketing strategy and decision-making. Consumer behavior, marketing institutions, competition and the law.

MKTG 3323
Consumer and Market Behavior
Prerequisite(s): 3213. Qualitative and quantitative analyses of the behavior of consumers; a marketing consideration of the contributions of economics and the behavioral disciplines to consumer behavior.

MKTG 3433
Promotional Strategy
Prerequisite(s): 3213. Promotional policies and techniques and their application to selling problems of the firm.

MKTG 3473
Professional Selling
Prerequisite(s): 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.

MKTG 3513
Sales Management
Prerequisite(s): 3213. Sales planning and control, organization of the sales department, developing territories, motivating salespersons and control over sales operations.

MKTG 3613
Retailing Management
Prerequisite(s): 3213. Applied marketing knowledge, with attention given to those concepts and methods which provide the necessary foundation for a retailing manager.

MKTG 3713
Sports Marketing
Prerequisite(s): 3323 and 3433. Applied marketing knowledge with attention given to those concepts and methods used in sports marketing.

MKTG 3813
Business to Business Marketing Management
Prerequisite(s): 3213. A strategic overview of the marketing of products and services to business, government and not-for-profit organizations.

MKTG 4223
Supply Chain Management
Prerequisite(s): 3213. An economic and operational analysis of the physical flow of goods and materials. A system interpretation of marketing channels.

MKTG 4333*
Marketing Research
Prerequisite(s): 3213; 3223; STAT 2023. Basic research concepts and methods. Qualitative and quantitative tools of the market researcher.

MKTG 4443*
Social Issues in the Marketing Environment
Prerequisite(s): 3213. Social and legislative considerations as they relate to the marketplace.

MKTG 4550
Problems in Marketing
1-9 credits, max 9. Prerequisite(s): 3213. Problems in marketing. Specific topics vary from semester to semester.

MKTG 4553
International Marketing
Prerequisite(s): 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.

MKTG 4683
Managerial Strategies in Marketing
Prerequisite(s): 3213, 3323 and a minimum of nine credit hours in marketing, ACCT 2103 and 2203, ECON 2103 and 2203, FIN 3113, LSB 3213, MGMT 3123, MSIS 2103. Analysis of the marketing management decision process; market opportunity analysis, strategy development, planning and integration with corporate strategy.

MKTG 4773
Services Marketing
Prerequisite(s): 3213. Conceptual and managerial tools for students who intend to be involved with the marketing of ser-vices. 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.

MKTG 4850
Applied Marketing Studies
1-6 credits, max 6. Prerequisite(s): 12 credit hours of marketing and consent of instructor. Structured internship or field project with supporting academic study.

MKTG 4973
New Product Development
Prerequisite(s): 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.

MKTG 4983
Database Marketing
Prerequisite(s): 3213, 3323, MSIS 2103 or consent of instructor. An information-driven process to develop, test, implement, measure, and adopt customized marketing programs and strategies.

MKTG 4993
Electronic Commerce Marketing
Prerequisite(s): 3213, 3433, MSIS 2103 or consent of instructor. Digital interactive tools changing the management of markets. The development and impact of electronic commerce on business and use of interactive (electronic) marketing for building one-to-one relationship with customers.

MKTG 5133*
Marketing Management
Prerequisite(s): Admission to MBA program. Consideration at an advanced level of the major elements of marketing from the point of view of the marketing executive. Emphasis on problem solving and decision making; using an interdisciplinary approach. Development of an integrated, comprehensive marketing strategy.

MKTG 5213*
Services Marketing
Prerequisite(s): 5133. Services and services marketing with emphasis on services research and services management.

MKTG 5220*
Seminar in Marketing
3 credits, max 9. Prerequisite(s): 5133. Selected topics in marketing. Industrial marketing, product management, strategic marketing planning, international marketing, and services marketing.

MKTG 5313*
Marketing Research Methodology
Prerequisite(s): 5133. Research methodology applied to marketing problems. Measurement, survey research, experimentation, and statistical analysis of data.

MKTG 5553*
International Marketing Strategy
Prerequisite(s): 5133. An analysis of marketing in the global environment. Environmental effects on international marketing management and corporate strategy decisions.

MKTG 5613*
Seminar in Consumer Behavior
Prerequisite(s): 5133 or consent of instructor. Psychological, sociological, and anthropological theories related to consumer decision processes. Special emphasis on current empirical research in consumer behavior.

MKTG 5963*
Data Mining and Customer Relationship Management Applications
Lab 2. Prerequisite(s): 5983 or consent of MBA, MIS/MSIS, MSTM director or assistant director or instructor. Data mining and turning business data into actionable information. Use of various data mining tools such as neural networks, decision trees, classification and prediction algorithms, in the context of most common applications in business-sales, marketing, and customer relationship management (CRM). Use of state-of-the-art industrial strength data mining software to analyze real-world data and make strategic recommendations for managerial actions.

MKTG 5973*
New Product Development
Prerequisite(s): Acceptance into the MBA program or consent of the MBA director. Elements involved in creating and selling a successful new product in a complex environment, including internal organizational and external environmental influences.

MKTG 5983*
Data Base Marketing
Prerequisite(s): 5133 or consent of MBA, MIS/MSIS, MSTM director or assistant director or instructor. An information-driven process managed by database technology that enables marketers to develop, test, implement, measure, and adopt customized marketing programs and strategies.

MKTG 5993*
Digital Business Strategy
Prerequisite(s): Consent of MBA, or MIS/AIS or MSTM director or instructor. Businesses employment of digital technologies to craft a superior and unique value proposition for its customers and strategic partners.

MKTG 6100*
Advanced Seminar in Marketing
1-3 credits, max 6. Prerequisite(s): Consent of instructor and doctoral student standing. Specialized topics in marketing for doctoral students.

MKTG 6323*
Seminar in Advanced Consumer Behavior
Prerequisite(s): MKTG 5133 or consent of the instructor. An interdisciplinary course examining empirical and theoretical studies of the factors that influence the acquisition, consumption, and disposition of goods, services, and ideas. Analysis of the psychological, sociological, anthropological, demographic, and regulatory forces that impact consumers. Examination of research methodologies employed to conduct empirical studies of consumer behavior.

MKTG 6413*
Advanced Marketing Research
Prerequisite(s): 5313. Introduction to the latest empirical marketing research techniques. Data collection and analysis techniques such as conjoint analysis, multidimensional scaling, path analysis, and structural equations modeling (via LISREL).

MKTG 6513*
Seminar in Marketing Theory
Prerequisite(s): 5133 or consent of instructor. Development of an evaluation of marketing theory.

MKTG 6683*
Seminar in Marketing Strategy
Prerequisite(s): 5133 or consent of instructor. Examination of a broad range of marketing management topics from a strategic perspective. Understanding of content, theory and research methods involved in the development of strategic marketing knowledge.

MKTG 6913*
Measurement and Experimental Design
An analysis of measurement issues from both psychometric and marketing perspectives. Scale construction and validation. The design, analysis, and evaluation of marketing experiments.

Mass Communications (MC)

MC 5000*
Thesis
1-6 credits, max 6. For mass communication graduate students who are candidates for the master's degree.

MC 5010*
Capstone Project or Creative Component
1-3 credits, max 3. Capstone research project or creative activity for a mass communication graduate student electing to not write a thesis to complete a master's degree.

MC 5020*
Advanced Practicum or Internship in Mass Communication
1-3 credits, max 3. Prerequisite(s): 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*.

MC 5030*
Independent Study in Mass Communication
1-3 credits, max 3. Prerequisite(s): Consent of instructor. Independent study, directed readings or project development in mass communications to fit the student's academic and professional interests.

MC 5113*
Methods of Research in Mass Communication
Principles and techniques of research; research planning, design and measurement in mass communication.

MC 5163*
Mass Communication Law
Prerequisite(s): 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. *No credit for students with credit in JB 4163.* ***(Same course as JB 4163)***

MC 5223*
Mass Communication Research Analysis and Interpretation
Prerequisite(s): 5113. Single- and multi-variate analysis, interpretation and reporting of mass communication research data. Use of computers in research analysis.

MC 5253*
International Mass Communications
Prerequisite(s): 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. *No credit for students with credit in JB 4253.* ***(Same course as JB 4253)***

MC 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.

MC 5383*
Media Relations
Prerequisite(s): Graduate standing. Strategies for dealing with the news media. Students will gain hands-on experience in conducting media news conferences, pitching story ideas and preparing themselves and others for dealing with news media interviews. *Meets with JB 4383. No credit for students with credit in JB 4383.*

MC 5520*
Specialized Public Relations Applications
3 credits, max 6. Prerequisite(s): JB 3283 and graduate standing. Professional public relations at an advanced level. Non-profit, corporate, agency, international and other specialized applications. Course content varies by semester. *No credit for students with credit in JB 4520.*
(Same course as JB 4520)

MC 5530*
Specialized Advertising Applications
3 credits, max 6. Prerequisite(s): Graduate standing. Professional advertising at an advanced level. Special topics in areas such as globalization, convergence and the digital realm or scene. Course content varies by semester. *Meets with JB 4530. No credit for students with credit in JB 4530.*

MC 5540*
Specialized Broadcast Applications
3 credits, max 6. Prerequisite(s): Graduate standing. Professional broadcast journalism at an advanced level. Special topics in areas such as sports media production, announcing, performance; political, investigative and sports reporting; advanced audio production. Course content varies by semester. *Meets with JB 4540. No credit for students with credit in JB 4540.*

MC 5560*
Specialized News-Editorial Applications
3 credits, max 6. Prerequisite(s): Graduate standing. Professional news-editorial at an advanced level. Special topics in areas such as investigative, political, sports and business reporting; feature, column and editorial writing; advanced layout and design. Course content varies by semester. *Meets with JB 4560. No credit for students with credit in JB 4560.*

MC 5603*
Integrated Marketing Communications
Prerequisite(s): JB 2003; JB 2013 or 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. *No credit for students with credit in JB 4603.* ***(Same course as JB 4603)***

MC 5651*
Introduction to Graduate Study in Mass Communications
Prerequisite(s): 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 theoretical concepts and issues associated with mass communication. Required of all mass communication MS candidates, and prerequisite to MS candidates enrolling in mass communication seminars.

MC 5733*
Responsibility in Mass Communication
Prerequisite(s): Graduate standing. Interaction between mass media and society with emphasis upon the communicator's ethics and responsibilities. *Meets with JB 4733. No credit for students with credit in JB 4733.*

MC 5753*
Media and Elections
Prerequisite(s): Graduate standing. Examination of media's role in the political process with primary emphasis placed on print and broadcast journalism practices. *Meets with JB 4753. No credit for students with credit in JB 4753.*

MC 5770*
Seminar in Communication Media
1-3 credits, max 9. Prerequisite(s): Graduate standing. International communication, media history, legal research, new technology, women and the media, television and children, industrial television, and communication research.

MC 5773*
Censorship
Prerequisite(s): Graduate standing. A critical examination of historical and contemporary occurrences of censorship from legal, philosophical, political, religious and sociological perspectives. The definition of censorship, the common elements found in all forms of censorship, the rationalizations and justifications for censorship, and the consequences and unintended results of censorship. *No credit for students with credit in JB 4773.*
(Same course as JB 4773)

MC 5863*
Media Management
Prerequisite(s): 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. *No credit for students with credit in JB 4863.* ***(Same course as JB 4863)***

MC 5883*
Advanced Media Management
Prerequisite(s): Graduate standing. Management concerns in four areas of mass communication practice: public relations, advertising, broadcasting and print journalism. Different emphases offered according to student demand or need.

MC 5923*
Law and Ethics for Public Relations and Advertising
Prerequisite(s): 5163 and graduate standing. A critical examination of the legal and ethical issues confronting public relations and advertising practitioners. Focus on First Amendment rights of public relations and advertising professionals; the interpretation and application of statutes, regulations and judicial opinions to specific situations; and the application of ethical reasoning and professional codes of conduct to determine the most ethical action. *Meets with JB 4923. No credit for students with credit in JB 4923.*

Master of Business Administration (MBA)

MBA 5010*
Independent Study
3-6 credits, max 6. Prerequisite(s): 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.*

MBA 5100*
Professional Development
1 credit, max 6. Prerequisite(s): Admission to MBA program or consent of MBA director. Career and professional development of MBA students. A blend of guest speakers, projects, and exercises used to better prepare students for advanced business careers.

MBA 5192*
Managing Operations and Decision Processes
Prerequisite(s): 5172. Study of concepts of management of production and service operations. Contemporary manufacturing technologies and application of quantitative techniques. Development of analytical skills required to conduct detailed investigations of real-world systems.

MBA 5233*
Global Competitive Environment
Prerequisite(s): 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 INTL 5233*)

MBA 5261*
Legal Issues in Business
Prerequisite(s): 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.

MBA 5300*
Current Business Topics
1-6 credits, max 9. Prerequisite(s): Admission to the MBA program or consent of the director. Examination of selected topics representing the most current academic and business concepts.

MBA 5303*
Corporate and Business Strategy
Prerequisite(s): 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.

MBA 5310*
Integrative Decision-Making II: Crossing Organizational Boundaries
2-6 credits, max 6. Prerequisite(s): 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.

MBA 5400*
Business Practicum
1-3 credits, max 3. Prerequisite(s): 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 training can help organizations.

MBA 5500*
Interdisciplinary Inquiry in Business Administration
1-3 credits, max 9. Prerequisite(s): Consent of MBA director. Investigation of various business problems using an interdisciplinary approach. Courses team taught to ensure problems viewed from varying functional perspectives.

MBA 5990*
MBA Applied Business Report
3-6 credits, max 6. Prerequisite(s): Admission to MBA program or consent of MBA director. Independent investigation of a business problem under the direction of a supervising professor.

Mathematics (MATH)

MATH 1483
(A)Mathematical Functions and Their Uses
Prerequisite(s): Intermediate algebra or placement into 1513. Analysis of functions and their graphs from the viewpoint of rates of change. Linear, exponential, logarithmic and other functions. Applications to the natural sciences, agriculture, business and the social sciences.

MATH 1493
(A)Applications of Modern Mathematics
Prerequisite(s): Intermediate algebra 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.

MATH 1513
(A)College Algebra
Prerequisite(s): Two years of high school algebra or intermediate algebra. 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.*

MATH 1613
(A)Trigonometry
Prerequisite(s): 1513 or equivalent, or concurrent enrollment. 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.*

MATH 1715
(A)College Algebra and Trigonometry
Prerequisite(s): One unit of high school plane geometry, and intermediate algebra 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.*

MATH 2103
(A)Elementary Calculus
Prerequisite(s): 1513. An introduction to differential and integral calculus. *For students of business and social sciences.*

MATH 2123
(A)Calculus for Technology Programs I
Prerequisite(s): 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.

MATH 2133
(A)Calculus for Technology Programs II
Prerequisite(s): 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.

MATH 2144
(A)Calculus I
Prerequisite(s): 1715, or 1513 and 1613. An introduction to derivatives, integrals and their applications.

MATH 2153
(A)Calculus II
Prerequisite(s): 2144. A continuation of 2144, including series and their applications, elementary geometry of three dimensions and introductory calculus of vector functions.

MATH 2163
Calculus III
Prerequisite(s): 2153. A continuation of 2153, including differential and integral calculus of functions of several variables and an introduction to vector analysis.

MATH 2233
Differential Equations
Prerequisite(s): 2153. Methods of solution of ordinary differential equations with applications. First order equations, linear equations of higher order, series solutions and Laplace transforms.

MATH 2910
Special Studies
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Special subjects in mathematics.

MATH 3013*
Linear Algebra
Prerequisite(s): 2153. Algebra and geometry of finite-dimensional linear spaces, linear transformations, algebra of matrices, eigenvalues and eigenvectors.

MATH 3263*
Linear Algebra and Differential Equations
Prerequisite(s): 2153. An integrated treatment of linear algebra and differential equations. *No credit for those with credit in 2233 or 3013.*

MATH 3403
Geometric Structures
Prerequisite(s): 1483, 1493 or 1513. Fundamentals of plane geometry, geometric motion (translation, rotations, reflections), polyhedra, applications to measurements.

MATH 3603
Mathematical Structures
Prerequisite(s): 1483, 1493 or 1513. Foundations of numbers (set theory, numeration, and the real number system), number theory, algebraic systems, functions and applications and probability.

MATH 3613*
Introduction to Modern Algebra
Prerequisite(s): 3013. Introduction to set theory and logic; elementary properties of rings, integral domains, fields and groups.

MATH 4003*
Mathematical Logic and Computability
Prerequisite(s): 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 nonstandard models, Godel numberings, Turing machines, recursive functions, and evidence for Church's thesis. ***(Same course as PHIL 4003*)***

MATH 4013*
Calculus of Several Variables
Prerequisite(s): 2163 and 3013. Differential and integral calculus of functions of several variables, vector analysis, Stokes' Theorem, Green's Theorem and applications.

MATH 4023*
Introduction to Modern Analysis
Prerequisite(s): 2163 and 3613 or consent of instructor. 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.

MATH 4033*
History of Mathematics
Prerequisite(s): 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.

MATH 4143
Advanced Calculus I
Prerequisite(s): 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. *No credit for students with credit in 5043.* ***(Same course as 5043*)***

MATH 4153*
Advanced Calculus II
Prerequisite(s): 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. *No credit for students with credit in 5053.* ***(Same course as 5053*)***

MATH 4233*
Intermediate Differential Equations
Prerequisite(s): 2233, 3013. Systems of differential equations, series, solutions, special functions, elementary partial differential equations, Sturm-Liouville problems, stability and applications.

MATH 4263*
Introduction to Partial Differential Equations
Prerequisite(s): 2163, 2233, 3013. Solution of the standard partial differential equations (Laplace's equation, transport equation, heat equation, wave equation) by separation of variables and transform methods, including eigenfunction expansions, Fourier and Laplace transform. Boundary value problems, Sturm-Liouville theory, orthogenality, Fourier, Bessel, and Legendre series, spherical harmonics.

MATH 4283*
Complex Variables
Prerequisite(s): 4013. Analytic functions, power series, residues and poles, conformal mapping and applications.

MATH 4313*
Numerical Mathematics: Analysis
Prerequisite(s): 2233, 3013, knowledge of programming 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)***

MATH 4403*
Geometry
Prerequisite(s): 3013, recommended 3613. An axiomatic development of Euclidean and non-Euclidean geometries.

MATH 4453*
Mathematical Interest Theory
Prerequisite(s): 2153. Fundamental concepts of financial mathematics including simple and compound interest, inflation, yield rates, and equations of value for annuities, stocks, bonds, and other financial instruments. Determining equivalent measures of interest, determining yield rates, estimating rates of return, amortization.

MATH 4553*
Linear and Nonlinear Programming
Prerequisite(s): 2163, 3013. Linear programming, simplex methods, duality, sensitivity analysis, integer programming and nonlinear programming.

MATH 4583*
Introduction to Mathematical Modeling
Prerequisite(s): 3013. Techniques of problem solving and mathematical models presented by examples and case studies of applications of mathematics in industrial settings. Oral and written presentation of solutions.

MATH 4613
Modern Algebra I
Prerequisite(s): 3613. An introduction to the theory of groups and vector spaces. *Meets with 5003*. No credit for students with credit in 5003.*

MATH 4623
Modern Algebra II
Prerequisite(s): 4613. Continuation of 4613. An introduction to the theory of rings, linear transformation and fields. *Meets with 5013*. No credit for students with credit in 5013.*

MATH 4663*
Combinatorial Mathematics
Prerequisite(s): 3013. Counting techniques, generating functions, difference equations and recurrence relations, introduction to graph and network theory.

MATH 4713*
Number Theory
Prerequisite(s): 3613. Divisibility of integers, congruencies, quadratic residues, distribution of primes, continued fractions and the theory of ideals.

MATH 4813*
Groups and Representations
Prerequisite(s): 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.

MATH 4900
Undergraduate Research
1-4 credits, max 4. Prerequisite(s): Consent of instructor. Directed readings and research in mathematics.

MATH 4910*
Special Studies
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Special subjects in mathematics.

MATH 4950
Problem Solving Seminar
1-3 credits, max 3. Prerequisite(s): 2233, 3013. The general process of problem solving. Selected problem-solving techniques. Applications to challenging problems from all areas of mathematics.

MATH 4993
Senior Honors Thesis
Prerequisite(s): Senior standing and Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a faculty member, including a public presentation. *Required for graduation with departmental honors in mathematics.*

MATH 5000*
Research and Thesis
1-6 credits, max 6. Prerequisite(s): Consent of advisory committee. Directed reading and research culminating in the master's report or master's thesis.

MATH 5003*
Modern Algebra I
Prerequisite(s): 3613. An introduction to the theory of groups and vector spaces. *Meets with 4613. No credit for students with credit in 4613.*

MATH 5010*
Seminar in Mathematics
1-3 credits, max 12. Prerequisite(s): Consent of instructor. Topics in mathematics.

MATH 5013*
Modern Algebra II
Prerequisite(s): 4613 or 5003. Continuation of 5003. An introduction to the theory of rings, linear transformations and fields. *Meets with 4623. No credit for students with credit in 4623.*

MATH 5023*
Advanced Linear Algebra
Prerequisite(s): 3013. A rigorous treatment of vector spaces, linear transformations, determinants, orthogonal and unitary transformations, canonical forms, bilinear and hermitian forms, and dual spaces.

MATH 5043*
Advanced Calculus I
Prerequisite(s): 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. *Meets with 4143. No credit for students with credit in 4143.*

MATH 5053*
Advanced Calculus II
Prerequisite(s): 4143 or 5043. Continuation of 5043. A rigorous treatment of sequences and series of functions, uniform convergence, differentiation and integration of vector-valued functions and differential forms. *Meets with 4153*. No credit for students with credit in 4153.*

MATH 5133*
Stochastic Processes
Prerequisite(s): 2233, 3013 and STAT 5123. 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, discrete and continuous Markov chains, birth and death processes, exponential model, queuing theory.
(Same course as IEM 5133* & STAT 5133*)

MATH 5143*
Real Analysis I
Prerequisite(s): 4153 or 5053. Measure theory, measurable functions, integration and differentiation with respect to measures.

MATH 5153*
Real Analysis II
Prerequisite(s): 5143. Aspects of point set topology: nets, locally compact spaces, product spaces, Stone-Weierstrass theorem. Elementary functional analysis: Hahn-Banach, uniform boundedness, and open mapping theorems, Hilbert spaces. Riesz representation theorems: duals of Lebesgue spaces and spaces of continuous functions.

MATH 5213*
Fourier Analysis and Wavelets
Prerequisite(s): 4013 or 4023. Orthogonal series expansions, Fourier series and integrals and boundary value problems. Haar wavelets and multiresolution analysis. Applications.

MATH 5233*
Partial Differential Equations
Prerequisite(s): 4013, 4143 and 4233 or consent of instructor. Representation formulas for solutions of transport equation, Laplace's equation, heat equation and wave equation, mean value theorems, maximum principle, Green's functions, characteristics, eigenvalue problems, separation of variables, transform methods, variational methods, general theory of first order equations.

MATH 5243*
Ordinary Differential Equations
Prerequisite(s): 4143 or 5043; 4233; 5023. Banach space, contraction mapping principle, existence and uniqueness theorems, linear systems, higher-order linear equations, boundary value and eigenvalue problems, stability and asymptotic behavior, attractors, Gronwall's inequality, Liapunov method.

MATH 5253*
Advanced Ordinary Differential Equations
Prerequisite(s): 5243. Selected topics in ordinary differential equations.

MATH 5283*
Complex Analysis I
Prerequisite(s): 4143 or 5043. Basic topology of the plane, functions of a complex variable, analytic functions, transformations, infinite series, integration and conformal mapping.

MATH 5293*
Complex Analysis II
Prerequisite(s): 5283. Riemann Mapping Theorem, meromorphic functions, analytic continuation, Dirichlet problem, and entire functions.

MATH 5303*
General Topology
Prerequisite(s): 4143 or 5043 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.

MATH 5313*
Geometric Topology
Prerequisite(s): 4613 or 5003, 5303. Manifolds, complexes, the fundamental group, covering spaces, combinatorial group theory, the Seifert-Van Kampen theorem, and related topics.

MATH 5413*
Differential Geometry
Prerequisite(s): 4013 or 4143 or 5043. Differential manifolds, vector fields, differential forms, connections, Riemannian metrics, geodesics, completeness, curvature, and related topics.

MATH 5543*
Numerical Analysis for Differential Equations
Prerequisite(s): 4233, 4513 or CS 4513. Advanced machine computing, algorithms, analysis of truncation and rounding errors, convergence and stability applied to discrete variables, finite elements, and spectral methods in ordinary and partial differential equations.

MATH 5553*
Numerical Analysis for Linear Algebra
Prerequisite(s): 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.

MATH 5580*
Case Studies in Applied Mathematics
1-3 credits, max 6. Prerequisite(s): 2233, 4013, and knowledge of computer programming. Selected mathematical problems from industry. Independent problem-solving, oral presentation of solutions, and technical report writing. Seminar-style format.

MATH 5593*
Methods of Applied Mathematics
Prerequisite(s): 2233, 4013, and knowledge of computer programming. Continuous and discrete techniques in modern applied mathematics. Positive definite matrices, eigenvalues and dynamical systems, discrete and continuous equilibrium equations, least squares estimation and the Kalman filter, potential flow, calculus of variations, network flows, and combinatorics.

MATH 5613*
Algebra I
Prerequisite(s): 4613 or 5003. A rigorous treatment of classical results in group theory and ring theory.

MATH 5623*
Algebra II
Prerequisite(s): 5613. A rigorous treatment of classical results in module theory and field theory.

MATH 5902*
Seminar and Practicum in the Teaching of College Mathematics
Prerequisite(s): 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.

MATH 6000*
Research and Thesis
1-9 credits, max 24. Prerequisite(s): Consent of advisory committee. Directed reading and research culminating in the PhD or EdD thesis.

MATH 6010*
Advanced Seminar in Mathematics
1-3 credits, max 12. Prerequisite(s): Consent of instructor and student's advisory committee. Directed reading on advanced topics in mathematics.

MATH 6143*
Functional Analysis I
Prerequisite(s): 4613 or 5003 or 5023, 5153, 5303. Theory of topological vector spaces including metrizability, consequences of completeness, Banach spaces, weak topologies, and convexity.

MATH 6213*
Harmonic Analysis
Prerequisite(s): 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.

MATH 6233*
Advanced Partial Differential Equations
Prerequisite(s): 5233 or consent of instructor. Schwarz class, tempered distributions, basic linear functional analysis, Holder spaces, Sobolev spaces, spaces involving time, Sobolev inequalities, existence and regularity theory of second-order elliptic, parabolic, and hyperbolic equations, semigroup theory.

MATH 6283*
Several Complex Variables
Prerequisite(s): 5293. Elements of function theory of several complex variables, including extension phenomena, domains of holomorphy, notions of convexity, holomorphic maps, and complex analytic varieties.

MATH 6290*
Topics in Analysis
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Advanced topics in analysis.

MATH 6323*
Algebraic Topology I
Prerequisite(s): 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.

MATH 6390*
Topics in Topology
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Advanced topics in topology.

MATH 6433*
Algebraic Geometry
Prerequisite(s): 5623. Affine and projective varieties, dimension, algebraic curves, divisors and Riemann-Roch theorem for curves.

MATH 6453*
Complex Geometry
Prerequisite(s): 5283. Complex manifolds, analytic sheaves, differential forms, Dolbeault cohomology, Hodge theory, line bundles, divisors, Kodaira embedding, and vanishing.

MATH 6490*
Topics in Geometry
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Advanced topics in geometry.

MATH 6513*
Theoretical Numerical Analysis
Prerequisite(s): 5153, 5543 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.

MATH 6590*
Topics in Applied Mathematics
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Advanced topics in applied mathematics.

MATH 6613*
Commutative Algebra
Prerequisite(s): 5623. Commutative rings, exactness properties of modules, tensor products, integral dependence, chain conditions, completions, filtrations, local rings, dimension theory, and flatness.

MATH 6623*
Homological Algebra
Prerequisite(s): 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.

MATH 6690*
Topics in Algebra
1-3 credits, max 9. Prerequisite: consent of instructor. Advanced topics in algebra.

MATH 6713*
Analytic Number Theory
Prerequisite(s): 4283 or 5283. Arithmetic functions, Zeta and L functions, distribution of primes and introduction to modular forms.

MATH 6723*
Algebraic Number Theory
Prerequisite(s): 5013 or 5623. Number fields, ideal theory, units, decomposition of primes, quadratic and cyclotomic fields, introduction to local fields.

MATH 6790*
Topics in Number Theory
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Advanced topics in number theory.

MATH 6813*
Lie Groups and Representations
Prerequisite(s): 4153 or 5053, 4613 or 5003, 5303. Differentiable manifolds, vector fields, Lie groups, exponential map, homogeneous spaces, representations of compact Lie groups, and maximal tori.

MATH 6823*
Lie Algebras
Prerequisite(s): 5013 and 5023. Matrix groups, Lie algebras, root systems, structure of semisimple Lie algebras, universal enveloping algebra, and representations of lie algebras.

MATH 6890*
Topics in Representation Theory
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Advanced topics in representation theory.

MATH 6990*
Topics in Collegiate Mathematics Education
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Advanced topics in collegiate mathematics education.

Mechanical and Aerospace Engineering (MAE)

MAE 3013
Mechanical and Aerospace Engineering Analysis
Prerequisite(s): MATH 2233, ENSC 2123, 2143, 2213, 2613, 3233. Setup and solution of equations which govern mechanical engineering systems. Application and solution of the governing equations to describe the steady state, transient, or harmonic behavior of dynamics, thermodynamics, mechanics, heat transfer and circuit problems. Behavior will be described with linear sets of equations, differential equations, and partial differential equations. Solutions of these equations may be simplified by using complex numbers, Fourier and Laplace transforms. In some cases only numerical solutions will be feasible.

MAE 3033
Engineering Design
Lab 2. Prerequisite(s): 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.

MAE 3113
Measurements and Instrumentation
Lab 4. Prerequisite(s): 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 integrated circuits and construction of prototype sensors. Practice in the use of signal processing, including digital filtering and applications of Fast Fourier Transform theory. Practice in the use of computer-based data acquisition systems. Preparation of formal reports, including the presentation of plots, figures and tables.

MAE 3123
Manufacturing Processes
Prerequisite(s): 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.

MAE 3223
Thermodynamics II
Prerequisite(s): 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.

MAE 3233
Heat Transfer
Prerequisite(s): ENSC 3233. Mechanisms of heat transfer. Steady and transient conduction, free and forced convection, heat exchanger design and analysis, radiation and multiphase behavior. Numerical methods, dimensional analysis and boundary layer theory.

MAE 3253
Applied Aerodynamics and Performance
Prerequisite(s): ENSC 3233, MATH 2233. Relevant fluid properties; standard atmospheres; mathematical models of flows about bodies. Characteristic parameters of airfoils and wings. Thin airfoil theory and flows about finite wings. Boundary layers. Propeller theory. Supersonic and hypersonic flows about wings and lifting bodies. Drag polars. Power required for level flight. Rate of climb and descent. Steady turns. Maximum range and endurance. Design applications.

MAE 3293
Compressible Fluid Flow
Prerequisite(s): ENSC 2213, 3233, 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, rocket propulsion, frictional high-velocity flows and heat addition effects. Two-dimensional ideal fluid flow, stream function, velocity potential, linearized flows and method of characteristics.

MAE 3323
Mechanical Design I
Prerequisite(s): 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.

MAE 3403
Computer Methods in Analysis and Design
Prerequisite(s): ENGR 1412. Application of computer methods in the design, analysis, and simulation of mechanical, thermal and fluid systems. Linear algebra and numerical methods. Applied statistics.

MAE 3723
Systems I
Prerequisite(s): 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)***

MAE 4010*
Mechanical Engineering Projects
1-6 credits, max 6, Lab variable. Prerequisite(s): Consent of instructor. Special projects and independent study in mechanical engineering.

MAE 4053*
Automatic Control Systems
Prerequisite(s): 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*)

MAE 4063*
Mechanical Vibrations
Prerequisite(s): 3723. Lumped parameter analysis of multi-mode vibrating systems. Analysis techniques including classical analytical methods, matrix methods and numerical methods. Selection and design of vibration isolation systems. Selection of vibration instrumentation. Machine dynamics, including balancing, whirl, nonlinear effects, and self-excited vibrations.

MAE 4223*
Aerospace Engineering Laboratory
Lab 6. Prerequisite(s): 3113, 3253, 4283. Experimental study of aerospace principles including topics in aeronautics and astronautics. State-of-the-art instrumentation, diagmostics, and computerized data acquisition equipment and techniques applied to experiments including application of low speed wind tunnel testing techniques, rocket propulsion and control-jet experiments, fundamentals of supersonic nozzles, and flight test evaluation of performance, stability, control, and handling qualities of a propeller-driven airplane.

MAE 4243*
Gas Power Systems
Prerequisite(s): ENSC 3233. Power and propulsion engines utilizing a gas as the working fluid. Thermodynamic and dynamic equations of one-dimensional compressible flow, including shock waves. Design and analysis of overall aircraft engine systems and individual components of the aircraft engine, as well as engine component matching, using design software packages. Centrifugal and axial flow turbines and compressors.

MAE 4263*
Vapor Power Systems
Prerequisite(s): 3223, 3233. Vapor power cycles, combustion processes applied to power production, power plants, and auxiliary systems associated with power plants. Overall design of power plants as well as component design. Power system economics and loan analysis. Extensive use of software design and analysis packages.

MAE 4273*
Experimental Fluid Dynamics
Lab 3. Prerequisite(s): 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.

MAE 4283*
Aerospace Vehicle Stability and Control
Prerequisite(s): 3253, 3723, ENSC 2123. Motion and control of aerospace vehicles. Derivation of equations of motion for aircraft and spacecraft. Aerodynamic stability derivatives. Static and dynamic aircraft stability and control. Handling qualities. Satellite orbital and attitude dynamics. Satellite attitude control. Design experience for stability and control in aeronautical and astronautical vehicles.

MAE 4313*
Advanced Processing of Engineered Materials
Prerequisite(s): ENSC 3313. Introduction of novel processing methods for a range of engineered materials, such as electro-slag remelting, vacuum melting, melting to remove tramp elements, precision casting, sintering, hot-pressing, directional solidification, mechanical alloying, liquid infiltration, net-shaped finishing, superplastic forming, sol-gel processing, float glass process, tape laying, microwave processing, laser processing, CVD and PVD, sputtering, ion plating, ultraprecision machining and grinding, polishing and lapping, multilayer coatings, Czhochralski single crystal growth, processing of nanocrystalline materials, engineered surfaces and surface modification, and layer processing for electronic materials.

MAE 4333*
Mechanical Metallurgy
Lab 2. Prerequisite(s): ENSC 3313. Mechanical deformation processes and strengthening mechanisms in engineering materials. Material failure modes including creep, fatigue, stress corrosion, ductile and brittle fractures.

MAE 4344*
Design Projects
Lab 4. Prerequisite(s): 3033, 3113, 3323. Students work in small teams on a semester-long design project sponsored by a company, agency, or individual. Team members work with mentors from sponsors and with faculty members in fields related to their topics. Presentations on safety, patent law, product liability, report writing, oral presentations, scheduling and ideation. Oral presentations, progress reports, and a professional log book documenting personal activity and contributions.

MAE 4353*
Mechanical Design II
Prerequisite(s): 3033, 3323 and 3403. Design of power transmission systems, including belts, chains and gears. Selection and application of hydraulic and pneumatic components in machine design applications. Selection of electric motors, actuators, encoders, and related electromechanical components. Design practice in the form of short projects integrating segments of the course. ***(Same course as BAE 4353*)***

MAE 4354*
Aerospace Systems Design for Mechanical Engineers
Lab 8. Prerequisite(s): 3033, 3113 and 3323. 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.*

MAE 4363*
Experimental Methods in Design
Lab 6. Prerequisite(s): 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.

MAE 4374*
Aerospace Systems Design
Lab 8. Prerequisite(s): 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.*

MAE 4383*
Nanotechnology for Engineers
Prerequisite(s): MATH 2163, CHEM 1414 or 1515, PHYS 2114. Size and shape dependence of material properties at the nanoscale. Top-down and bottom-up nanofabrication and self-assembly. Interaction, functionalization, binding, and immobilization of nanostructures. Properties applications and synthesis of well-studied building blocks; quantum dots (semiconductor nanocrystals), carbon nanostructures (nanotubes and fullerines), semiconductor nanowires, metal nanoparticles and nanowire. Supramolecular structures, nanophase films, and nanocomposites. Characterization of nanostructures.

MAE 4513*
Aerospace Structures I
Prerequisite(s): 3323 and 3403. Design and analysis of flight structures. Topics from two and three-dimensional elasticity. Behavior of composite materials. Stress and deflection analysis of thin-skinned stiffened structures. Introduction to the finite element method and its applicability in the design process.

MAE 4623*
Biomechanics
Prerequisite(s): MATH 2163, ENSC 2143, ENSC 3233. To introduce non-bioengineering students to the field of biomechanics. This class will serve as a foundation for further biomechanics investigation at senior undergraduate and graduate level. At the end of this class students will be able to apply engineering principles to describe the mechanical properties of biological systems.

MAE 4703*
Design of Indoor Environmental Systems
Prerequisite(s): 3223, 3233. Design of heating, ventilating and air conditioning systems. Calculation of heating and cooling loads.

MAE 4713*
Thermal Systems Design, Simulation and Optimization
Prerequisite(s): 3233, 3223; 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.

MAE 4733*
Mechatronics Design
Prerequisite(s): 3113 and 3403. Design of mechanical and electrical components, including sensors and actuators into an integrated environment 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.

MAE 5000*
Thesis
1-6 credits, max 6. A student studying for a master's degree who elects to write a thesis must enroll in this course.

MAE 5003*
Advanced Biomaterials Science and Engineering
Prerequisite(s): Graduate standing or consent of instructor. Engineering issue that are implicit in understanding the interactions of living tissue and processed materials will be introduced. Emphasis is on identifying the processes in which cells interact with surfaces and particulate matter and the outcome of these interactions. Highlighted biological responses will include inflammation and coagulation. Also, biomaterial issues related to drug delivery and tissue engineering will be discussed. ***(Same course CHE 5003)***

MAE 5010*
Mechanical Engineering Projects
1-12 credits, max 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.

MAE 5013*
Basic Physiology and Physiological System Analysis for Engineers
Prerequisite(s): Graduate standing or consent of instructor. The goals of this class are: 1) to introduce the basic physiology concepts used widely in biomedical engineering research; 2) to introduce and develop engineering concepts and approaches for quantitative analysis of physiological systems. Engineering principles will be applied to study mechanical properties of various tissue and organ systems under normal and diseased conditions. Knowledge obtained from this class can help engineers to apply engineering principles to the design and development of medical devices for disease treatments. ***(Same course as CHE 5013)***

MAE 5030*
Engineering Practice
1-12 credits, max 12. Prerequisite(s): Senior or graduate standing and consent of instructor. Solution of real-life engineering design and development problems in an actual or simulated industrial environment. 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.

MAE 5033*
Advanced Biomedical Engineering
Prerequisite(s): 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. ***(Same course as CHE 5293)***

MAE 5073*
Advanced Mechanical Vibrations
Prerequisite(s): 4063 or consent of instructor. Analysis of nonlinear vibrations, classical analysis of continuous systems and numerical methods.

MAE 5083*
Engineering Acoustics
Acoustical analysis and measurement techniques, with emphasis on design applications for noise and vibration control in machinery and in buildings.

MAE 5093*
Numerical Engineering Analysis
Prerequisite(s): Undergraduate course in computer programming and consent of professor. Practical digital methods for obtaining steady-state and transient solutions to lumped and distributed mechanical, fluid and thermal problems.

MAE 5113*
Diffraction for Non-destructive Materials Evaluation
Introduction to crystallography and diffraction with an emphasis on X-ray diffraction, some exposure to Neutron diffraction. Applications will focus on mechanical properties measurements. New methods will be surveyed with an emphasis on current research.

MAE 5123*
Metal Cutting
Prerequisite(s): 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.

MAE 5133*
Mechanical Behavior of Materials
Prerequisite(s): 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.

MAE 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, mechanisms 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.

MAE 5153*
Precision Engineering I
Prerequisite(s): 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, scanning probe microscopy, ultra-precision machining and grinding, and precision assembly.

MAE 5233*
Viscous Fluid Dynamics
Prerequisite(s): ENSC 3233. The dynamics of viscous flow over external surfaces, inside channels, and in free shear layers. Boundary layer solutions. Theory of similarity. Approximation methods.

MAE 5243*
Micro Flows
Prerequisite(s): Graduate standing or consent of instructor. Fundamentals and simulation of micro flows including governing equation, slip models, shear- and pressure-driven micro flows. Thermal effects in micro scales. Applications; MEMS and micro propulsion. Numerical methods for continuum simulation and atomistic simulation.

MAE 5253*
Multiphase Flow
Prerequisite(s): Graduate standing. Theory, methods and practical experience for studying complex transient multiphase flows: basic concepts and definition, dynamics of bubbles, drops and rigid particles, gas-liqud transport in ducts, fluid-solid transport in ducts, aerosol and spray systems, foam, fluidization, particle separation systems multiphase flow in porous media, breakup of liquid sheets and jets, modeling, advanced experimental techniques for multiphase flow.

MAE 5403*
Computer-aided Analysis and Design
Prerequisite(s): Undergraduate course in computer programming and consent of professor. 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.

MAE 5413*
Optimal Control
Prerequisite(s): 5713 or ECEN 5713. Optimal control theory for modern systems design. Specification of optimum performance indices. Dynamic programming, calculus of variations and Pontryagin's minimum principle. Iterative numerical techniques for trajectory optimization.
(Same course as ECEN 5413)

MAE 5433*
Robotics, Kinematics,Dynamics and Control
Prerequisite(s): 4053 or ECEN 4413 or consent of instructor. Kinematic and dynamic analysis of robot manipulators. Inverse kinematics, motion planning and trajectory generation. Industrial practice in robot servo control. Dynamics and control in the presence of constraints. Actuators and sensors. Force sensors and vision systems. Robotic force control and its applications in industry. Passivity based control algorithms. Advanced control techniques for motion and force control. ***(Same course as ECEN 5433)***

MAE 5463*
Nonlinear System Analysis and Control
Prerequisite(s): 4053 or ECEN 4413. 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 ECEN 5463)

MAE 5473*
Digital Control Systems
Prerequisite(s): 4053 or ECEN 4413. Input output and state space representations of linear discrete-time systems. Approximate methods in discrete-time representation. Stability methods. Controllability, observability, state estimation, and parameter identification. Design and analysis of feedback control system using frequency-domain and state-space methods. Introduction to optimal control. ***(Same course as ECEN 5473)***

MAE 5483*
Digital Data Acquisition and Control
Prerequisite(s): 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)***

MAE 5503*
Mechanics of Advanced Composites for Structural Design
Prerequisite(s): ENSC 2113, ENSC 2143 or consent of instructor. Basic principles governing the micro-mechanics of a lamina, and the macro-mechanics of a laminate are discussed in detail. Analysis of continuous fiber, short-fiber, and woven-fiber polymer matrix composites. A computer program for a analysis and design of composite laminates is developed.

MAE 5513*
Stochastic Systems
Prerequisite(s): ECEN 3513 and 4503 or STAT 4033 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 non-stationary random processes. Response of linear systems to stochastic processes. State-space formulation and covariance analysis.
(Same course as ECEN 5513)

MAE 5523*
Estimation Theory
Prerequisite(s): 5513 or ECEN 5513. Stochastic model development, parameter estimation and state estimation. The linear model, model order determination, least squares, estimation, maximum likelihood estimation, Bayesian estimation. Gaussian random vectors, estimation in linear and Gaussian models, state estimation, the Kalman filter, prediction and smoothing. ***(Same course as ECEN 5523)***

MAE 5533*
Analysis of Structural Systems
Prerequisite(s): 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.

MAE 5543*
Modern Materials
Prerequisite(s): ENSC 3313. Properties, applications and recent innovations of structural engineering materials. Metals, ceramics, polymers and composites considered.

MAE 5553*
Fatigue and Fracture Mechanics
Prerequisite(s): 4333 or consent of instructor. Fracture processes in engineering materials including design considerations, failure avoidance and predictability. Fatigue processes and high-strength, toughness-limited materials.

MAE 5563*
Finite Element Methods
Introduction to the finite element method in mechanical engineering. Numerical and mathematical formulations including an introduction to variational methods. Computer applications in solid mechanics, heat transfer and fluid mechanics.

MAE 5573*
Continuum Mechanics
Prerequisite(s): Consent of instructor. Principles governing the mechanics of continua. Kinematics of deformation, including the Lagrangian and Eulerian descriptions. Development of stress and strain tensors. Conservation principles to derive field equations describing solid and fluid mechanics. Application to problems in linear elasticity and viscous fluid flow.

MAE 5583*
Corrosion Engineering
Lab 2. Prerequisite(s): ENSC 3313. Modern theory of corrosion and its applications in preventing or controlling corrosion damage economically and safely in service.

MAE 5593*
Theory of Viscoelasticity
Prerequisite(s): Consent of instructor. Advanced stress analysis in solids exhibiting time-dependent behavior. Material characterization and thermodynamic foundation of the constitutive behavior 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.

MAE 5633*
Advanced Thermal Systems
Prerequisite(s): 3223, 3233, ENSC 3233. Analysis, design, simulation and optimization of thermal systems. Engineering applications to HVAC systems, refrigeration systems, ground-source heat pump systems.

MAE 5653*
Refrigeration
Prerequisite(s): 3223. Thermal engineering or refrigeration and heat pump systems, vapor compression systems, absorption refrigeration cycles, cryogenics, compressors, heat exchangers, refrigerant control devices, laboratory simulators and measurements, socio-economic and environmental impact of systems and refrigerants.

MAE 5663*
Advanced Finite Element Analysis
Prerequisite(s): 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 implicitly 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.

MAE 5673*
Mechanics of Fracture, Contact and Friction
Prerequisite(s): Graduate standing or consent of instructor. Rigorous derivation and presentation of the equations of fracture mechanics, contact and friction. Equations of solid mechanics and mathematical preliminaries, elastic stress field near a crack tip, stress intensity factors, fracture toughness, Griffith solution and J-integral, elastic-plastic fracture, fatigue, Dugdale model and cohesive zone laws, experimental techniques in fracture mechanics, contact mechanics, friction modeling. More advanced topics and projects will be chosen from interfacial crack growth, subsonic and intersonic dynamic fracture, rate- and state-dependent friction laws, fracture and friction at the small scales (nanomechanics), and finite-element analysis using commercial packages.

MAE 5683*
Advanced Materials Science I
Notions of energy, entropy, equilibrium, macrostates, and microstates and their relation to material processes and properties. Deriving material properties from equations of state: Maxwell relations. Statistical thermodynamics: predicting material properties from microstates. Partition function. Phase transformations. Thermodynamics of surfaces and defects. Electrochemistry.

MAE 5703*
Optimization Applications
Prerequisite(s): 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* & IEM 5023*)***

MAE 5713*
Linear Systems
Prerequisite(s): 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 solutions; controllability, observability, and stability; linearization and realization theory; and state feedback and state observer.
(Same course as ECEN 5713*)

MAE 5733*
Neural Networks
Prerequisite(s): 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 CHE 5733* & ECEN 5733*)***

MAE 5773*
Intelligent Systems
Prerequisite(s): 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, seminotics); reinforcement learning and hybrid systems; and case studies and design projects. ***(Same course as ECEN 5773*)***

MAE 5823*
Radiation Heat Transfer
The mechanism of the transfer of energy by thermal radiation; radiant properties of materials, energy transfer prediction methods and solar energy topics.

MAE 5843*
Conduction Heat Transfer
Prerequisite(s): ENSC 3233. Advanced heat transfer analysis and design, with primary emphasis on conduction.

MAE 5853*
Computational Heat Transfer
Prerequisite(s): 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.

MAE 5863*
Building Heat Transfer and Simulation
Prerequisite(s): 3223, 3233, ENSC 3233. Conduction, convection and radiation heat transfer applied to building thermal simulation. Solar radiation.

MAE 5873*
Advanced Indoor Environmental System
Prerequisite(s): 4703. Heating, air-conditioning, ventilation and refrigeration systems. System and component analysis, design and simulation.

MAE 5913*
Advanced Aerodynamics
Prerequisite(s): ENSC 3233 or equivalent. Aerodynamics of the subsonic, transonic, supersonic, and hypersonic flow regimes. Derivation of governing equations and fundamental principles. Analytical and computational analysis methods. Recent developments.

MAE 5923*
Guidance and Control of Aerospace Vehicles
Prerequisite(s): 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.

MAE 5933*
Aeroelasticity
Prerequisite(s): 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.

MAE 5943*
Unsteady Aerodynamics and Aeroacoustics
Prerequisite(s): ENSC 3233 or equivalent. Development of governing fluid dynamic equations for unsteady flows; linear unsteady aerodynamics for isolated and cascaded lifting surfaces; acoustics in moving media; three-dimensional duct acoustics; sound generation from isolated airfoils, cascaded airfoils, rotor-stator interactions, multiple pure-tone sources, propellers and jets.

MAE 5993*
Microstructural Mechanics
Prerequisite(s): Graduate standing or consent of instructor. Build a framework to understand the various microstructures of materials with their respective roles in controlling mechanical properties. Grain size, orientation, surface facets, compositional gradients, and second or multiple phases, in combination with the three-dimensional arrangement of the various types of imperfections, together constitute the microstructure of a material. An emphasis will be placed on new research areas and exposure to methods for controlling and probing microstructures.

MAE 6000*
Research and Thesis
1-15 credits, max 30. Prerequisite(s): 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 MS degree.

MAE 6010*
Advanced Study
1-12 credits, max 12. Prerequisite(s): 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.

MAE 6123*
Non-traditional Machining
Prerequisite(s): 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 assisted processing and electron beam machining.

MAE 6133*
Surface Mechanics
Prerequisite(s): 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.

MAE 6143*
Thermal Analysis of Manufacturing Processes
Prerequisite(s): 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.

MAE 6233*
Turbulent Fluid Dynamics
Prerequisite(s): 5233. Isotropic turbulence, turbulent wakes and jets, bound turbulent shear flows, transition, hydrodynamic stability and integral calculation methods for turbulent boundary layers.

MAE 6263*
Computational Fluid Dynamics
Prerequisite(s): 5233. Steam function-vorticity and pressure-velocity simulations of incompressible and compressible flows. Temperature and concentration solutions. Applications to various external and internal flow problems.

MAE 6423*
System Identification
Prerequisite(s): 5473 or 5713 or ECEN 5473 or ECEN 5713. Linear and nonlinear system modeling of random systems. Models of linear time-invariant systems, nonparametric methods and preliminary model development, parameter estimation methods, convergence and consistency, asymptotic distributions of parameter estimates, nonlinear modeling. ***(Same course as ECEN 6423*)***

MAE 6453*
Adaptive Control
Prerequisite(s): 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*)***

MAE 6463*
Advances in Nonlinear Control
Prerequisite(s): 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*)***

MAE 6483*
Robust Multivariable Control Systems
Prerequisite(s): 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*)***

MAE 6843*
Convection Heat Transfer
Prerequisite(s): 5233 or equivalent. Advanced convective heat transfer in laminar and turbulent flows over external surfaces and inside channels. Heat transfer at high velocities, free convection boundary layers, and mass transfer.

Mechanical Engineering Technology (MET)

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.

MET 1223
Industrial Computer-aided Design
Lab 4. Prerequisite(s): GENT 1153. Computer-aided design (CAD) generation of engineering drawings. ANSI/ASME and ISO drawing standards.

MET 2103
Industrial Materials
Lab 3. Prerequisite(s): 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.

MET 2313
Fundamentals of Hydraulic Fluid Power
Lab 2. Prerequisite(s): 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.

MET 3003
Dynamics
Prerequisite(s): 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.

MET 3113
Basic Instrumentation
Lab 2. Prerequisite(s): 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.

MET 3313
Applied Fluid Mechanics
Prerequisite(s): 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.

MET 3333
Thermodynamics and Heat Transfer for Electronics
Lab 3. Prerequisite(s): MATH 2133 and junior standing. Principles of thermodynamics and heat transfer important to the design, construction and operation of electronic systems. Basic heat transfer by conduction, convection, and radiation. Heat removal from electronic systems by heat-sinking, free-air convection, forced-air convection and combinations. Identification of specific over-heating problems in electronics systems and the design of appropriate heat removal techniques.

MET 3343
Physical Metallurgy
Lab 3. Prerequisite(s): 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 metallographic specimen preparation, inspection and testing; and standard tests of tensile properties, hardenability, hardness and toughness.

MET 3413
Fundamentals of Pneumatic Fluid Power
Lab 2. Prerequisite(s): 2313, ECT 1003, MATH 1513. Basic pneumatics concepts, gas laws, component design and application, system design considerations. Air logic.

MET 3573
Advanced Production Processes
Lab 3. Prerequisite(s): 1223, 2103, 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).

MET 4003
Machine Design I
Prerequisite(s): 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.

MET 4013
Parametric Computer-aided Design Modeling
Lab 4. Prerequisite(s): 1223. Computer-aided drafting and design using parametric, feature-based solid modeling techniques.

MET 4050
Advanced Mechanical Design
1-3 credits, max 6, Lab 0-2. Prerequisite(s): junior standing and consent of instructor. Special problems in mechanical engineering technology.

MET 4123
Senior Design Projects
Lab 6. Prerequisite(s): 1223, 4003 and ENGL 3323. Selected problems in design integrating principles of drafting, analysis, materials and manufacturing. Design projects are typically supplied by industry.

MET 4203
Finite Element Methods
Prerequisite(s): 4003. Application of Finite Element Methods to machine component design. Problems involving stress, strain, temperature and vibration will be solved using state of the art Finite Element Software.

MET 4303
Computer Integrated Manufacturing
Lab 2. Prerequisite(s): GENT 1223, MET 1223. 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 COMPACT II computer assistance.

MET 4313
Electrohydraulics and Motion Control
Lab 2. Prerequisite(s): 2313, 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.

MET 4453
Applied Thermodynamics
Prerequisite(s): ENSC 2213 or GENT 3433. Mixtures, psychrometrics, combustion, heat engine cycles, heat pumps cycles, internal and external combustion engines. Refrigeration.

MET 4463
Thermal Fluids Laboratory
Lab 3. Prerequisite(s): 3313, GENT 3433 and GENT 4433. Experimental study of topics in fluid mechanics, thermodynamics, and heat transfer. Interpretation of experimental data and technical report writing.

MET 4883
Tool Design
Lab 3. Prerequisite(s): 2213, 3343. Basic design and development of special tools for processing or manufacturing engineering materials. Design and specification and inspection tools using appropriate techniques of engineering graphics and analysis.

MET 4993
Mechanical Engineering Technology Practice
Prerequisite(s): 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)

MCAG 1413
Introduction to Engineering in Agriculture
Prerequisite(s): 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.

MCAG 2313
Surveying
Lab 3. Prerequisite(s): 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 land measurement.

MCAG 3011
AG Structures
Lab 2. Prerequisite(s): MATH 1513. Study of types of agricultural structures, building materials, construction tools and methods. Laboratory will provide opportunity to apply and develop associated skills.

MCAG 3211
Engines and Power
Lab 2. Prerequisite(s): MATH 1513. Theory, operation, performance and diagnostics of internal combustion engines for mobile applications.

MCAG 3222
Metals and Welding
Lab 2. Welding safety and the principles and applications of gas, stick and MIG welding, and cutting.

MCAG 3232
Lab Management and Project Construction
Lab 2. Prerequisite(s): 3222. Theory and practice of managing secondary school Ag Mechanics laboratories including safety, organization, design, project construction and evaluation of student projects.

MCAG 4101
AG Electrification
Lab 2. Prerequisite(s): MATH 1513. A study of electrical theory and electrical applications in agricultural environments.

MCAG 4112
Land Measurement and Site Analysis
Lab 2. Prerequisite(s): MATH 1513 or equivalent. Methods and techniques used to locate sites and evaluate physical conditions. Includes map interpretation and land description, use of Global Positioning Systems, Rectangular System of Land Description and determination of land elevations, areas and slopes. ***(Same course as ENVR 4112)***

MCAG 4123*
Principles of Food Engineering
Prerequisite(s): 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.

MCAG 4200*
Topics in Mechanized Agriculture
1-4 credits, max 4. Investigations in specialized areas of mechanized agriculture.

MCAG 4203*
Irrigation Principles
Prerequisite(s): 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.

MCAG 4212
Safety and Health in Agribusiness
Lab 2. Prerequisite(s): Junior standing or 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.

MCAG 4220*
Advanced Methods in Agricultural Mechanics
1-6 credits, max 6. Prerequisite(s): 4222. Developing agricultural mechanics programs for vocational agriculture and technical schools. Application of agricultural mechanics methods, practices and skills to advanced projects.

Microbiology (MICR)

MICR 1513
Inquiry-based Biology
Lab 4. Directed inquiry and hands-on study of biological principles. Restricted to elementary education majors or related fields as model course to learn and teach science.

MICR 2002
Science Literacy
Prerequisite(s): Consent of instructor. An introduction to skills needed to identify, read and critically evaluate scientific literature and to manage and communicate research data in written oral and poster formats.

MICR 2123
Introduction to Microbiology
Prerequisite(s): BIOL 1114, CHEM 1225 or CHEM 1515. General principles of the biology of microorganisms, including bacteria, viruses, algae, fungi, protozoa and archea.

MICR 2132
Introduction to Microbiology Laboratory
Lab 4. Prerequisite(s): 2123 or concurrent enrollment. Sterile technique, microscopy, identification of microorganisms, microbial metabolism, microbial genetics and environmental microbiology. Molecular and culture techniques.

MICR 3033
Cell and Molecular Biology
Prerequisite(s): 2123 and 2132 or BOT 1404 or ZOOL 1604 and CHEM 1225 or CHEM 1515 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.

MICR 3103
(N)Microbes: Friends or Foes
Explores the impact of microorganisms on human life, the environment, and world history.

MICR 3143
Medical Mycology
Lab 4. Prerequisite(s): 2123, 2132. Examination of fungi as animal pathogens; laboratory techniques used in the identification of human and animal pathogens, and differentiation from common contaminants.

MICR 3154
Food Microbiology
Lab 4. Prerequisite(s): 2123, 2132 and CHEM 3015 or 3053. 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 FDSC 3154)***

MICR 3223
Advanced Microbiology
Prerequisite(s): 2123, 2132; Co-requisite(s): CHEM 3015 or CHEM 3053. Subcellular structure and function of microorganisms. Synthesis, translocation, and metabolism of cellular macromolecular constituents. Substrate transport and metabolism.

MICR 3253
Immunology
Prerequisite(s): 2123 and 2132. Vertebrate host's ability to defend itself against foreign intrusion. Chemistry and biology of the acquired immune response.

MICR 4000
Honors in Microbiology
1-4 credits, max 4. Prerequisite(s): Consent of departmental honors committee. Supervised study and research in microbiology.

MICR 4001
Professional Transitions in Microbiology and Cell and Molecular Biology
Prerequisite(s): Declared microbiology 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.

MICR 4012
Molecular Microbiology Laboratory I
Lab 4. Prerequisite(s): 3223, 4233. Emphasis on good laboratory practices in microbiology and molecular biology; isolation and enumeration of microorganisms; physiological, biochemical, and molecular characterization of aerobic and anaerobic microorganisms. *Must be taken in conjunction with 4112 the following semester. No credit for students with credit in 5012.*

MICR 4112
Molecular Microbiology Laboratory II
Lab 4. Prerequisite(s): 4012. Continuation of 4012. Molecular characterization of prokaryotic and eukaryotic microorganisms utilizing nucleic acids, proteins, cell fractionation, cytology, and antigen-antibody reactions. *No credit for students with credit in 5112.*

MICR 4117
Clinical Microbiology
Lab 12. Prerequisite(s): Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except 30 hours clinical laboratory science. The theory and laboratory study of pathogenic bacteria, viruses, rickettsiae, fungi, and parasites. Includes isolation, identification, antimicrobial susceptibility testing, and medical significance.

MICR 4123
Virology
Prerequisite(s): 3033 or BIOC 3653; BIOL 3023; Co-requisite(s): 3223. Virus-host interactions, including structure-function of animal, plant and bacterial viruses. Discussion of the molecular biology of virus infection and development. *No credit for students with credit in 5123.*

MICR 4125
Clinical Chemistry I
Lab 9. Prerequisite(s): Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except for 30 hours clinical laboratory sicence. The theory and laboratory methodology of analytical biochemistry, clinical microscopy, routine and special procedures, and medical significance.

MICR 4133
Molecular and Microbial Genetics
Prerequisite(s): 2123, 2132, BIOL 3023, CHEM 3015 or 3053; Co-requisite(s): 3223. The properties of macromolecules, from the structure of proteins and nucleic acids to molecular mechanisms of DNA replication and recombination, transcription, protein synthesis, and gene regulation. Gene transfer mechanisms in bacteria and their viruses. Fundamentals of recombinant DNA technology. *No credit for students with credit in 5133.*

MICR 4134
Pathogenic Microbiology
Lab 3. Prerequisite(s): 2123, 2132. Co-requisite(s): 3223. Examination of pathogenic bacteria as they relate to humans, other animals, plants and insects. *No credit for students with credit in 5134.*

MICR 4203
Bioinformatics
Prerequisite(s): 3033 or BIOC 3653 or equivalent. Fundamental concepts of biological sequence information and inferential techniques to assign structure, function, and evolutionary relationship among genes and proteins. No prior programming necessary, but familiarity with computers assumed. *No credit for students with credit in 5203.*

MICR 4214
Microbial Ecology
Lab 4. Prerequisite(s): 2123, 2132 and CHEM 3015 or 3053. Co-requisite(s): 3223. Fundamentals of microbial physiology and genetics of microbial populations under various redox conditions. Species and functional guilds in natural habitat. Community structure and diversity of niches. Population interactions, competition and ecosystem stability. Metabolic activities in natural and managed systems. Microbial capacities and elemental cyclings. Genes and genetic exchange in the environment. Modern nucleic acid tools in microbial identification and evolutionary phylogeny. *No credit for students with credit in 5214.*

MICR 4233
Advanced Cell and Molecular Biology
Prerequisite(s): 3033. Advanced topics in cell and molecular biology including regulatory mechanisms of gene expression, protein function, cell structure and organization, cell division, and development. *No credit for students with credit in 5233.*

MICR 4236
Clinical Hematology
Lab 12. Prerequisite(s): Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except for 30 hours of clinical laboratory science. Systematized 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.

MICR 4246
Clinical Immunology
Lab 12. Prerequisite(s): Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except for 30 hours clinical laboratory science. 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.

MICR 4253
Concepts in Medical Genetics
Prerequisite(s): BIOL 3023. Application of genetic principles in the study of human diseases, including the inheritance, molecular mechanisms, detection, characterization, and discovery of human genes. *No credit for students with credit in 5253.*

MICR 4263
Eukaryotic Genetics
Lab 4. Prerequisite(s): 3033. Integration of genetics and genomics principles, the basic processes of gene transmission, molecular biology of gene expression and evolutionary genetics by gaining social and historical context in which genetics are developed. Focus on the dramatic change in our understanding of human genetics and the role such information has in our view of disability and disease. *No credit for students with credit in 5263.*

MICR 4323
Bioenergetics
Prerequisite(s): 3033 or BIOC 3653. Bioenergetic reactions and mechanisms involved in energy production in plants, animals and microbial systems. *No credit for students with credit in 5323.*

MICR 4325
Clinical Chemistry II
Lab 9. Prerequisite(s): Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except for 30 hours clinical laboratory science. The theory and laboratory methodology of analytical biochemistry, instrumentation, lab mathematics, routine and special procedures and medical significance.

MICR 4351
Topics in Clinical Laboratory Science
Prerequisite(s): Concurrent internship in affiliated hospital and all degree requirements for BS in microbiology except for 30 hours clinical laboratory science. Principles and practices of the medical laboratory including basic management, quality assurance, education methodology, computer applications, laboratory safety, and special projects in selected areas.

MICR 4353
Photobiology
Prerequisite(s): 3033 or BIOC 3653. The proteins and processes involved in biological photosynthesis, photosensing, and photodamage, including their biological relevance. Involves critical reading of primary literature and examination of protein structures using bioinformatics tools. *No credit for students with credit in 5353.*

MICR 4423
Bacterial Cell Walls: Form and Function
Prerequisite(s): 2123, 2132, and 3223. Topics will include structure and synthesis of membrane and cell wall components (including lipids, peptidoglycan and membrane proteins), mechanisms of transport across the cell wall, roles components of the cell wall play in the survival of the cell (and in the case of pathogens, the ability to cause disease), and antimicrobial agents that affect the cell wall and the mechanisms used to eliminate these agents from the cell. *No credit for students with credit in 5423.*

MICR 4990
Special Problems
1-3 credits, max 12. Prerequisite(s): Consent of instructor. Investigations in the field of microbiology.

MICR 4993
Senior Honors Project
Prerequisite(s): 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.

MICR 5000*
Thesis
2-6 credits, max 6. Prerequisite(s): Consent of major professor. A student studying for the MS degree enrolls in this course for six hours credit.

MICR 5001*
Professionalism for the Microbiologist
Prerequisite(s): Microbiology graduate student and permission of instructor. Introduces the microbiology graduate student to the standards of the microbiology professional and to basic skills in communication and data retrieval needed by all microbiologists. It is required of all and limited to MS and PhD students in Microbiology & Molecular Genetics.

MICR 5012*
Molecular Microbiology Laboratory I
Lab 4. Prerequisite(s): 3223, 4233. Emphasis on good laboratory practices in microbiology and molecular biology; isolation and enumeration of microorganisms; physiological, biochemical, and molecular characterization of aerobic and anaerobic microorganisms. *Must be taken in conjunction with 5112 the following semester. No credit for students with credit in 4012.*

MICR 5052*
Techniques in Molecular Biology
Lab 2. Prerequisite(s): Graduate student and permission of instructor. Provides the basic skills for scientific thinking and analysis in molecular microbiological research.

MICR 5112*
Molecular Microbiology Laboratory II
Lab 4. Prerequisite(s): 5012. Continuation of 5012. Molecular characterization of prokaryotic and eukaryotic microorganisms utilizing nucleic acids, proteins, cell fractionation, cytology, and antigen-antibody reactions. *No credit for students with credit in 4112.*

MICR 5113*
Advanced Immunology
Prerequisite(s): 3253. Advanced studies with emphasis on the regulation of vertebrate immune responses.

MICR 5123*
Virology
Prerequisite(s): 3033 or BIOC 3653, BIOL 3023. Co-requisite(s): 3223. Virus-host interactions including structure-function of animal, plant, and bacterial viruses. Discussion of the molecular biology of virus infection and development. *No credit for students with credit in 4123.*

MICR 5133*
Molecular and Microbial Genetics
Prerequisite(s): BIOL 3023, CHEM 3015 or CHEM 3053, MICR 2123 and 2132. Co-requisite(s): 3223. The properties of macromolecules, from the structure of proteins and nucleic acids to molecular mechanisms of DNA replication and recombination, transcription, protein synthesis, and gene regulation. Gene transfer mechanisms in bacteria and their viruses. Fundamentals of recombinant DNA technology. *No credit for students with credit in 4133.*

MICR 5134*
Pathogenic Microbiology
Prerequisite(s): 2123 and 2132. Co-requisite(s): 3223. Examination of pathogenic bacteria as they relate to humans, other animals, plants and insects. *No credit for students with credit in 4134.*

MICR 5142*
Techniques in Molecular Biology
Lab 4. Prerequisite(s): Consent of instructor. Comprehensive laboratory course in research techniques involving classical genetics and molecular biology.

MICR 5153*
Emerging Infectious Agents
Prerequisite(s): 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.

MICR 5160*
Seminar
1 credit, max 2. Prerequisite(s): consent of instructor. Required of and limited to all MS and PhD students majoring in microbiology, cell and molecular biology.

MICR 5203*
Bioinformatics
Prerequisite(s): 3033 or BIOC 3653 or equivalent. Fundamental concepts of biological sequence information and inferential techniques to assign structure, function, and evolutionary relationship among genes and proteins. No prior programming necessary, but familiarity with computer desktop assumed. *No credit for students with credit in 4203.*

MICR 5213*
Environmental Microbiology
Prerequisite(s): 3223, 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.

MICR 5214*
Microbial Ecology
Lab 4. Prerequisite(s): 2123 and 2132 and CHEM 3015 or 3053; Co-requisite(s): 3223. Fundamentals of microbial physiology and genetics of microbial populations under various redox conditions. Species and functional guilds in natural habitat. Community structure and diversity of niches. Population interactions, competition and ecosystem stability. Metabolic activities in natural and managed systems. Microbial capacities and elemental cyclings. Genes and genetic exchange in the environment. Modern nucleic acid tools in microbial identification and evolutionary phylogeny. *No credit for students with credit in 4214.*

MICR 5233*
Advanced Cell and Molecular Biology
Prerequisite(s): 3033. Advanced topics in cell and molecular biology including regulatory mechanisms of gene expression, protein function, cell structure and organization, cell division, and development. *No credit for students with credit in 4233.*

MICR 5253*
Concepts in Medical Genetics
Prerequisite(s): BIOL 3023. Application of genetic principles in the study of human diseases, including the inheritance, molecular mechanisms, detection, characterization, and discovery of human genes. *No credit for students with credit in 4253.*

MICR 5263*
Eukaryotic Genetics
Prerequisite(s): 3033. Integration of genetics and genomics principles, the basic processes of gene transmission, molecular biology of gene expression and evolutionary genetics by gaining social and historical context in which genetics are developed. Participants are expected to comprehend the dramatic change in our understanding of human genetics and the role such information has in our view of disability and disease. *No credit for students with credit in 4263.*

MICR 5323*
Bioenergetics
Prerequisite(s): 3033 or BIOC 3653. Bioenergetic reactions and mechanisms involved in energy production in plants, animals and microbial systems. *No credit for students with credit in 4323.*

MICR 5353*
Photobiology
Prerequisite(s): 3033 or BIOC 3653. The proteins and processes involved in biological photosynthesis, photosensing, and photodamage, including their biological relevance. Involves critical reading of primary literature and examination of protein structures using bioinformatics tools. *No credit for students with credit in 4353.*

MICR 5423*
Bacterial Cell Walls: Form and Function
Prerequisite(s): 2123, 2132, and 3223. Topics will include structure and synthesis of membrane and cell wall components (including lipids, peptidoglycan and membrane proteins), mechanisms of transport across the cell wall and the roles components of the cell wall play in the survival of the cell (and in the case of pathogens, the ability to cause disease). In addition, antimicrobial agents that affect the cell wall and the mechanisms used to eliminate these agents from the cell will also be discussed. *No credit for students with credit in 4423.*

MICR 5990*
Special Problems
1-4 credits, max 10. Prerequisite(s): Permission of instructor. Investigations in the field of microbiology.

MICR 6000*
Dissertation
1-15 credits, max 45. Prerequisite(s): Consent of major adviser. Research in microbiology for the PhD degree.

MICR 6112*
Molecular Biology of Bacterial Viruses
Prerequisite(s): 4123 and 4133. Advanced study of bacteriaphages.

MICR 6120*
Recent Advances in Microbiology
1 credits, max 6. Prerequisite(s): One graduate course in biochemistry. Discussion and evaluation of recent scientific contributions in terms of the living organism.

MICR 6133*
Cellular Microbiology
Prerequisite(s): A strong undergraduate level background in microbiology, biochemistry or cell biology is expected. The molecular interactions between intracellular parasites and their host cells will be explored, emphasizing the manipulation of normal cellular processes to the benefit of the parasite. The course will involve critical reading of the current literature and development of an understanding of molecular microbe and cell biology research techniques.

MICR 6143*
Advanced Microbial Physiology
Lab 3. Prerequisite(s): 3223 or consent of instructor. Discussion of selected topics in microbial physiology. Critical analysis of research papers.

MICR 6153*
Advanced Molecular Genetics
Prerequisite(s): 4133. Structure, function and regulation of nucleic acids. Gene transfer mechanisms, genetic recombination and plasmid biology. Recent developments in recombinant DNA technology.

MICR 6213*
Molecular Microbial Ecology
Prerequisite(s): 3223 or consent of the instructor. Current questions and recent advances in molecular microbial ecology methodologies and approaches, examination of the phylogenetic and metabolic diversity of Bacteria, Archaea, and microeukaryotics in various ecosystems, microbial community composition and ecophysiology in selected habitats, identification of rare members of the microbial community.

MICR 6253*
Microbial Evolution
Prerequisite(s): 2123, 2132, BIOC 3653, BIOL 3023. The mechanisms and results of microbial evolution in nature and in the laboratory, with emphasis on microbes as model evolutionary systems, molecular evolution, classification and phylogeny, and discussion of protobiology and the probable fate of engineered microbes.

MICR 6304*
Genetics of Simple Eukaryotes
Prerequisite(s): 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).

MICR 6323*
Current Topics in Eukarytic Signal Transduction and Gene Regulation
Prerequisite(s): 3033, BIOC 3653, BIOL 3023. Discussion of current literature on the mechanisms of eukaryotic signal transduction and gene regulation.

Military Science (MLSC)

MLSC 1000
Leadership Laboratory
1 credit, max 2, Lab 2. Prerequisite(s): 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.

MLSC 1112
Foundations of Officership
Team study and activities in basic drill, physical fitness, rappelling, leadership reaction course, first aid, presentations and basic marksmanship. Fundamentals of leadership. Optional weekend exercise. *Concurrent enrollment in MLSC 1000 recommended.*

MLSC 1212
Basic Leadership
Principles of effective leading, communication skills, and organizational ethical values. *Concurrent enrollment in MLSC 1000 recommended. Optional weekend exercise.*

MLSC 2130
Military Physical Conditioning
1 credit, max 2, Lab 3. Prerequisite(s): 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.

MLSC 2233
Individual Leadership Studies
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.

MLSC 2313
Leadership and Teamwork
Lab 2. Prerequisite(s): 2233. Individual and team aspects of military tactics in small unit operations. Safety assessment, movement techniques, planning for team safety and security and methods of pre-execution checks. Training techniques for continued leadership development.

MLSC 3113
Leadership and Problem Solving
Lab 2. Prerequisite(s): 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.

MLSC 3223
Leadership and Ethics
Lab 2. Prerequisite(s): 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.

MLSC 4014
Reserve Officers' Training Corps (ROTC) Advanced Camp
Lab 8. Prerequisite(s): 3113 and 3223. A five-week camp conducted at an Army post. Individual leadership and basic skills performance.

MLSC 4123
Leadership and Management
Lab 2. Prerequisite(s): 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.

MLSC 4223
Officership
Lab 2. Prerequisite(s): 3113 and 3223. Continuation of the methodology from MLSC 4123. 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.

MLSC 4422
The Tactical Planning Process
Prerequisite(s): 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)

MUSI 0500
Student Recital Attendance
Graduation requirement for music degree or certificate candidates. *Graded on a pass/fail basis.*

MUSI 1001
Percussion Techniques
Lab 2. Methods for playing and teaching percussion instruments.

MUSI 1011
Piano Class Lessons
Prerequisite(s): Music major status or consent of instructor. *For students with no previous experience.*

MUSI 1021
Piano Class Lessons
Prerequisite(s): Music major status or consent of instructor.

MUSI 1031
Voice Class Lessons

MUSI 1071
Single Reed Techniques
Lab 2. Methods for playing and teaching the clarinet and saxophone.

MUSI 1081
Double Reed Techniques
Lab 2. Methods for playing and teaching the oboe and bassoon.

MUSI 1090
Secondary Harpsichord
1-2 credits, max 8.

MUSI 1091
High Brass Techniques
Lab 2. Methods for playing and teaching the trumpet and French horn.

MUSI 1100
Elective Harpsichord **1-2 credits, max 8.**

MUSI 1110
Elective Organ **1-4 credits, max 8.**

MUSI 1120
Elective Piano **1-4 credits, max 8.**

MUSI 1130
Elective Voice **1-4 credits, max 8.**

MUSI 1140
Elective Brass **1-4 credits, max 8.**

MUSI 1150
Elective Strings **1-4 credits, max 8.**

MUSI 1160
Elective Woodwinds **1-4 credits, max 8.**

MUSI 1170
Elective Percussion **1-4 credits, max 8.**

MUSI 1180
Secondary Organ **1-2 credits, max 8.**

MUSI 1190
Secondary Piano **1-2 credits, max 8.**

MUSI 1200
Secondary Voice **1-2 credits, max 8.**

MUSI 1210
Secondary Brass **1-4 credits, max 8.**

MUSI 1220
Secondary String **1-2 credits, max 8.**

MUSI 1230
Secondary Woodwind **1-2 credits, max 8.**

MUSI 1240
Secondary Percussion **1-2 credits, max 8.**

MUSI 1250
Major Organ **1-4 credits, max 8.**

MUSI 1260
Major Piano **1-4 credits, max 8.**

MUSI 1270
Major Voice **1-4 credits, max 8.**

MUSI 1280
Major Violin **1-4 credits, max 8.**

MUSI 1290
Major Viola **1-4 credits, max 8.**

MUSI 1300
Major Cello **1-4 credits, max 8.**

MUSI 1310
Major Double Bass **1-4 credits, max 8.**

MUSI 1340
Major Flute **1-4 credits, max 8.**

MUSI 1350
Major Oboe **1-4 credits, max 8.**

MUSI 1360
Major Clarinet **1-4 credits, max 8.**

MUSI 1370
Major Saxophone **1-4 credits, max 8.**

MUSI 1380
Major Bassoon **1-4 credits, max 8.**

MUSI 1390
Major Trumpet **1-4 credits, max 8.**

MUSI 1400
Major French Horn **1-4 credits, max 8.**

MUSI 1410
Major Trombone **1-4 credits, max 8.**

MUSI 1420
Major Euphonium **1-4 credits, max 8.**

MUSI 1430
Major Tuba **1-4 credits, max 8.**

MUSI 1440
Major Percussion **1-4 credits, max 8.**

MUSI 1531
Sight Singing and Ear Training I
Lab 2. Development of skills in sight singing and aural perception. *Taken concurrently with MUSI 1533.*

MUSI 1533
Theory of Music I
Lab .5. Choral and instrumental writing and analysis correlated with keyboard skills. *Taken concurrently with MUSI 1531.*

MUSI 1541
Sight Singing and Ear Training II
Prerequisite(s): 1531 and 1533. A continuation of 1531. *Taken concurrently with 1543.*

MUSI 1543
Theory of Music II
Lab .25. Prerequisite(s): 1531 and 1533. A continuation of 1533. *Taken concurrently with 1541.*

MUSI 1623
Introduction to Music Business
Prerequisite(s): Music major status or consent of instructor. A survey of music business procedures, opportunities, technologies and trends.

MUSI 1723
Introduction to Music Education
An entry level course designed to socialize the music education major to the role of the music education teacher within US schools. Motivation and discipline, teaching cycles, stimulus variation, multicultural music, music learning theories, music advocacy, foundations of music introduction, structured observational skills.

MUSI 2010
Piano Class Lessons
1 credit, max 3. Prerequisite(s): 1021 and music major status. Class lessons for music majors (non-keyboard concentration) preparing for the piano proficiency examination.

MUSI 2052
String Instrument Techniques
Methods for playing and teaching the violin, viola, cello and double bass.

MUSI 2071
Flute Techniques
Methods for playing and teaching the flute.

MUSI 2091
Low Brass Techniques
Methods for playing and teaching the trombone, euphonium, and tuba.

MUSI 2250
Major Organ
1-6 credits, max12. Prerequisite(s): 1250.

MUSI 2260
Major Piano
1-6 credits, max 12. Prerequisite(s): 1260.

MUSI 2270
Major Voice
1-6 credits, max 12. Prerequisite(s): 1270.

MUSI 2280
Major Violin
1-6 credits, max 12. Prerequisite(s): 1280.

MUSI 2290
Major Viola
1-6 credits, max 12. Prerequisite(s): 1290.

MUSI 2300
Major Cello
1-6 credits, max 12. Prerequisite(s): 1300.

MUSI 2310
Major Double Bass
1-6 credits, max 12. Prerequisite(s): 1310.

MUSI 2340
Major Flute
1-6 credits, max 12. Prerequisite(s): 1340.

MUSI 2350
Major Oboe
1-6 credits, max 12. Prerequisite(s): 1350.

MUSI 2360
Major Clarinet
1-6 credits, max 12. Prerequisite(s): 1360.

MUSI 2370
Major Saxophone
1-6 credits, max 12. Prerequisite(s): 1370.

MUSI 2380
Major Bassoon
1-6 credits, max 12. Prerequisite(s): 1380.

MUSI 2390
Major Trumpet
1-6 credits, max 12. Prerequisite(s): 1390.

MUSI 2400
Major French Horn
1-4 credits, max 8. Prerequisite(s): 1400.

MUSI 2410
Major Trombone
1-6 credits, max 12. Prerequisite(s): 1410.

MUSI 2420
Major Euphonium
1-4 credits, max 8. Prerequisite(s): 1420.

MUSI 2430
Major Tuba
1-6 credits, max 12. Prerequisite(s): 1430.

MUSI 2440
Major Percussion
1-4 credits, max 8. Prerequisite(s): 1440.

MUSI 2450
Major Harpsichord
1-4 credits, max 8.

MUSI 2551
Sight Singing and Ear Training III
Prerequisite(s): 1541 and 1543. Further development of skills in sightsinging and aural perception. *Taken concurrently with 2553.*

MUSI 2553
Theory of Music III
Lab .5. Prerequisite(s): 1541 and 1543. Choral and instrumental writing correlated with sightsinging, melodic and harmonic dictation and keyboard skills. *Taken concurrently with 2551.*

MUSI 2561
Sight Singing and Ear Training IV
Prerequisite(s): 2551 and 2553. A continuation of 2551. *Taken concurrently with 2563.*

MUSI 2563
Theory of Music IV
Lab .5. Prerequisite(s): 2551 and 2553. A continuation of 2553. *Taken concurrently with 2561.*

MUSI 2573
(H)Introduction to Music
Instruments, musical forms and styles, and major composers from the 16th century to the present. *For non-majors; no prior musical experience required.*

MUSI 2600
Chamber Ensembles
1 credit, max 8, Lab 2. Combination of voices, keyboard, and orchestral instruments for performing chamber music, music theater and duo piano repertoire. ***(Same course as 4600*)***

MUSI 2610
University Bands I
1-2 credits, max 6, Lab 3-5.

MUSI 2620
Symphony Orchestra I
1-2 credits, max 6, Lab 3. ***(Same course as 3620 & 5620*)***

MUSI 2630
University Choral Ensembles I
1-2 credits, max 6. ***(Same course as 3630 & 5630*)***

MUSI 2832
Elementary Music Methods
An overview of effective methods, techniques and materials for teaching music to children in the elementary grades. Theories of child development and implications on music learning; current philosophies or approaches for teaching music (Kodaly, Orff, and Dalcroze); designing and teaching musical activities through which children learn musical concepts and develop musical skills.

MUSI 2842
Intermediate Music Methods
Prerequisite(s): 2832. Second in a series of two vocal method courses for vocal music education majors. Field experience and peer teaching activities. Curriculum design and evaluation; technology for music instruction; multicultural music in the classroom; music for exceptional children; and music in an integrated curriculum.

MUSI 3022
Piano Skills for Vocal Music Education Majors
Prerequisite(s): 2010 or consent of instructor. Development of skills in sight-reading, score reading, and general ensemble accompaniment for vocal music education majors.

MUSI 3110
Elective Organ
1-4 credits, max 8. Prerequisite(s): 1110.

MUSI 3120
Elective Piano
1-4 credits, max 8. Prerequisite(s): 1120.

MUSI 3130
Elective Voice
1-4 credits, max 8. Prerequisite(s): 1130.

MUSI 3140
Elective Brass
1-4 credits, max 8. Prerequisite(s): 1140.

MUSI 3150
Elective String
1-4 credits, max 8. Prerequisite(s): 1150.

MUSI 3160
Elective Woodwind
1-4 credits, max 8. Prerequisite(s): 1160.

MUSI 3170
Elective Percussion
1-4 credits, max 8. Prerequisite(s): 1170.

MUSI 3180
Secondary Organ
1-2 credits, max 8. Prerequisite(s): 1180.

MUSI 3190
Secondary Piano
1-2 credits, max 8. Prerequisite(s): 1190.

MUSI 3200
Secondary Voice
1-2 credits, max 8. Prerequisite(s): 1200.

MUSI 3210
Secondary Brass
1-2 credits, max 8. Prerequisite(s): 1210.

MUSI 3220
Secondary String
1-2 credits, max 8. Prerequisite(s): 1220.

MUSI 3230
Secondary Woodwind
1-2 credits, max 8. Prerequisite(s): 1230.

MUSI 3240
Secondary Percussion
1-2 credits, max 8. Prerequisite(s): 1240.

MUSI 3250
Major Organ
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2250.

MUSI 3260
Major Piano
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2260.

MUSI 3270
Major Voice
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2270.

MUSI 3280
Major Violin
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2280.

MUSI 3290
Major Viola
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2290.

MUSI 3300
Major Cello
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2300.

MUSI 3310
Major Double Bass
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2310.

MUSI 3340
Major Flute
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2340.

MUSI 3350
Major Oboe
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2350.

MUSI 3360
Major Clarinet
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2360.

MUSI 3370
Major Saxophone
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2370.

MUSI 3380
Major Bassoon
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2380.

MUSI 3390
Major Trumpet
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2390.

MUSI 3400
Major French Horn
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2400.

MUSI 3410
Major Trombone
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2410.

MUSI 3420
Major Euphonium
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2420.

MUSI 3430
Major Tuba
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2430.

MUSI 3440
Major Percussion
1-4 credits, max 8. Prerequisite(s): Upper-division examination, 2440.

MUSI 3450
Major Harpsichord
1-4 credits, max 8.

MUSI 3460
Secondary Harpsichord
1-2 credits, max 8.

MUSI 3543
(H,I)Music and Culture of Northern Italy
Study of northern Italy's contributions to culture through music and composers, instrument makers, architecture, and visual arts.

MUSI 3552
Introduction to Recording Studio Techniques I
Prerequisite(s): 3592. Introduction to performance and characteristics of studio components. Basic signal flow, basic microphone design and application, recording session procedures, role of assistant engineers.

MUSI 3562
Recording Studio Techniques II
Prerequisite(s): 3552. Introduction to specialized computer applications in music, including introductory music notation, digital audio recording.

MUSI 3573
(D,H)America's Ethnic Music
A survey of the ethnic settlers of America and their musical traditions and literatures. Particular emphasis is given to settlers indigenous to Oklahoma. Students will examine their individual ethnic roots in music, family traditions, and life passages (births, deaths, celebrations).

MUSI 3583
(H,I)Traditional World Music
Survey of the richly diverse music of non-western cultures emphasizing traditional musical practices prior to contact with western media. Exploration of the wide parameters of musical possibilities and the distinct priorities of various musical cultures, in order to gain insight and appreciation of distinctly non-western music. Historical recordings supplemented by video tapes. Knowledge of western classical music notation helpful. *Intended for students having earned at least 40 credit hours.* ***(Same course as 5583*)***

MUSI 3592
Introduction to Music Technology
Introduction to specialized computer applications in music, including music notation, digital audio recording, processing and editing.

MUSI 3610
University Bands II
1-2 credits, max 6, Lab 3. Prerequisite(s): 4 hours of 2610.
(Same course as 2610 & 5610*)

MUSI 3620
Symphony Orchestra II
1-2 credits, max 6, Lab 3. ***(Same course as 2620 & 5620*)***

MUSI 3630
University Choral Ensembles II
1-2 credits, max 6. Prerequisite(s): 4 hours of 2630.
(Same course as 2630 & 5630*)

MUSI 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.

MUSI 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.

MUSI 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.

MUSI 3712
Basic Conducting
Principles of conducting choral and instrumental groups.

MUSI 3722
Advanced Ensemble Conducting
Prerequisite(s): 3712. Studies in advanced physical conducting techniques and score orientation, score reading, score analysis, and score interpretation.

MUSI 3732
Secondary Choral Methods
Prerequisite(s): 3712. Repertoire, rehearsal procedures, and vocal techniques for the public school choral teacher.

MUSI 3741
Survey of Rock and Roll I
An examination of the cultural and musical elements that led to the advent of Rock and Roll, through an exploration of the evolution of the music from its inception to 1980 through lecture, reading and musical recordings.

MUSI 3743
Foundations of Music Education
Prerequisite(s): Full admission to Professional Education. Interdisciplinary approach including aspects of philosophy, aesthetics, sociology and psychology as they are applied in music in post-elementary public schools.

MUSI 3751
Survey of Rock and Roll II
An examination of the cultural and musical elements that led to the advent of Rock and Roll, through an exploration of the music from 1980 to the present.

MUSI 3753
(H)History of Music to 1600
Prerequisite(s): 1543 or consent of instructor. Aids music majors and other qualified students in understanding the musical styles, forms, schools, composers and instruments that developed in Western civilization from antiquity through the Renaissance period.

MUSI 3763
History of Music from 1600-1800
Prerequisite(s): 1533, 1543 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 Baroque period through to the Classical period.

MUSI 3772
Counterpoint
Prerequisite(s): 2563 and satisfactory upper-division examination. Analysis and application of contrapuntal techniques of the 18th century.

MUSI 3783
Form and Analysis
Prerequisite(s): 2563 and satisfactory upper-division examination. Analysis of standard repertoire with emphasis on form and structural harmonic analysis.

MUSI 3842
Marching Band Methods
Prerequisite(s): 2832. Organizational responsibilities and charting for public school marching bands.

MUSI 3852
Secondary Instrumental Methods
Prerequisite(s): 2832; 3712. This course is designed to give instrumental music education majors an in-depth look at administering a public school band program, including history and wind literature, literature selection, preparing budgets, preparing commissioning projects, working with administration, school boards and parent groups, organizational responsibilities, and charting for public school marching bands.

MUSI 3873
History of Music from 1800-present
Prerequisite(s): 1533 and 1543. Aids music majors and other qualified students in understanding the musical styles, forms, schools, composers and instruments that developed in Western civilization from the Romantic period through to the present.

MUSI 3901
Junior Recital
Prerequisite(s): Junior standing and consent of major applied music teacher.

MUSI 4100
Music Industry Internship
1-8 credits, max 8. Prerequisite(s): 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.

MUSI 4250
Major Organ
1-6 credits, max 12. Prerequisite(s): 3250 and successful completion of recital attendance requirements.

MUSI 4260
Major Piano
1-6 credits, max 12. Prerequisite(s): 3260 and successful completion of recital attendance requirements.

MUSI 4270
Major Voice
1-6 credits, max 12. Prerequisite(s): 3270 and successful completion of recital attendance requirements.

MUSI 4280
Major Violin
1-6 credits, max 12. Prerequisite(s): 3280 and successful completion of recital attendance requirements.

MUSI 4290
Major Viola
1-6 credits, max 12. Prerequisite(s): 3290 and successful completion of recital attendance requirements.

MUSI 4300
Major Cello
1-6 credits, max 12. Prerequisite(s): 3300 and successful completion of recital attendance requirements.

MUSI 4310
Major Double Bass
1-6 credits, max 12. Prerequisite(s): 3310 and successful completion of recital attendance requirements.

MUSI 4340
Major Flute
1-6 credits, max 12. Prerequisite(s): 3340 and successful completion of recital attendance requirements.

MUSI 4350
Major Oboe
1-6 credits, max 12. Prerequisite(s): 3350 and successful completion of recital attendance requirements.

MUSI 4360
Major Clarinet
1-6 credits, max 12. Prerequisite(s): 3360 and successful completion of recital attendance requirements.

MUSI 4370
Major Saxophone
1-6 credits, max 12. Prerequisite(s): 3370 and successful completion of recital attendance requirements.

MUSI 4380
Major Bassoon
1-6 credits, max 12. Prerequisite(s): 3380 and successful completion of recital attendance requirements.

MUSI 4390
Major Trumpet
1-6 credits, max 12. Prerequisite(s): 3390 and successful completion of recital attendance requirements.

MUSI 4400
Major French Horn
1-6 credits, max 12. Prerequisite(s): 3400 and successful completion of recital attendance requirements.

MUSI 4410
Major Trombone
1-6 credits, max 12. Prerequisite(s): 3410 and successful completion of recital attendance requirements.

MUSI 4420
Major Euphonium
1-4 credits, max 8. Prerequisite(s): 3420 and successful completion of recital attendance requirements.

MUSI 4430
Major Tuba
1-6 credits, max 12. Prerequisite(s): 3430 and successful completion of recital attendance requirements.

MUSI 4440
Major Percussion
1-6 credits, max 12. Prerequisite(s): 3440 and successful completion of recital attendance requirements.

MUSI 4450
Major Harpsichord
1-4 credits, max 8.

MUSI 4490*
Lessons in Applied Music (Major Field)
1-4 credits, max 4. Prerequisite(s): Bachelor's degree or equivalent performing level in applied major field. Major applied music field.

MUSI 4600*
Chamber Ensembles
1-2 credits, max 12, Lab 2. Prerequisite(s): 4 hours of MUSI 2600 or equivalent. Combinations of voices, keyboard, and orchestral instruments for performing chamber music, music theater and duo piano repertoire.
(Same course as 2600)

MUSI 4810*
Problems in Musical Composition
1-2 credits, max 8. Prerequisite(s): 1543 and consent of instructor. Practical experience in musical composition.

MUSI 4840*
Special Studies in Music Literature
1-2 credits, max 4. Prerequisite(s): Junior standing or consent of instructor. Survey of music literature suitable for teaching various levels in applied music.

MUSI 4890*
Special Studies in Music Pedagogy
1-2 credits, max 4. Prerequisite(s): Junior standing or consent of instructor. Survey of music pedagogical methods suitable for various levels and types of applied music.

MUSI 4901
Senior Recital
Prerequisite(s): Senior standing and permission of major applied music teacher.

MUSI 4912
Orchestration and Arranging
Prerequisite(s): Upper-division standing as a music major or consent of instructor. Orchestrating for instrumental ensembles and arranging for choral ensembles.

MUSI 4940
Student Teaching in Public School Music
1-12 credits, max 12. Prerequisite(s): Full admission to Professional Education. Directed observation, seminars, and supervised student teaching in selected elementary and secondary music programs. *Graded on a pass-fail basis.*

MUSI 4952*
Music in the School Curriculum
Aims, content and motivation of the music education program in elementary and secondary schools from the standpoint of the classroom teacher, music specialist and administrator.

MUSI 4962*
Music Education Seminar
Research into latest developments of public school choral and instrumental music.

MUSI 4972
Analysis of Music Since 1900
Prerequisite(s): 2563, 3873. Techniques for the analysis of music from the 20th and 21st centuries, including set analysis. *Meets with 5972. No credit for students with credit in MUSI 5972.*

MUSI 4990*
Selected Studies in Music and Music Education
1-3 credits, max 8. Short-term area studies in music and music education.

MUSI 4993
Senior Honors Project
Prerequisite(s): 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.

MUSI 5002*
Final Degree Performance
Prepare and perform or conduct a public concert or recital of significant repertoire.

MUSI 5012*
Final Degree Paper
Submission of a formal paper that is an interpretive analysis of repertoire performed on the final degree performance, or a formal paper on topics related to the student's applied area.

MUSI 5113*
Introduction to Graduate Studies in Music
Prerequisite(s): 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.

MUSI 5480*
Lessons in Applied Music (Minor Field)
1-4 credits, max 12. Prerequisite(s): Bachelor's degree or equivalent performance level in applied major field.

MUSI 5490*
Lessons in Applied Music (Major Field)
1-4 credits, max 12. Prerequisite(s): Bachelor's degree or equivalent performing level in applied major field. Private Lessons.

MUSI 5512*
Advanced Studies in Music Literature and Pedagogy I
Prerequisite(s): 3753, 3763 or equivalent. Techniques of successful programming, teaching and performance of ensemble literature through a survey of repertoire appropriate to the student's chosen medium.

MUSI 5522*
Advanced Studies in Music Literature and Pedagogy II
Prerequisite(s): 3753, 3763 or equivalent. A continuation of 5512, with emphasis upon music of the 20th century and its attendant specialized performance techniques.

MUSI 5583*
Traditional World Music
Survey of the richly diverse music of non-Western cultures emphasizing traditional musical practices prior to contact with Western media. Historical recordings supplemented by video tapes. Knowledge of Western classical music notation helpful. *Taught in conjunction with 3583.*
(Same course as 3583)

MUSI 5610*
University Bands
1-2 credits, max 12. Large ensembles. ***(Same course as 2610 & 3610)***

MUSI 5620*
Symphony Orchestras
1-2 credits, max 12. Large ensembles. ***(Same course as 2620 & 3620)***

MUSI 5630*
University Choral Ensembles
1-2 credits, max 12. Large ensembles. ***(Same course as 2630 & 3630)***

MUSI 5712*
Advanced Studies in Conducting I
Prerequisite(s): 3712 and 3722 or equivalent. Acquisition of an expressive conducting gestural vocabulary as it relates to the student's chosen medium.

MUSI 5722*
Advanced Studies in Conducting II
Prerequisite(s): 5712. A continuation of 5712 focusing upon the gestural vocabulary as it relates to the specific complexities of contemporary music.

MUSI 5733*
Techniques of Pedagogy and Performance
Prerequisite(s): 3712 and 3722 or equivalent. Advanced techniques and modes for preparing music for performance.

MUSI 5742*
Conducting Practicum
Prerequisite(s): 5712, 5722. Supervised conducting opportunities with major OSU ensembles or approved off-campus ensembles.

MUSI 5750*
Seminar in Music History
3 credits, max 9. Prerequisite(s): 3753 and 3763 or equivalent. Major European musical genres and pedagogical methods of a specified time in musical history. Acquaintance with source materials from the specified period to facilitate a knowledge of performance of genres studied. Topics vary.

MUSI 5842*
Music Repertory
Survey of music literature suitable for teaching various levels in applied music.

MUSI 5962*
Analysis of Musical Styles
Prerequisite(s): 3783 or equivalent. Exploration of techniques appropriate for the analysis of selected music of various styles and genres of the 17th, 18th and 19th centuries, including Schenkerian analytic techniques.

MUSI 5972*
Analysis of Music Since 1900
Prerequisite(s): 2563, 3873. Techniques for the analysis of music from the 20th and 21st centuries, including set analysis. *Meets with 4972. No credit for students with credit in MUSI 4972.*

Natural Resource Ecology and Management (NREM)

NREM 1011
Professions in Natural Resources
An examination of the professions that focus on the ecology and management of natural resources. Exploration of academic and career options. *Graded on a pass-fail basis.*

NREM 1014
(N,L)Introduction to Natural History
Lab 2. The study of living organisms especially their origins, life histories, behaviors, conservation, and unique adaptations for reproducing and relating to their environment. Laboratory emphasis is on observation and investigation of the diversity and adaptations of living organisms.

NREM 1114
Elements of Forestry
Lab 3. Survey of forestry as an art, science and profession including forestry and natural resource management theory, forest resource distribution and ownership, history of forest resource policy development, administration and management of forest resources, forest protection, wildlife interactions, forest recreation, forest ecosystem process, land and tree measurements, mapping, current issues, and career opportunities. *One required two-day field trip.*

NREM 1214
Introduction to Wood Properties and Products
Lab 2. Basic understanding of anatomical, physical and mechanical properties of solid wood and wood products. Macroscopic and microscopic identification of wood. Principles of manufacture of lumber, plywood and wood composites. Biological deterioration of wood and main wood preservation techniques. *One weekend field trip required.*

NREM 2013
(N)Ecology of Natural Resources
Prerequisite(s): BIOL 1114 or PLNT 1213. Introductory focus on 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.

NREM 2103
Forest Measurements I
Lab 2. Prerequisite(s): 1114; MATH 1715 (or MATH 1513 and 1613); STAT 2013 (or concurrent). An introduction to the measurements of forests, forest products, standing trees, growth, and the application of mensurational techniques to timber valuation and analysis. Measurement techniques of non-timber components of forest resources.

NREM 2113
Timber Harvesting
Lab 3. Theory and strategies of planning and management of timber harvesting. Harvesting techniques including felling, bucking, skidding operations, and cable yarding. Timber harvest cost analysis, safety aspects of harvesting, and principles of forest road building. Field practices in road design and surveying. Field trips to industrial timber harvesting operations.

NREM 2134
Dendrology
Lab 4. Identification, taxonomy and distribution of forest trees and shrubs of the United States; their environmental requirements and utilization.

NREM 3083
Aerial Photogrammetry and Information Systems
Lab 3. Prerequisite(s): MATH 1483, 1493 or 1513. 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.

NREM 3102
Forest Measurements II
Lab 4. Prerequisite(s): 2103. Two-week segment of seven-week summer field camp. Field study focusing on land, tree and stand-level mensuragion and the use and care of measurement equipment. Special emphasis on the statistical and physical design of forest inventory methods.

NREM 3103
Natural Resources Use, Values and Assessment
Lab 6. 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.

NREM 3112
Silvics and Silvicultural Practices
Lab 4. Prerequisite(s): 2134; BOT 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.

NREM 3113
Wood Properties
Lab 2. Prerequisite(s): 1214. Cellular and microscopic structure of wood. Properties of cellulose, lignin and hemicellulose. Wood and water relationship; wood drying and treatment systems. Stress-strain systems, rheological characteristics of wood, and assignment of design stresses in structural uses.

NREM 3213
Forest Ecology
Lab 2. Prerequisite(s): BOT 1404. Study of the forest ecosystem, its structure, function, physical environment, biotic components, change over time and management implications.

NREM 3223
Silviculture
Lab 2. Prerequisite(s): 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*.

NREM 3323
Forest Economics and Finance
Prerequisite(s): AGEC 1114. 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 non-market goods.

NREM 3343
(N)Forest Environmental Science
Overview and analysis of forests, their related environments, their associated natural resources, and their tangible and intangible values, emphasizing basic principles of scientific forest management, the use of forest resources by society, natural resource administration and policy, and current issues in forestry. *No credit for NREM in Forestry options.*

NREM 3363
Forest Biometrics
Prerequisite(s): 3102; MATH 2103. The application of statistical methods to forestry problems including stand volume estimation, growth measurement, 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.

NREM 3900
Colloquium on the Environment and Conservation
1 credit, max 4. Current conservation and environmental concerns presented by scholars and experts emphasizing discovery and solutions. Natural resource agencies and conservation organizations.

NREM 3502
Wildlife Law Enforcement
Prerequisite(s): 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, videotapes and field exercises.

NREM 3513
Principles of Conservation Biology
Prerequisite(s): 60 credit hours including BIOL 3034. Application of ecological principles to the maintenance and restoration of biological diversity at genetic, population, and community levels. ***(Same course as ZOOL 3513)***

NREM 3613
Rangeland Management and Restoration
Prerequisite(s): 2613 or 3213 or BIOL 3034; SOIL 2124. Managing and restoring rangelands using prescribed burning, grazing and seeding. Managing invasive species with herbicides and mechanical treatments.

NREM 4213*
Forest Ecophysiology
Prerequisite(s): BOT 1404. 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.

NREM 4273*
Forest Genetics and Tree Improvement
Prerequisite(s): 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 programs as part of forest and nursery management systems.

NREM 4323*
Timber Management
Prerequisite(s): 3223, 3323. Regulation of forest growing stock to meet management objectives. Land and timber appraisals. Organization of the forest enterprise to meet financial objectives of management.

NREM 4333*
Forest Resource Management: Planning and Decision-Making
Lab 2. Prerequisite(s): 4323. Integrated problem solving, to apply biological, quantitative, economic, political, and administrative principles in solving forest resource management problems.

NREM 4343*
Forest Administration and Policy
Forest policy and legislation; personnel matters, organization, supervision and financing of federal, state and private forest enterprises.

NREM 4353*
Forest Recreation
An analysis of planning, management, administration and use of forests and related wildlands for recreation, including an overview of public agency and private sector recreation resources, programs, and policy; social foundations of recreation; measurement and evaluation of recreation resource settings, activities, experiences, and use-impact; resource operations and interpretive services; and wilderness management.

NREM 4393
(I)International Forestry and Natural Resources
Prerequisite(s): Consent of instructor. Relationship between people, forests, the land, and associated natural resources from an international perspective, including an examination of the cultural basis for resource use and development. Topics include sustainable development, ecotourism, deforestation and related issues.

NREM 4403*
Wetland Ecology and Management
Lab 3. Prerequisite(s): 3513 or BIOL 3034, or NREM 3213 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.

NREM 4411*
Water Quality Laboratory
Lab 3. Prerequisite(s): 4413, previous or concurrent. Techniques to monitor surface water for non-point 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.*

NREM 4413*
Watershed Hydrology and Water Quality
Lab 2. A study of the effects of land management on non-point source pollution of surface waters. Basic watershed hydrology and the role of hydrologic processes and watershed characteristics in controlling the quantity and quality of water from watersheds. Forest, range and agricultural land uses. Discussion of methods of non-point source pollution control.

NREM 4414*
Fisheries Management
Lab 4. Prerequisite(s): BIOL 3034. Techniques and principles involved in management of fishes. *Field trip fee required.*

NREM 4424
Fisheries Techniques
Lab 4. Prerequisite(s): 4414, BIOL 3034, and ENGL 3323 strongly recommended. Research techniques and methodology in fisheries science, including sampling design, habitat measurements, sampling gears and abundance estimation, age and growth analysis, recreational surveys, data analysis, and report writing. *No credit for students with credit in 5424*.*

NREM 4464*
Ornithology
Lab 2. Prerequisite(s): ZOOL 1604. Classification, evolution, distribution, identification, life histories, and morphological, ecological, and behavioral adaptations of birds. *Two weekend field trips required.*
(Same course as ZOOL 4464*)

NREM 4513*
Wildlife Management
Prerequisite(s): BIOL 3034 or NREM 3213. Biological basis for the management of wildlife populations and habitats, with emphasis on current management problems.

NREM 4524*
Wildlife Management Techniques
Lab 4. Prerequisite(s): 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.

NREM 4543*
Wildlife Habitat Ecology
Prerequisite(s): BIOL 3034 or concurrent enrollment. Exploration of relationships among wildlife and the habitat features that limit or sustain their distributions. Topics span global biogeography to Oklahoma ecoregions. Group exercises in original literature discussion and production of habitat models.

NREM 4613
Rangeland Resources Planning
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)***

NREM 4783
Prescribed Fire
Lab 3. Prerequisite(s): 3613. 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.*

NREM 4793
Advanced Prescribed Fire
Lab 3. Prerequisite(s): 4783 or consent of instructor. Preparing fire plans and executing prescribed fires as the fireboss. *No credit for both NREM 4793 and NREM 5793.* ***(Same course as 5793*)***

NREM 4980
Undergraduate Research Problems
1-3 credits, max 3, Lab 1-3. Prerequisite(s): Upper-division standing, GPA of 2.50 or better and consent of instructor. Participation in faculty research or execution of a research problem formulated by the student.

NREM 4990*
Special Topics in Natural Resource Ecology and Management
1-3 credits, max 12. Advanced topics and new developments in natural resource ecology and management.

NREM 4991
Senior Seminar
Prerequisite(s): Senior standing in Natural Resource Ecology and Management. Career opportunities (talks and field trips); preparation of resumes and interviews. *Graded on a pass-fail basis.*

NREM 5000*
Master's Thesis or Report
1-6 credits, max 6 (Thesis), 2 (Report). Independent research planned, conducted and reported in consultation with a major professor.

NREM 5020*
Graduate Seminar
1 credit, max 10. Special topics in Natural Resource Ecology and Management; philosophy, methods and interpretation of research.

NREM 5030*
Special Problems in Natural Resource Ecology and Management
1-9 credits, max 9. Special problems in areas of natural resource ecology and management other than those covered in the student's thesis research.

NREM 5103*
Production Ecology of Forested Ecosystems
Prerequisite(s): 3213 or BIOL 3034. Mechanisms driving the growth and productivity of forests, shrublands, and savannas in response to resource availability, genetics, disturbance, and climate. Topics will include the factors affecting the distribution of forests, relationship between leaf area and productivity, the causes for declining productivity with age, effects of diversity on productivity, the proximal causes of increased growth associated with resource additions, the effects of genetics and uniformity on stand growth, and using stand-level mechanisms to predict forest growth.

NREM 5130*
Special Topics in Forestry
1-3 credits, max 9. Advanced study on special topics in forestry.

NREM 5133*
Advanced Topics in Forest Biometrics
Prerequisite(s): 3363 or equivalent; STAT 5013 concurrently or equivalent. Quantitative description of forest populations and methods for modeling forest growth and development. Sampling techniques for forest populations.

NREM 5424*
Fisheries Techniques
Lab 4. Prerequisite(s): 4414, BIOL 3034, and ENGL 3323 strongly recommended. Research techniques and methodology in fisheries science, including sampling design, habitat measurements, sampling gears and abundance estimation, age and growth analysis, recreational surveys, data analysis and report writing. *No credit for students with credit in 4424.*

NREM 5433*
Fisheries Science
Prerequisite(s): 4414 or equivalent or consent of instructor. Principles of fisheries science as they relate to fish and aquatic biota, their habitats, and the humans who utilize them.

NREM 5464*
Stream Ecology
Lab 4. Prerequisite(s): Course in ecology strongly recommended. Ecology of streams and rivers, physical and chemical properties, biotic assemblages and interactions, ecosystem processes and theories and human impact.

NREM 5523*
Population Ecology
Lab 2.5. Prerequisite(s): 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. ***(Same course as ZOOL 5523*)***

NREM 5563*
Forest Wildlife Ecology
Prerequisite(s): 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.*

NREM 5573*
Grassland and Desert Wildlife Ecology
Prerequisite(s): 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.

NREM 5583*
Wetland Wildlife Ecology
Prerequisite(s): 4513 or consent of instructor. Ecology and management of wetland dependent wildlife species with an emphasis on the autecology, adaptations for inhabiting wetland systems, and management problems associated with these taxa.

NREM 5654*
Applied Landscape Ecology
Lab 3. Advanced ecology and management of grasslands, shrublands, and forests. Understanding the effects of grazing, fire and other disturbances on biotic and abiotic processes. Vegetation dynamics, wildlife habitat evaluation, woody plant encroachment, rangeland monitoring, and landscape ecology. *Field trips required at additional cost to students.*

NREM 5660*
Special Topics in Rangeland Science
2-4 credits, max 4. Prerequisite(s): Consent of instructor. Selected topics in rangeland research methods or other rangeland topics.

NREM 5783*
Prescribed Fire
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.*

NREM 5793*
Advanced Prescribed Fire
Lab 3. Prerequisite(s): 4783 or consent of instructor. Preparing fire plans and executing prescribed fires as the fireboss. *No credit for both 4793 and 5793.*

NREM 6000*
Doctoral Dissertation
1-15 credits, max 45. Independent research planned, conducted and reported in consultation with major professor.

NREM 6010*
Advanced Topics and Conference
1-6 credits, max 6. Prerequisite(s): MS degree. Supervised study of advanced topics. A reading and conference course designed to acquaint the advanced student with fields not covered in other courses.

Natural Science (NATS)

NATS 5050*
Report
1-2 credits, max 2. Prerequisite(s): Enrollment in program leading to MS in natural science. Guidance in reading and research required for MS in natural science degree.

NATS 5990*
Topics in Natural and Applied Sciences
1-3 credits, max 9. Prerequisite(s): 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)

NSCI 2111
Professional Careers in Nutritional Sciences
Prerequisite(s): For students interested in Allied Health, Community Nutrition or Nutrition and Exercise or consent of instructor. Career opportunities in health professions. Roles and responsibilities of health care professionals. Routes to professional memberships and current issues in professionalism.

NSCI 2114
(N)Principles of Human Nutrition
Functions of the nutrients in human life processes. Nutrient relationship to health as a basis for food choices. *Open to all University students.*

NSCI 2211
Professional Careers in Dietetics
Prerequisite(s): For students interested in Dietetics and Dietetics and Exercise options or consent of instructor. Career opportunities in Dietetics. Roles and responsibilities of Dietitians. Routes to professional memberships and current issues in professionalism.

NSCI 2850
Special Topics in Nutritional Sciences
1-3 credits, max 4. Study of specific consumer education issues or topics in nutritional sciences.

NSCI 3133
Science of Food Preparation
Lab 3. Prerequisite(s): HRAD 1114, NSCI 2114, organic chemistry. Scientific principles underlying functions of food ingredients, recipe/menu modification, diet management for disease states and food safety.

NSCI 3223
Nutrition Across the Life Span
Prerequisite(s): 2114 or equivalent. Nutritional needs and dietary concerns of individuals from conception through old age.

NSCI 3440
Nutritional Sciences Preprofessional Experience
1-3 credits, max 3. Directed practical experience in an approved work situation related to the food or nutrition.

NSCI 3543
(I,S)Food and the Human Environment
Impact of the various factors that affect food availability, production, processing, distribution and consumption of food in the world. International cultures and foods. Challenges of and solutions to the world food crisis.

NSCI 3813
Nutrition Assessment and Counseling Skills
Lab 3. Prerequisite(s): NSCI Dietetics or Dietetics and Exercise students only, 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.

NSCI 3991
Dietetics Career Experience
Prerequisite(s): 2111. Observational career experience in various settings with practicing registered dietitians.

NSCI 4013*
Experimental Foods
Lab 3. Prerequisite(s): 3133 or consent of instructor. Investigations in physical, chemical and sensory, and functional properties of foods and their ingredients. Research project applying food science and nutrition principles to product development.

NSCI 4023
Nutrition and Health Issues
Prerequisite(s): 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.

NSCI 4133
Nutrition for Exercise and Sport
Prerequisite(s): 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.

NSCI 4323
Human Nutrition and Metabolism
Prerequisite(s): 2114 or equivalent, organic chemistry, physiology. Digestion, absorption and metabolism of nutrients; functions and health implications in the human organism.

NSCI 4365*
Quantity Food Production Management
Lab 5. Prerequisite(s): 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.

NSCI 4373
Principles of Nutrition Education
Prerequisite(s): 2114, 3223 or consent of instructor. Analysis of various methods, strategies, theories, resources and evaluation methods for nutrition education.

NSCI 4573
Food Systems Administration
Prerequisite(s): HRAD 3553, 4365. Management and integration of financial, human, physical, food and other material resources in various settings.

NSCI 4643
Capstone for Nutritional Sciences
Prerequisite(s): Senior standing in NSCI or consent of instructor. Integration of the body of knowledge in nutritional sciences. Examination of the research basis for defining and solving critical issues. Oral and written reports.

NSCI 4733
Community Nutrition
Prerequisite(s): NSCI Dietetics, Dietetics and Exercise, or Community Nutrition students only, 2114, 3223 or consent of instructor. Application of nutrition, education and communication principles to community nutrition programs and services. *Field work required.*

NSCI 4850*
Special Unit Studies in Nutritional Sciences
1-3 credits, max 6. Special units of study in nutritional sciences.

NSCI 4854
Medical Nutrition Therapy I
Prerequisite(s): 3133, 3813, 4323 or concurrent enrollment. Physiological and metabolic bases for dietary modifications in disease states.

NSCI 4864
Medical Nutrition Therapy II
Prerequisite(s): 4854. A continuation of 4854, Medical Nutrition Therapy I.

NSCI 4900
Honors Creative Component
1-3 credits, max 3. Prerequisite(s): 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.

NSCI 5000*
Research in Nutritional Sciences
1-6 credits, max 6. Prerequisite(s): Consent of adviser. Individual research and thesis that will fulfill the requirements for the master's degree.

HDFS 5011*
Special Topics in Nutritional Sciences
Prerequisite(s): NSCI graduate standing. Orientation to graduate study and research in nutritional sciences.

NSCI 5012*
Public Policy Development in Food, Nutrition and Related Programs
Rationale underlying governmental programs in food and nutrition and human environmental sciences and assessment of the effectiveness of the programs.

NSCI 5013*
Cost Control in Food Service Systems
Prerequisite(s): Admission to Great Plains IDEA online MS in Dietetics. An overview of accounting, cost controls, and financial management in food service. Special emphasis placed on understanding the topics and applying them to the theoretical and/or practical research for food service systems. Web-based instruction.

NSCI 5023*
Advanced Nutrition and Health Issues
Prerequisite(s): BIOC 3653 and NSCI 4323/5333 or equivalent or consent of instructor. In-depth analysis of the role of specific nutrients in health maintenance and in prevention of chronic disease.

NSCI 5123*
Research Methods in Nutritional Sciences
Basic components of the research process and application of research methods to nutritional sciences. ***(Same course as 6453*)***

NSCI 5133*
Advanced Nutrition for Exercise and Sport
Prerequisite(s): HHP 3114, NSCI 4323, BIOC 3653 or consent of instructor. Advanced study of nutrition and metabolism relating to physical activity, sports and health.

NSCI 5210*
Contemporary Issues in Food Service
3-9 credits, max 9. Prerequisite(s): Admission to the Great Plains IDEA online MS in Dietetics program or consent of instructor. Contemporary issues in food service in dietetics; formulation of innovative solutions and processes to enhance effectiveness in the work place.

NSCI 5213*
Entrepreneurship in Food Service and Dietetics
Prerequisite(s): Admission to Great Plains IDEA online MS in Dietetics. An overview of entrepreneurship, characteristics of entrepreneurs and small business development within the context of food service and dietetics. Web-based instruction.

NSCI 5221*
Contemporary Issues in Clinical Nutrition
Prerequisite(s): 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.*

NSCI 5223*
Advanced Nutrition Across the Life Span
Prerequisite(s): Admission to the Great Plains IDEA online MS in Dietetics. Examination of the influence of normal physiological stresses on nutritional needs throughout the life span. Web-based instruction.

NSCI 5231*
Contemporary Issues in Community Nutrition
Prerequisite(s): Acceptance as a dietetic intern. Discern contemporary issues in the practice of community dietetics; formulate innovative solutions and processes to enhance effectiveness in the workplace. *Graded on a pass-fail basis.*

NSCI 5240*
Contemporary Issues in Nutrition
3-9 credits, max 9. Prerequisite(s): Enrolled in Great Plains IDEA online MS in Dietetics. Contemporary issues in nutrition. Web-based instruction.

NSCI 5323*
Nutrition and Physical Activity in Aging
Basic physiological changes during aging and their impact in health and disease. Successful aging with emphasis on physical activity and nutrition. Practical application to community settings. Web-based instruction.

NSCI 5333*
Human Nutrition and Metabolism
Prerequisite(s): 2114 or equivalent, organic chemistry, physiology. Digestion, absorption and metabolism of nutrients; functions and health implications in the human organism.

NSCI 5363*
Maternal and Infant Nutrition
Prerequisite(s): 2114 or equivalent. Nutritional needs and dietary concerns during pregnancy, lactation and the first year of life. Implications for nutrition intervention, education and policy.

NSCI 5373*
Childhood Nutrition
Prerequisite(s): 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.

NSCI 5393*
Nutrition and Aging
Prerequisite(s): 2114 or equivalent. Nutritional needs, and dietary concerns of the elderly. Implications for food and nutrition programs, policies, research and education.

NSCI 5403*
Contemporary Issues in Dietetics Practice
Prerequisite(s): Acceptance as a dietetic intern. Contemporary issues in the practice of dietetics; innovative solutions and processes to enhance effectiveness in the workplace.

NSCI 5412*
Dietetic Internship Management Practicum
Prerequisite(s): 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.*

NSCI 5422*
Dietetic Internship Clinical Practicum
Prerequisite(s): 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.*

NSCI 5432*
Dietetic Internship Community Nutrition
Prerequisite(s): 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.*

NSCI 5553*
International Nutrition and World Hunger
Prerequisite(s): Consent of instructor. Advanced study of the magnitude, causes, and nature of hunger and under-nutrition in low income countries; emphasis on programs, policies and planning directed toward alleviating hunger.

NSCI 5563*
Nutritional Assessment
Prerequisite(s): 3223, 4323, or equivalent. Dietary, physical, and biochemical assessment techniques and their application to patient or client nutritional status assessment in health care systems.

NSCI 5613*
Theory, Research and Practice of Nutrition Education
Prerequisite(s): 4373 or equivalent and consent of instructor. Analyses of various learning and behavior change theories and application in nutrition education.

NSCI 5643*
Advanced Medical Nutrition Therapy
Prerequisite(s): Admission to dietetic internship or consent of instructor. Physiological and metabolic bases for nutritional support in disease.

NSCI 5673*
Manpower Management in Health Care and Related Industries
Prerequisite(s): Consent of instructor. Future role, focus, practices and governance of human resources in health care.

NSCI 5713*
Advanced Community Nutrition
Prerequisite(s): 2114, 3223 and 4733 or equivalent or consent of instructor. Current issues in community nutrition with emphasis on program development and evaluation of community nutrition programs. Analysis of the impact of economic, political, legislative and cultural diversity factors in the field of community nutrition.

NSCI 5743*
Experimental Methods in Nutritional Sciences
Prerequisite(s): 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.

NSCI 5753*
Management in Health Care Systems
Prerequisite(s): Consent of instructor. Overview of US, international and transcultural health care systems. Futuristic managerial roles of health care professionals and how they affect health and health care in various settings.

NSCI 5783*
Food Technology
Prerequisite(s): Consent of instructor; graduate standing. Principles and pertinent issues in food technology, including concepts, experimental and product design, process development, evaluation, packaging and marketing. Web-based instruction.

NSCI 5840*
Masters Creative Component
1-6 credits, max 6. Prerequisite(s): Consent of adviser. An in-depth application of theoretical models and philosophies.

NSCI 5863*
Sensory Evaluation of Food
Lab 2. Prerequisite(s): 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.

NSCI 5870*
Problems in Nutritional Sciences
1-4 credits, max 6. Analysis of emerging problems and trends in nutritional sciences.

NSCI 5961*
Seminar in Nutritional Sciences
Prerequisite(s): MS students. Individual and group seminars on current issues and research in nutritional sciences. ***(Same course as 6961*)***

NSCI 6000*
Doctoral Thesis
1-12 credits, max 30. Prerequisite(s): Consent of major professor.

NSCI 6023*
Macronutrients in Human Nutrition
Prerequisite(s): BIOC 3653 and NSCI 4323/5333 or equivalent or consent of instructor. Application to the human being of metabolic processes which involve essential dietary components.

NSCI 6033*
Phytochemicals in Reduction of Chronic Disease
Prerequisite(s): 4323/5333 or equivalent or consent of instructor. Identification of basic structural, functional and metabolic properties of phytochemicals (substances in plants that have been linked to reducing chronic disease). Special attention placed on health benefits and chronic disease risk reduction.

NSCI 6123*
Micronutrients in Human Nutrition
Prerequisite(s): 6023 or consent of instructor. In-depth study of vitamins and minerals and their interrelationships in metabolism.

NSCI 6223*
Nutrition in Immunology
Prerequisite(s): 6123 or consent of instructor. Principles and issues related to nutrition and immunology. Impact of nutrients and nutritional status on integrity of the immune system.

NSCI 6233*
Critical Analysis of Current Issues in Food Service Administration
Prerequisite(s): 5593, 5673. Current issues in food service administration with emphasis on total quality management, robotics, solid waste management and research needs.

NSCI 6453*
Advanced Research Methods in Nutritional Sciences
Components of the research process for students who have completed an advanced degree. Development, application and interpretation of research methodology. ***(Same course as 5123*)***

NSCI 6870*
Independent Study in Nutritional Sciences
1-3 credits, max 6. In-depth analysis of research issues in nutritional sciences.

NSCI 6961*
Advanced Studies in Nutritional Sciences
Critical evaluation of research in nutritional sciences. Individual and group seminars on selected topics. ***(Same course as 5961*)***

Occupational Education (OCED)

OCED 5000*
Thesis or Report
2-10 credits, max 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.

OCED 5010*
Seminar
1-3 credits, max 6. Graduate student seminars focusing on current and critical issues and common problems relevant to occupational education.

OCED 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.

OCED 5123*
Evaluation of Occupational and Workforce Education Programs and Instruction
Principles of evaluation applied to instructional programs in occupational and workforce education. Techniques and strategies for designing, conducting, reporting, and applying evaluations of programs in occupational/technical schools, government agencies, and public or private sector workplaces.

OCED 5133*
Internationalism, Globalization and Occupational Education
Prerequisite(s): Graduate standing. Preparing a globally competitive workforce. Analysis of comparative international occupational/technical education systems, and critical issues in internationalism and globalization in workforce education development.

OCED 5153*
Curriculum Planning in Occupational Education
Principles and procedures for curriculum planning, development and management in occupational and adult education with analyses of current trends and practices and their implications for program quality.

OCED 5223*
Program Planning for Occupational and Technical Educators
Approaches to program planning designed around continuous improvement methods for problem solving, flow charting, budgeting, gaining program support, and Lifelong Education Program Planning (LEEP) model.

OCED 5232*
Teaching Related Information
Selection of job-related topics common to most occupational programs; procedures for incorporating those topics into the regular curriculum.

OCED 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 employment skills and the selection of job-related topics common to most occupations with procedures for incorporating those topics into the regular curriculum.

OCED 5313*
History, Principles and Organization of Workfoce Education
Prerequisite(s): Graduate standing. History, underlying principles and evolving social, political and economic forces acting upon workforce education. In-depth with critical analysis of educational programs and service areas and resulting implications for leadership development and program responsibility.

OCED 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.

OCED 5340*
Special Problems in Occupational Education
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Directed independent study of special topics involving assigned readings, library research, field work or a combination of these.

OCED 5413*
Guidance, Placement and Follow-up in Occupational Education
Teacher-counselor cooperation in occupational student advisement, placement and follow-up.

OCED 5423*
Individualized Competency-based Instruction and Customized Training
Principles, techniques, and technologies for creating and delivering individualized competency-based instruction and customized workplace training. Includes LAP systems and customizing for industry.

OCED 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.

OCED 5483*
Modern Technology in Occupational Education
Technology developments in occupational and technical education analyzed for instructional and curriculum implications.

OCED 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.

OCED 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.

OCED 5673*
Principles and Practices of Distance Learning in Occupational Education
Prerequisite(s): 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.

OCED 5720*
Workshop
1-3 credits, max 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.

OCED 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.

OCED 5880*
Internship in Occupational Education
3-6 credits, max 6. Prerequisite(s): Consent of instructor. Supervised experience working in business, industry, human service, or education settings.

OCED 5910*
Developing and Analyzing Teaching Content
1-3 credits, max 6. Provides opportunity for experienced teachers to incorporate the latest industrial technology into their course of study.

OCED 6000*
Doctoral Dissertation
1-25 credits, max 25. Required of all candidates for the Doctor of Philosophy degree. Credit is given upon completion of the dissertation.

OCED 6103*
Philosophy of Occupational Education
Alternative perspectives for developing a philosophic position in occupational and adult education.

OCED 6110*
Graduate Reading in Occupational Education
1-6 credits, max 6. Prerequisite(s): Graduate standing and consent of supervising professor. Supervised readings of significant literature not included in regularly scheduled courses.

OCED 6113*
Professional Education and Personnel Development for Occupational Education
Prerequisite(s): 6103. Research, trends and innovative practices in professional education and personnel development for occupational education.

OCED 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 context.

OCED 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.

OCED 6343*
Financing Occupational Education
Prerequisite(s): 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.

OCED 6353*
Education 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.

OCED 6871*
Doctoral Seminar: Level 1
Orientation to doctoral program in OCED. *May be taken prior to program application; required of all applicants.*

OCED 6880*
Doctoral Internship in Occupational Education
1-8 credits, max 8. Prerequisite(s): 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.

OCED 6881*
Doctoral Seminar: Level 2
Preparation of the required tentative proposal for dissertation and the comprehensive doctoral examination. *Required for OCED doctoral candidates.*

Philosophy (PHIL)

PHIL 1013
Philosophical Classics
Basic works by great thinkers, including Plato, Descartes and Hume.

PHIL 1213
(H)Philosophies of Life
Introductory ethics and social philosophy. Moral decision-making, the good life, social values, freedom, and responsibility.

PHIL 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.

PHIL 2113
Introduction to Philosophy
Selected philosophical problems: the nature of reality, knowledge, value, social ideals and religion.

PHIL 3003
(A)Symbolic Logic
Propositional logic and predicate logic with identity. Formal analysis of language.

PHIL 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.

PHIL 3213
(H)17th and 18th Century Philosophy
Major philosophers and problems in Western thought from the 17th through the 18th century. Emphasis on Descartes, Hume and Kant.

PHIL 3313
(H)19th and 20th Century Philosophy
Major philosophers and problems in Western thought from Hegel to the present.

PHIL 3413
(H)Ethics
Contemporary and classical views on the nature of moral judgments, moral value, relativity and objectivity, freedom and responsibility.

PHIL 3513
(H)Social Philosophy
Major social thinkers and contemporary issues. Social authority, human rights, political forms and justice. Emphasis on Aristotle, Locke, Mill and Marx.

PHIL 3613
(H)Philosophy of Religion
Nature of religion, religious experience and religious language. God-concepts, theistic arguments, God and evil, God and immortality.

PHIL 3713
(H)Philosophy of Education
Classical and contemporary philosophers who have systematically developed their ideas about education, including Plato, Aristotle, Rousseau, Locke and Dewey.

PHIL 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.

PHIL 3813
(H)Recent American Philosophy
Dominant trends in American philosophy during the last 100 years, with emphasis on pragmatism.

PHIL 3823
(H)Engineering Ethics
Philosophical analysis of moral issues in engineering practice, such as whistle blowing, conflicts of interest and product liability. Professional codes of ethics.

PHIL 3833
(H)Biomedical Ethics
Moral problems brought about by recent developments in scientific research and medical technology. Abortion, euthanasia, genetic engineering, and human experimentation.

PHIL 3843
(H)Philosophy of Law
Prerequisite(s): Upper-division standing. Philosophical issues related to US law. The relationship between law and morality, the nature and functions of law and grounds of liability.

PHIL 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, Marcel and Buber.

PHIL 3920
Contemporary Philosophical Problems
3 credits, max 9. Selected contemporary problems and discussions.

PHIL 3923
Contemporary Issues in Philosophy
Selected current controversies and recent trends in philosophy.

PHIL 3933
(H)Creation and Evolution
Critical examination of claims that various Creationist/Intelligent Design models offer better scientific explanations for selected biological phenomena than does the current dominant view of Darwinian Evolution.

PHIL 3943
(H,I)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.

PHIL 4003*
Mathematical Logic and Computability
Prerequisite(s): 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 nonstandard models, Gödel numberings, Turing machines, recursive functions, and evidence for Church's thesis.
(Same course as MATH 4003)

PHIL 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.

PHIL 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.

PHIL 4313
(H)Philosophy of Mind
Problems in philosophical psychology. Mind and body, freedom and determinism, personal identity and survival, self-knowledge, analysis of mental concepts.

PHIL 4453
(H)Philosophy in Literature
Selected literary works examined for philosophical ideas and themes. Attention to the interrelation of form and content. Thematic approach.

PHIL 4543*
Philosophy in Language
Prerequisite(s): 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.

PHIL 4553*
Contemporary Ethical Theory
Debate in ethical theory since Moore. The naturalistic fallacy, intuitionism, and value realism.

PHIL 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.

PHIL 4733
(H)Philosophy of Biology
Selected philosophical topics, such as Darwinism and other theories of evolution, physical reductionism, and issues of genetic engineering.

PHIL 4943*
Indian Philosophy
Prerequisite(s): 3943 or consent of instructor. Study of texts and themes in two main traditions of Indian Philosophy: Hinduism and Buddhism. How these schools present the fundamental nature and knowledge of reality, human existence, the divine, and enlightenment.

PHIL 4953*
East Asian Philosophy
Prerequisite(s): 3943 or consent of instructor. Study of texts and themes in the Chinese and Japanese traditions: Confucianism, Daoism and Zen. How these schools present the fundamental nature and knowledge of reality, human existence, community and enlightenment.

PHIL 4983*
Metaphysics and Epistemology
Prerequisite(s): 12 credit hours of philosophy. The study of the fundamental nature of reality and human knowledge of it.

PHIL 4990*
Special Studies in Philosophy
1-3 credits, max 10. Selected philosophical topics or works.

PHIL 4991*
Contemporary Philosophy Research
Prerequisite(s): 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.

PHIL 4993
Senior Honors Thesis
Prerequisite(s): 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.*

PHIL 5000*
Thesis in Philosophy
1-6 credits, max 6. Supervised individual work on a thesis for a master's degree.

PHIL 5203*
Proseminar
Introduction to professional oral and written communication in philosophy.

PHIL 5210*
Seminar on a Major Philosopher
3 credits, max 9. Prerequisite(s): Three courses in philosophy. The writings of a major philosopher and related material.

PHIL 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.

PHIL 5310*
Seminar on a Field of Philosophy
3 credits, max 9. Prerequisite(s): Three courses in philosophy. Selected topics in one field of philosophy.

PHIL 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).

PHIL 5323*
Seminar in Ancient Philosophy
Prerequisite(s): 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.

PHIL 5333*
Seminar in Modern Philosophy
Prerequisite(s): 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.

PHIL 5343*
Seminar in East and West Comparative Philosophy
Prerequisite(s): 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.

PHIL 5353*
Seminar in Contemporary Continental Philosophy
Prerequisite(s): 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, Husserl, Heidegger, Sartre, Derrida, and Faucault.

PHIL 5363*
Topics in Metaphysics
Prerequisite(s): 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.

PHIL 5373*
Contemporary Epistemology
Prerequisite(s): 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.

PHIL 5383*
Seminar in American Philosophy
Selected philosophical schools or traditions influential in American thought, such as transcendentalism, pragmatism, or naturalism.

PHIL 5393*
German Idealism
Prerequisite(s): 3113 or 3213. Selected major works of post-Kantian German Philosophy, such as the nature of a philosophical system, identity, and self-consciousness.

PHIL 5423*
Topics in Ethical Theory
Prerequisite(s): 3413. Central problems in ethical theory, such as ethical realism/anti-realism, motivational internalism/externalism, and problems within specific normative systems.

PHIL 5433*
Topics in Philosophy of Law
Prerequisite(s): 3843. In-depth examination of selected topics in philosophy of law, such as punishment, jurisprudence, and principles of legislation. Seminar format.

PHIL 5443*
Topics in Biomedical Ethics
Prerequisite(s): 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.

PHIL 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, whistle blowing, and confidentiality.

PHIL 5610*
Philosophical Issues in Education
2-3 credits, max 3. Contemporary issues in educational theory and practice. The relation of education to political thought, religion, public law and culture.

PHIL 5910*
Research Problems in Philosophy
1-3 credits, max 10. Prerequisite(s): Consent of instructor and department head. Individual or group research on specific philosophical problems.

Physics (PHYS)

PHYS 1001
Frontiers of Physics
Student and faculty discussions of current research topics in physics as presented in popular journals. *Graded on pass-fail basis.*

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.*

PHYS 1114
(L,N)General Physics
Lab 2. Prerequisite(s): High school algebra and trigonometry or MATH 1483 or MATH 1715. 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.

PHYS 1214
(L,N)General Physics
Lab 2. Prerequisite(s): 1114. Continuation of 1114; electricity, magnetism, optics, quantum physics, atomic and nuclear structure.

PHYS 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.

PHYS 2014
(L,N)General Physics
Lab 2. Prerequisite(s): MATH 2144 or concurrent enrollment. Calculus-based introductory course for science, math and engineering majors. Mechanics, waves, heat, and thermodynamics.

PHYS 2114
(L,N)General Physics
Lab 2. Prerequisite(s): 2014 or 2314. Continuation of 2014. Electricity, magnetism, and optics.

PHYS 2314
General Physics for Science Majors I
Lab 2. Prerequisite(s): MATH 2144. Calculus-based introductory course for science and math majors. Conservation of energy and momentum, energy transfer, Newton's Laws, kinematics, relativity.

PHYS 2414
General Physics for Science Majors II
Lab 2. Prerequisite(s): 2014 or 2314. Continuation of 2314. Electrostatics, electric fields and currents, circuits, waves, physical optics, modern physics, nuclear physics, and thermodynamics.

PHYS 3013*
Mechanics I
Prerequisite(s): 2114 or equivalent, and MATH 2233 or concurrent enrollment. Mechanics of particles, systems of particles and rigid bodies.

PHYS 3113*
Heat
Prerequisite(s): 1214 or equivalent and MATH 2163 or concurrent enrollment. Thermometry, heat transfer, elementary theory of specific heat and the three laws of thermodynamics.

PHYS 3213*
Optics
Prerequisite(s): 2114 or 2414 and 3513, or consent of the instructor. Geometrical optics; interference, diffraction, dispersion, absorption, and polarization of light.

PHYS 3313
Introduction to Semiconductor Device Physics
Prerequisite(s): 2114 or equivalent. An introduction to crystal structure, the quantum theory of solids, the physics of semiconductor materials and the pn junction, with an emphasis on applications to semiconductor devices.

PHYS 3322*
Modern Laboratory Methods I
Lab 6. Prerequisite(s): 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.

PHYS 3513*
Mathematical Physics
Prerequisite(s): 1214, 2114 or 2414 and MATH 2163. Physical applications of vectors, vector calculus and differential equations. Fourier analysis. Orbit geometry, coordinate systems and transformation of coordinates. Matrices and determinants.

PHYS 3622
Modern Laboratory Methods II
Lab 6. Prerequisite(s): 2014, 2114. Introduction to the operating principles and applications of modern physical methods used in research. Laboratory experiments with lasers, wave propagation, thermometry, radiation detection, optical interferometry, and spectroscopy.

PHYS 3713
Modern Physics I
Prerequisite(s): 2114. Atomic physics, special theory of relativity, and introduction to solid state and nuclear physics.

PHYS 4003*
Computer Simulation Methods in Physics
Prerequisite(s): 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.

PHYS 4010*
Special Problems
1-3 credits, max 9. Prerequisite(s): Consent of instructor. Individual laboratory work of an advanced nature.

PHYS 4113*
Electricity and Magnetism
Prerequisite(s): 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.

PHYS 4213*
Introduction to Nuclear and Particle Physics
Prerequisite(s): 2114 and 3713 or consent of instructor. Survey of phenomenological aspects of nuclear and particle physics, photon and charged particle interactions with matter, particle detectors, particle accelerators, electromagnetic, strong and weak interactions, models of the nucelus, quark model of mesons and baryons, elementary particles, and symmetries in the Standard Model.

PHYS 4263
Introduction to Solid State Physics
Prerequisite(s): 3013, 3713 or consent of instructor. Structure, specific heat, dielectric properties, lattice vibrations, free electron theory, band structure, and superconductivity of solids.

PHYS 4313*
Molecular Biophysics
Prerequisite(s): 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.

PHYS 4413*
Modern Physics II
Prerequisite(s): 3013 and 3713. Atomic and X-ray spectra; one-dimensional Schroedinger equation; nuclear structure; introduction to statistical mechanics and elementary quantum statistics.

PHYS 4423*
Mechanics II
Prerequisite(s): 3013. Coupled oscillators, propagation of waves in discrete and continuous media, mechanics of discrete and continuous media and acoustics.

PHYS 4513*
Introductory Quantum Mechanics
Prerequisite(s): 3713. Uncertainty principle, setting up Schroedinger equation (time dependent as well as time independent) and solving it for linear oscillator, hydrogen atom, periodic, and other potentials.

PHYS 4663*
Radioactivity and Nuclear Physics
Prerequisite(s): 3713 or consent of instructor. Natural and artificial radioactivity, decay laws; absorption, detection and measurement of radiations; nuclear transformations.

PHYS 4712*
Senior Project
Lab 6. Advanced individual experimental projects. Project proposal, formal laboratory report, and oral presentation are required.

PHYS 4813*
Electromagnetic Radiation
Prerequisite(s): 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.

PHYS 4993
Senior Honors Thesis
Prerequisite(s): 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.*

PHYS 5000*
Master's Thesis Research or Report
1-9 credits, max 9. Prerequisite(s): Consent of major professor. Thesis research or report for master's degree.

PHYS 5110*
Seminar
1-5 credits, max 20. Prerequisite(s): Graduate standing in physics. Special topics in physics.

PHYS 5113*
Statistical Thermodynamics and Kinetic Theory
Prerequisite: 3113. Fundamental concepts of thermodynamics: first, second and third laws; thermodynamic potentials. Statistical physics: Maxwell-Boltzman, Fermi-Dirac, Bose-Einstein distribution functions. Kinetic theory: transport phenomena, Boltzman H Theorem, the approach to thermodynamic equilibrium.

PHYS 5123*
Geometrical Optics
Prerequisite(s): 3213 or consent of instructor. Foundations of geometrical optics, geometrical theory of optical imaging, geometrical theory of aberrations, image forming instruments. ***(Same course as ECEN 5803)***

PHYS 5133*
Laser Spectroscopy
Prerequisite(s): 5163. Principles of different types of laser spectroscopy based on fluorescence, absorption, saturated absorption, absorption in a cavity: Infrared, Raman, light scattering, four wave mixing, CARS, phase conjugation, two photon absorption, double resonance, and multiphoton ionization.

PHYS 5163*
Lasers
Prerequisite(s): 4813 or equivalent. Semi-classical description of absorption and emission of light by matter; effects of cavities and optical elements; theory of lasers—gas, liquid, solid state and semiconductor. Electro-optics. Techniques of mode-locking, Q-switching, phase conjugation, Fourier transform optics. An introduction to non-linear optics.

PHYS 5213*
Statistical Mechanics
Prerequisite(s): 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.

PHYS 5220*
Physics Topics for Teachers
1-6 credits, max 6. Prerequisite(s): Teaching experience or consent of instructor. Special topics for elementary and secondary science teachers to improve their subject matter competence. Content varies, depending on the needs of specific groups of teachers.

PHYS 5263*
Particle Physics
Prerequisite(s): 5613 or consent of instructor. Phenomenology of elementary particles: quark model, electromagnetic, weak, and strong interactions of quarks, leptons, and gauge bosons, Feynman diagram techniques, parton model, gauge symmetries, spontaneous symmetry breaking, Standard model, experimental tests.

PHYS 5303*
Physical Optics
Prerequisite(s): 3213 or consent of instructor. Multiple beam interference, diffractions, imaging, near field optical probes of matter, surface plasmons, light scattering from random media, optical coherence tomography - biomedical applications, negative materials, perfect lenses and super resolution. ***(Same course as ECEN 5823*)***

PHYS 5313*
Electromagnetic Theory
Prerequisite(s): 5453. Electric and magnetic fields in free space and in matter. Boundary value problems, Green's functions, stress tensors, multipole expansions, thermodynamics; electromagnetic waves.

PHYS 5350*
Special Problems
1-3 credits, max 3. Prerequisite(s): Graduate standing in physics. Special problems of experimental or theoretical nature. Largely individual work with written report required.

PHYS 5413*
Classical Mechanics
Prerequisite(s): 4423 or consent of instructor. Generalized coordinates and advanced dynamics; coupled systems, wave motion; theory of elasticity.

PHYS 5453*
Methods of Theoretical Physics
Prerequisite(s): 3513. Introduction to the various methods and techniques used in theoretical physics.

PHYS 5613*
Quantum Mechanics I
Prerequisite(s): 5453. Postulates of quantum mechanics. Operators, commutation relations, eigenfunctions. Schroedinger, Heisenberg and interaction formalisms, angular momentum and central field problems; nondegenerate perturbation theory.

PHYS 5663*
Solid State Physics I
Prerequisite(s): 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.

PHYS 5713*
Solid State Physics II
Prerequisite(s): 5663 or equivalent. Symmetry, dielectric properties, ferroelectrics, magnetic properties, mechanical properties, and defects of solids.

PHYS 5813*
General Relativity
Prerequisite(s): 5453 or consent of instructor. Theory and applications of general relativity: the principle of equivalence, general coordinate invariance, tensors, affine connections, Einstein's field equations, classic tests, application to stellar dynamics, black holes, and cosmology.

PHYS 5960*
Problems in Chemical Physics
3-6 credits, max 6. Prerequisite(s): Consent of instructor. Intermolecular forces, interaction of radiation with matter in bulk form, dielectric properties of matter, polymer physics and quantum theory of biopolymers.

PHYS 6000*
Doctoral Dissertation Research
1-15 credits, max 60. Prerequisite(s): Admission to candidacy and permission of major professor.

PHYS 6010*
Advanced Graduate Seminar
1-3 credits, max 15. Prerequisite(s): Consent of instructor. Special topics of an advanced nature in physics.

PHYS 6113*
Advanced Theory of Solids
Prerequisite(s): 5663. Many-body techniques, transport processes, band theoretical techniques, superconductivity, dynamics of electrons in a magnetic field, and alloys.

PHYS 6213*
Group Theory for Physics
Prerequisite(s): 5453. Group theory and imperfections in crystals. Dislocation theory and color centers.

PHYS 6243*
Semiconductors I
Prerequisite(s): 5113, 5613, 5663. The first part of a survey of the physics of semi-conductors. Bonding and structure, crystal growth, epitaxial growth, band theory, phonons, photons, defects, intrinsic and extrinsic statistics, trapping and recombination.

PHYS 6260*
Special Topics in High Energy Physics
1-3 credits, max 9. Prerequisite(s): 5263 or consent of instructor. Advanced topics of current interest in high-energy physics: collider physics, supersymmetry, unification, flavor physics, string phenomenology, extra dimensions.

PHYS 6313*
Quantum Mechanics II
Prerequisite(s): 5613. Scattering theory, many-particle quantum mechanics and application to atomic and molecular systems; degenerate and time-dependent perturbation theory.

PHYS 6323*
Quantum Field Theory
Prerequisite(s): 6313 or consent of instructor. Relativistic Quantum Mechanics: Klein-Gordon field, path integral formulation of Quantum Mechanics, Feynman diagrams, Quantum Electrodynamics, relativistic scattering radiative corrections, renormalization and critical exponents, non-Abelian gauge theories, spontaneous symmetry breaking.

PHYS 6343*
Semiconductors II
Prerequisite(s): 6243. The second part of the semiconductors sequence. Transport phenomena, junctions, devices, heterostructures, and optical properties.

PHYS 6413*
Nonlinear Optics
Prerequisite(s): 5163, 5313, and 5613. The response of matter at high radiation powers; nonlinear susceptibilities. Wave propagation in nonlinear medium; three wave and four wave interactions; saturated absorption, optical switching and limiting; two photon and stimulated Raman processes; Self focusing; solitons.

PHYS 6423*
Quantum Optics
Prerequisite(s): 5163, 5613 or consent of instructor. Quantization of Electromagnetic Fields, coherence, quantum entanglement, parametric down conversion, two photon interferometry, Bell's inequalities, quantum teleportation and cryptography, cavity QED.

PHYS 6513*
Advanced Topics in Solid State Physics
Prerequisite(s): 5663 or equivalent. Interaction of radiation and matter, neutron scattering, phase transitions, magnetic resonance and cooperative phenomena.

PHYS 6613*
Advanced Nuclear and Particle Physics
Prerequisite(s): 5263, 6313; or consent of instructor. Renormalization of quantum field theories, spontaneous symmetry breaking, Standard model, flavor physics, grand unification, super-symmetry.

PHYS 6713*
Advanced Electromagnetic Radiation
Prerequisite(s): Consent of instructor. Radiation theory, wave guides, scattering and dispersion relations; relativity.

PHYS 6803*
Photonics I: Advanced Optics
Lab 9. Prerequisite(s): ECEN 3213 or 3813. 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 CHEM 6803* & ECEN 6803*)

PHYS 6810*
Photonics II: THz Photonics and THz-TDS
1 credit, max 4, Lab 1. Prerequisite(s): 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* & ECEN 6810*)***

PHYS 6820*
Photonics II: Spectroscopy II
1 credit, max 4, Lab 1. Prerequisite(s): 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 & ECEN 6820)

PHYS 6830*
Photonics II: Spectroscopy III
1 credit, max 4, Lab 1. Prerequisite(s): 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. Multiphotonic excitations. Fast measuring techniques including subnanosecond detectors, picosecond streak cameras, and ultrafast four-wave mixing and correlation techniques. Time-dependent photoconductivity measurements.
(Same course as CHEM 6830 & ECEN 6830)

PHYS 6840*
Photonics III: Microscopy I
1 credit, max 4, Lab 1. Prerequisite(s): CHEM 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 air.
(Same course as CHEM 6840* & ECEN 6840*)

PHYS 6850*
Photonics III: Microscopy II
1 credit, max 4, Lab 1. Prerequisite(s): 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 CHEM 6850* & ECEN 6850*)***

PHYS 6860*
Photonics III: Microscopy III and Image Processing
1 credit, max 4, Lab 1. Prerequisite(s): 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 and compression. ***(Same course as CHEM 6860* & ECEN 6860*)***

PHYS 6870*
Photonics IV: Synthesis and Devices I
1 credit, max 4, Lab 1. Prerequisite(s): 6803 and 6840. Preparation of functional nanostructures and related optical and electronic devices. Physical and chemical methods of thin film deposition. Engineering of prototypes of light emitting diodes, sensors, optical limiting coatings, lithographic patterns. ***(Same course as CHEM 6870* & ECEN 6870*)***

PHYS 6880*
Photonics IV: Semiconductor Devices, Testing and Characterization
1 credit, max 4, Lab 1. Prerequisite(s): 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 CHEM 6880* & ECEN 6880*)***

PHYS 6890*
Photonics IV: Semiconductor Synthesis and Devices III
1 credit, max 4, Lab 1. Prerequisite(s): 6803. 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* & ECEN 6890*)

Plant Pathology (PLP)

PLP 3343
Principles of Plant Pathology
Lab 2. Prerequisite(s): BOT 1404 or BOT 3463 or MICR 2125 or PLNT 2013. Introduction to basic principles and concepts of plant pathology, including the nature, cause and control of biotic and environmentally induced plant diseases, with emphasis on principles and methods of disease management. *Offered in combination with PLP 5343. No credit for both 3343 and 5343.*

PLP 3553
Fungi: Myths and More
Lab 1. Prerequisite(s): BIOL 1114. Explores the impact of fungi on beliefs, culture and society via the colorful folklore and myths of fungi and their role in the environment and human affairs, including diseases of plants, animals and humans exemplified by the Great Bengal famine of 1943, The Irish potato famine, 1840's and the Salem witch trials 1692. Laboratory instruction on use of microscopes, mushroom identification, mechanisms of dispersal, and genetic recombination. ***(Same course as BOT 3553)***

PLP 3663
Turfgrass Integrated Pest Management
Lab 2. Prerequisite(s): 3343, ENTO 2991, 2992. 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)***

PLP 4400
Special Topics
1-3 credits, max 3. Prerequisite(s): Consent of instructor. Special topics in Plant Pathology, Entomology or related fields. ***(Same course as ENTO 4400)***

PLP 4922*
Applications of Biotechnology in Arthropod and Pathogen Control
Prerequisite(s): 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*)***

PLP 5000*
Research
1-6 credits, max 6. Research for the MS degree.

PLP 5004*
Plant Nematology
Lab 3. Prerequisite(s): 3343 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.

PLP 5012*
Plant Virology Laboratory
Lab 4. Prerequisite(s): Previous or concurrent enrollment in 5013. Methods of investigating plant viruses.

PLP 5013*
Plant Virology
Prerequisite(s): 3343 or equivalent; one course in biochemistry or physiology. Transmission, characterization, differentiation, replication, and control of plant viruses; discussion of current literature.

PLP 5104*
Mycology
Lab 4. Prerequisite(s): 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*)***

PLP 5304*
Phytobacteriology
Lab 3. Prerequisite(s): 3343. Bacteria as plant pathogens, with examination of the taxonomy, genetics, ecology, physiology, host-parasite interaction, and control of phytobacteria.

PLP 5343*
Principles of Plant Pathology
Lab 2. Prerequisite(s): BOT 1404 or BOT 3463 or MICR 2125 or PLNT 2013. Introduction to basic principles and concepts of plant pathology, including the nature, cause and control of biotic and environmentally induced plant diseases. *Offered in combination with PLP 3343. No credit for both 3343 and 5343. Graduate students will be expected to complete extra assignments.*

PLP 5413*
Plant Disease Epidemiology
Lab 3. Prerequisite(s): 3343 or 5043. Introduction to methodology and technical equipment used in epidemiological research and application of epidemiological principles in plant disease control.

PLP 5524*
Integrated Management of Insect Pests and Pathogens
Lab 4. Prerequisite(s): 3343, ENTO 2991 & 2992 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 ENTO 5524)***

PLP 5560*
Problems in Plant Pathology
1-5 credits, max 10. Prerequisite(s): Consent of instructor.

PLP 5613*
Host Plant Resistance
Lab 2. Prerequisite(s): 3343 and ENTO 2991, 2992 or equivalent and 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 ENTO 5613***)

PLP 5623*
Advanced Biotechnology Methods
Lab 3. Prerequisite(s): BIOC 3653, BIOL 3023 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 biotechnology, including genome analysis, gene transfer, identification and isolation of genes and their products, and regulation of gene expression in plants and arthropods. ***(Same course as ENTO 5623*)***

PLP 5724*
Physiology of Host-Pathogen Interactions
Lab 4. Prerequisite(s): 3343 and BIOC 3653. Physiology of the interactions between plants and pathogens. Mechanisms by which pathogens infect and by which plants resist infection.

PLP 5860*
Colloquium
2 credits, max 2. Prerequisite(s): 3343. Concepts and principles of plant pathology through discussions of pertinent literature.

PLP 5870*
Scientific Presentations
1 credit, max 5. Prerequisite(s): Consent of instructor. Preparation and delivery of scientific presentations, including 50-minute seminars, 10-minute talks, and posters. ***(Same course as ENTO 5870*)***

PLP 5992*
Career Skills and Professionalism for Scientists
Prerequisite(s): 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 ENTO 5992*)***

PLP 6000*
Research
1-12 credits, max 36. Research for the PhD degree.

PLP 6303*
Soilborne Diseases of Plants
Lab 3. Prerequisite(s): 3343. 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)

PLNT 1213
Introduction to Plant and Soil Systems
Introduction to the concepts of plant and soil systems including cropland, rangeland and pastureland. A systems approach to the importance of plant and soil resources to the producer, consumer and citizen; modern management and production practices; maintenance of natural resources.

PLNT 1223
Plants, Genes and the Consumer
Issues of plant-based food production from both a scientific and a social perspective. The fundamental principles of plant growth and development; how plants function in an agroecosystem and how to utilize these principles to grow food in an environmentally and socially sound manner. The role of genetics and biotechnology. *No credit for Plant and Soil Sciences or Horticulture majors.*

PLNT 2013
Applied Plant Science
Lab 2. Prerequisite(s): 1213 or BOT 1404 or FOR 1123 or HORT 1013. Application of agronomic principles to the management, improvement and use of plants. 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.

PLNT 2041
Professional Development
Prerequisite(s): Sophomore standing in plant and soil sciences. Development of professional and personal goals in plant and soil sciences through identification of personal values and professions, the building of a skills toolbox and networking. *Graded on pass-fail basis.*

PLNT 3111
Weed Control Laboratory
Lab 2. Prerequisite(s): 1213 or HORT 1013; 3211, 3221 and 3231 (or concurrent enrollment in 3211, 3221 and 3231). Identification of common weeds, principles and practices of herbicide application, and application equipment, handling and proper use of herbicides.

PLNT 3211
Principles of Weed Biology and Ecology
Prerequisite(s): 1213 or HORT 1013. Importance of biological growth, activity, and ecological role of selected crop and weed species in controlling growth patterns of each organism. *May concurrently enroll in 3221, 3231.*

PLNT 3221
Principles of Herbicide Chemistry
Prerequisite(s): 1213 or HORT 1013 and 3211 (or concurrent enrollment in 3221). Weed control terminology, understanding modes of action for selected herbicide families and their activity on plant growth. *May concurrently enroll in 3211, 3231.*

PLNT 3231
Principles of Agronomic Weed Control
Prerequisite(s): 1213 or HORT 1013, 3211 and 3221 (or concurrent enrollment in 3211 and 3221). Basic principles and practices of weed control for agronomic crops and pastures and knowledge on the safe and effective use of herbicides.

PLNT 3554*
Plant Genetics and Biotechnology
Lab 2. Prerequisite(s): BIOL 1114. Basic principles of heredity. Interrelationship between classical genetics and molecular genetics emphasized. Mendelian genetics, cytogenetics, mutations, gene regulation and genetic engineering.

PLNT 3782
Seed Technology
Prerequisite(s): 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.*

PLNT 3790
Seed and Plant Identification
1 credit, max 2, Lab 3. Prerequisite(s): 1213. Identification and classification of agronomically important crop and weed species from seed and from seedling, vegetative, flowering or mature plants.

PLNT 4080
Professional Internship
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Internship must be at an approved agribusiness unit or other agency serving agronomic agriculture. Requires a final conference with on campus adviser and a written report. *Graded on a pass-fail basis.*

PLNT 4113*
Advanced Weed Science
Prerequisite(s): 3111 and 3221. 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.

PLNT 4123*
Plant-Environment Interactions
Prerequisite(s): BOT 1404. Environmental impact on plant life cycle; (i.e. germination, flowering and senescence); plant growth responses (e.g. photosynthesis, phototropism, biomass production) to light quality, precipitation, temperature, and population or community changes.

PLNT 4353*
Plant Breeding
Prerequisite(s): 3554 or equivalent. Basic principles dealing with the improvement of plants through application of genetic principles.

PLNT 4470*
Problems and Special Study
1-3 credits, max 12, Lab 1-3. Prerequisite(s): 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.

PLNT 4571
Senior Seminar
Prerequisite(s): 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 SOIL 4571)***

PLNT 4613*
Forage and Grazinglands Resource Management
Prerequisite(s): 1213 or BOT 1404. Designing forage systems that optimize yield potential, economical livestock production and pasture system development.

PLNT 4673*
Cropland Ecosystems
Lab 2. Prerequisite(s): 2013. Designing sustainable cropping systems that optimize yield potential, economic and environmental benefit based upon climatic and social conditions.

PLNT 4772*
Oilseed, Pulse and Mucilage Crops
Prerequisite(s): 1213. Production, utilization and improvement of oilseed, pulse and mucilage crops with special emphasis on peanuts and soybeans.

PLNT 4783*
Cotton Production
Prerequisite(s): 1213. Production, utilization and improvement of cotton. Several other agronomic fiber crops briefly discussed.

PLNT 4990
Senior Thesis in Plant and Soil Sciences
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Supervised undergraduate research in topics related to plant and soil sciences. Completion of an approved research project based on a thesis topic in plant or soil science will include submission of a written report and a public defense of the work.

PLNT 5000*
Master's Thesis
1-6 credits, 6 max total credits under Plan I, and 2 max total credits under Plan II. Prerequisite(s): Consent of adviser. Research planned, conducted and reported in consultation with a major professor.

PLNT 5020*
Graduate Seminar
1 credit, max per semester 1 credit on MS program and 2 credits on a PhD program required. Prerequisite(s): Graduate standing. Philosophy of research, methods of research, or interpretation of research.

PLNT 5110*
Problems and Special Study
1-4 credits, max 6. Prerequisite(s): Consent of instructor. Supervised study of special problems and topics not covered in other graduate courses.

PLNT 5112*
Herbicide Fate in the Environment
Prerequisite(s): 4113. Processes involved in the behavior and fate of herbicides in air, soil, and water. Reaction, movement, and dissipation of herbicides in soil.

PLNT 5230*
Research
1-4 credits, max 4. Prerequisite(s): Consent of a faculty member supervising the research. Supervised independent research on selected topics.

PLNT 5293*
Plant Response to Water Stress
Prerequisite(s): BIOC 3653, BOT 3463. Physiological ramifications of water deficit stress on cells, tissues, plants and canopies. Discussion of the soil/plant/atmosphere continuum, and avoidance and tolerance mechanisms leading to drought resistance. Photosynthesis, transpiration, and water-use efficiency and their relationship to biomass accumulation and crop yield.

PLNT 5403*
Physiological Action of Herbicides
Prerequisite(s): BOT 3463. The mode of action, uptake and translocation, and metabolism of herbicides in crops and weeds.

PLNT 5414*
Plant Breeding Theory, Methods and Strategies
Prerequisite(s): 3554, 4353 and STAT 5013, or consent of instructor. 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.

PLNT 5433*
Biotechnology in Plant Improvement
Prerequisite(s): 3554, 4353, and BIOL 3014 or consent of instructor. Use of emerging technologies in cell biology and molecular genetics to study and manipulate plants. Emphasis on genetic systems which influence productivity and end-product utilization. The integration of biotechnology into plant breeding programs and issues concerning the release of genetically engineered organisms into the environment.

PLNT 5443*
Advanced Genetics
Prerequisite(s): 3554; BIOC 3653. Concepts of eukaryotic genetics with emphasis on classical, molecular, and quantitative genetics.

PLNT 5452*
Cytogenetics
Prerequisite(s): 5443 or concurrent enrollment in BOT 5232. Behavior of chromosomes, cellular organelles and cytoplasm in relation to genetic behavior.

PLNT 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.

PLNT 6000*
Doctoral Thesis
1-6 credits, max 36. Prerequisite(s): Consent of adviser. Independent research to be conducted and reported with the supervision of a major professor as partial requirement for the PhD degree.

PLNT 6010*
Advanced Topics and Conference
1-6 credits, max 12. Prerequisite(s): MS degree. Supervised study of advanced topics. A reading and conference course designed to acquaint the advanced student with fields not covered in other courses.

PLNT 6410*
Topics in Plant Breeding and Genetics
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Selected topics in the statistical and experimental analysis of quantitative traits, evolutionary development of domesticated plants and animals, and techniques used in breeding crop plants.

Political Science (POLS)

POLS 1010
Studies in American Government
1-2 credits, max 2. Special study in American government to allow transfer students to fulfill general education requirements as established by Regents' policy.

POLS 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.

POLS 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.

POLS 2023
(S)Public Law and Private Rights
Introduction to the US Constitution, legal reasoning, legal research techniques, and topical issues of US public law.

POLS 2033
Introduction to Public Administration
Public administration, including administration, administrative organization, decision-making, governmental public relations and administrative responsibilities.

POLS 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.

POLS 2993
Honors Tutorial in Political Science
Prerequisite(s): 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.

POLS 3003
(I,S)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.* ***(Same course as HIST 3003 & RUSS 3003)***

POLS 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.

POLS 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.

POLS 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 GEOG 3053, HIST 3053 & RUSS 3053)***

POLS 3063
(I,S)Civilization, Empire and Change in World Politics
Prerequisite(s): 2013 or consent of instructor. The evolution and nature of interactions among the world's civilizations; the role of cultural power and empire-building in contemporary world politics; theories that attempt to explain international "order" and change.

POLS 3100
Political Science Internship
1-6 credits, max 6. Prerequisite(s): Consent of department. Internship education experience in a specific subfield in the discipline of political science.

POLS 3123
(I)Government and Politics of Russia
Political processes, governmental institutions and public policies of post-Soviet Russia. Parties, elections and citizen participation in government.

POLS 3143
(I)Politics of Western Europe
State-society relations in key West European countries, including political processes, governmental institutions, cultural pluralism and gender relations.

POLS 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.

POLS 3223
(I)Politics and Administration in East Asia
Political processes, governmental institutions and administration in China, Japan, and Korea.

POLS 3233
(I,S)Chinese Politics
Political process, government institutions and experience of development in People's Republic of China.

POLS 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.

POLS 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.

POLS 3353
Parties and Interest Groups
Political parties and interest groups as institutions; their role in elections and government.

POLS 3414*
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.

POLS 3423*
(S)Voting and Elections
Electoral systems and their relationship to political development, political socialization, issue emergence, voting patterns and electoral cycles.

POLS 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 US Congress.

POLS 3483
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.

POLS 3493*
Public Policy
Prerequisite(s): Any one of 1013, 2033, 2113, ECON 1113, 2123, SOC 1113, PHIL 2113. Identification of policy options open to policy makers and examination of measurements and rationales underlying governmental programs.

POLS 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.

POLS 3523
Campaign Fundraising and the Media
Prerequisite(s): 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.

POLS 3533
Political Lobby and Grassroots Organization
Prerequisite(s): 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. ***(Same course as JB 3533)***

POLS 3543
Political Candidacy
Prerequisite(s): 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.

POLS 3613*
State and Local Government
Political processes, government and administration of American states, cities and counties; special emphasis on Oklahoma.

POLS 3643
Theories of Empire
Surveys the history of analytic and normative theories of empire and investigates ways to define, understand, and reform imperial power. Topics include the balance of powers, pre-emptive war, unilateralism and multilateralism, international law and globalization.

POLS 3663*
Political Thought
The teachings of the three lasting traditions of Western political thought: classical, Christian and modern.

POLS 3683
American Politics in Contemporary Film
Prerequisite(s): 1113. The effect of politics on contemporary film. Exploration of the often subtle political imagery and symbolism contained in film.

POLS 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.

POLS 3763
Mitigation and Recovery
Prerequisite(s): 3813. Introduction to recovery and mitigation activities for emergency managers. Covers components, policies, programs and organizations related to recovery and mitigation, illustrates course concepts with case studies.

POLS 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.

POLS 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.

POLS 3953
(D,S)Minorities in the American Political System
Prerequisite(s): 1113. Examination of mass and elite level behavior of minorities in the contemporary US political system.

POLS 3973
(D)Race, Politics and Sports
Prerequisite(s): 1113. Historical, as well as the contemporary relationship, between race, politics and sports in the US political system.

POLS 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.

POLS 4003
Political Analysis
Prerequisite(s): 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.

POLS 4013*
American Foreign Policy
Major problems and policies of American foreign relations since World War II and description of foreign formulation and aid administration.

POLS 4053
(I)World Politics
Foreign policies of major powers, areas of tension and sources of international conflict.

POLS 4100*
Problems of Government, Politics and Public Policy
1-6 credits, max 6. Prerequisite(s): 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.

POLS 4113*
International Institutions
The organization, procedures, functions and role of international institutions, with emphasis on the United Nations and related agencies.

POLS 4123
(S)The Politics of Globalization
Prerequisite(s): 2113 or consent of instructor. The policies and institutions to manage the economic and political consequences of the deeper integration of national economics 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.* ***(Same course as 5123*)***

POLS 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.* ***(Same course as 5133*)***

POLS 4223
Comparative Political and Social Movements and the Politics of Protest
Prerequisite(s): 1113. The origins, activities and impact of political and social movements. Concepts 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.

POLS 4343*
The United States Constitution
An examination of the theoretical, philosophical, and legal underpinnings of the US Constitution, relying heavily on a study of The Federalist Papers.

POLS 4353*
Administrative Law
Legal powers, limits, and procedures of administrative agencies with emphasis on federal and state administrative procedure acts.

POLS 4363*
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.

POLS 4403*
Urban Politics and Management
Problems of governing and managing American metropolitan areas.

POLS 4413*
Government Budgeting
The politics, planning and administration of government budgets.
(Same course as 5320*)

POLS 4453*
Public Personnel Administration
Problems, processes, and procedures of public personnel administration.
(Same course as 5333*)

POLS 4466
Fundraising for Non-Profits
Prerequisite(s): 1113. Non-profit organizations play a vital and dynamic role in policy formation and implementation, shaping public policy concerns and in providing services for target groups. This course provides guided overview of the major aspects of non-profit fundraising and internship experience in such an organization.

POLS 4513*
American Politics
Significant developments and issues in American politics, including American political behavior and political leadership.

POLS 4553
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.

POLS 4573
Democratic Theory
Investigates the origins, development, and continuing challenges of theories of democratic government, with particular emphasis on the American political tradition. Topics include citizenship, accountability, voting and elections, federalism, and institutional design.

POLS 4593*
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.

POLS 4623
(S)Oklahoma Politics
Prerequisite(s): 1113. Introduction to Oklahoma Politics. Topics include the evolution of Oklahoma political institutions; the struggle to shape the Oklahoma political culture with special attention to the role of race and woman suffrage; political issues; the structure of Oklahoma political institutions at the state and local levels; and elections.

POLS 4653
(H)Contemporary Political Thought
An analysis of 19th and 20th century political ideas, with emphasis on the rise and fall of ideologies along side controversies over relativism, positivism, pragmatism, and resurgent religious faiths.

POLS 4693
(S)Women in Politics
Changing role of women in government and politics. Voting behavior, public opinion, women in government, and the women's movement.

POLS 4963
American Constitutional Law: Equal Protection of the Laws
Prerequisite(s): 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.

POLS 4973*
American Constitutional Law: The Division of Governmental Powers
Prerequisite(s): 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.

POLS 4983
American Constitutional Law: Due Process of Law
Prerequisite(s): 2023 or 3983 recommended. 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.

POLS 4990*
Applications of Political Theory
1-3 credits, max 9. Application of major relevant theoretical perspectives to selected case studies of political problems and issue areas. Theories and attendant case studies selected by visiting faculty members.

POLS 4993
Political Science Honors Thesis
Prerequisite(s): 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.

POLS 5000*
Thesis
1-6 credits, max 6.

POLS 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.

POLS 5020*
Research in Public Administration, Public Policy and Politics
1-6 credits, max 6. Individually supervised research.

POLS 5030*
Internship in Public Administration and Government
1-6 credits, max 6. Individually supervised internships in administrative and governmental career areas. Paper required.

POLS 5040*
Readings in Politics, Public Policy or Public Administration
1-6 credits, max 6. Prerequisite(s): Consent of supervising professor. Readings in the student's major area of study.

POLS 5100*
Advanced Problems in Government, Politics, and Public Policy
3 credits, max 6. Special seminar, topics vary from semester to semester.

POLS 5103*
Research Methods
Prerequisite(s): Graduate standing. Overview of research design, including conceptualization and operationalization, literature review, deductive and inductive theorizing, hypothesis testing, quantitative and qualitative data collection and analysis.

POLS 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.

POLS 5123*
The Politics of Globalization
Prerequisite(s): 2113 or consent of instructor. The policies and institutions to manage the economic and political consequences of the deeper integration of national economics 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.* ***(Same course as 4123)***

POLS 5133*
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.* ***(Same course as 4133)***

POLS 5143*
Social and Political Perspectives in Europe
Examination of the current and historical social, cultural and political landscapes of European societies. Material related to identity politics, citizenship, democratization and collective memory feature regularly in the course.

POLS 5210*
Seminar in International Relations
3 credits, max 6. Research on the dynamics and institutions of international politics.

POLS 5213*
Seminar in the International Political Economy
Prerequisite(s): Graduate standing. Research on the mechanics and theories of interaction between economic and political phenomena.
(Same course as INTL 5213*)

POLS 5300*
Seminar in Emergency Management
1-3 credits, max 6. Topics in emergency management such as terrorism, emergency management planning-mitigation, response, and recovery, or delivering emergency medical services (EMS).

POLS 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.

POLS 5320*
Seminar in
Public Budgeting and Finance
3 credits, max 6. Major processes and practices involved in governmental budgeting in the United States at national, state and local level.
(Same course as 4413*)

POLS 5323*
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.

POLS 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.

POLS 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.

POLS 5353*
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, implementation, and administrative accountability.

POLS 5363*
Public Sector Dispute Resolution
Prerequisite(s): 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.

POLS 5373*
Populations at Risk
Describes populations at risk for increased injury, death and property loss. Identifies policies, programs and resources for risk reduction. Applies research for purposes of planning and capacity building.

POLS 5383*
Disaster Recovery
Prerequisite(s): 5683. Processes, conditions and components of recovery in disaster contexts. Topics include environmental, economic, housing, infrastructure, and policy. Roles of voluntary organizations; securing and managing resources.

POLS 5410*
Seminar in Comparative Politics and Government
3 credits, max 6. Research in the political processes and governmental institutions of foreign countries.

POLS 5510*
Seminar in Political Behavior
1-3 credits, max 6. Examination of contemporary theories of political behavior with emphasis on empirical studies.

POLS 5513*
Seminar in Political Psychology
Examination of psychological theories as they pertain to politicial behavior, including attitude change, political cognition, public opinion and decision-making.

POLS 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.

POLS 5620*
Seminar in Natural Resource Policy, Law, and Administration
3 credits, max 9. 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.

POLS 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.

POLS 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.

POLS 5653*
Risk Assessment in Emergency Management Planning
Risk assessment for the emergency manager and fire department manager. Concepts of risk assessment, its use in emergency management planning, and its limitations. Applications to emergency management. Specifically designed for FEMP students, but of interest to students in environmental management.

POLS 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 routine and non-routine releases of chemicals and radioactive materials. Strategies for community-based planning, emergency preparedness, environmental response, site damage, and conflict management.

POLS 5673*
Understanding and Responding to Terrorism
Exploration of the experience of non-state terrorism in the US 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; US anti-terrorism policies and considerations that emergency responders face in preparing for and responding to terrorist incidents.

POLS 5683*
Emergency Management and Public Policy in the United States
Examination of natural and man-made disasters in the US along with the policies and programs intended to prevent, respond to, mitigate, and recover from such events. The evolution of the US Emergency Management System, the emergency management profession, and future directions in emergency policy.

POLS 5693*
Emergency Management in the International Setting
Introduction to emergency management in the international setting. Provides background for students who may work with international assistance programs or who may become involved in the delivery of emergency management services abroad as part of an international assistance effect.

POLS 5710*
Seminar in American Political Institutions
1-3 credits, max 6. American institutions, including Congress, the presidency, courts, political parties, and interest groups.

POLS 5713*
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.

POLS 5743*
Seminar in Political Communication
Examination of recent theories within politics and the media, including effects of media on opinion, role of media as a political institution and the role of media during elections.

POLS 5810*
Seminar in Women and Politics
3 credits, max 9. Prerequisite(s): Graduate standing. Research on a variety of topics concerning women and politics, including women's movements, women and elections, and public opinion.

POLS 5903*
Practicum in Fire and Emergency Management Administration
Prerequisite(s): Consent of instructor. Supervised practicum in fire and emergency management administration.

Psychology (PSYC)

PSYC 1113
(S)Introductory Psychology
Principles, theories, vocabulary and applications of the science of psychology.

PSYC 2313
Psychology and Human Problems
Prerequisite(s): 1113. Personality dynamics and their application to personal, cultural and vocational experience.

PSYC 2583
(S)Developmental Psychology
Prerequisite(s): 1113. The nature of pertinent studies, causes, and theories of human developmental phenomena across the life span.

PSYC 2593
Psychology of Human Sexuality
Prerequisite(s): 1113. Survey of behavioral, personality and psychophysiological components of human sexuality, with special emphasis on the delineation of facts from sexual myths.

PSYC 2743
(S)Social Psychology
Theories and applications of social cognition, the self, pro-social and aggressive behavior, groups, attitudes and the environment.

PSYC 3013
Psychology of Motivation
Prerequisite(s): 1113. Review of research and theory in such areas of motivation as hunger, sex, frustration, aggression, achievement, affiliation, and altruism.

PSYC 3073
(N)Neurobiological Psychology
Prerequisite(s): 1113. Neural bases of human experience and behavior. Topics include sensation and perception, motivation and emotion, learning and thinking.

PSYC 3113
(N)Comparative Psychology
Prerequisite(s): 1113. Comparative study of behavior characteristics of selected samples of the animal kingdom from protozoa to humans.

PSYC 3214
Quantitative Methods in Psychology
Lab 2. Prerequisite(s): 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.

PSYC 3413
Psychology of Social Behaviors
Prerequisite(s): 1113, 3214. Contemporary theoretical and methodological issues in social psychology with special emphasis on the social psychology of the experiment and experimentation with the social aspects of human behavior.

PSYC 3443
(S)Abnormal Psychology
Prerequisite(s): 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.

PSYC 3513
Psychology of Learning
Prerequisite(s): 1113, 3413. 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.

PSYC 3713
Psychology of Memory
Prerequisite(s): 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.

PSYC 3823
Cognitive Psychology
Prerequisite(s): 1113, 3214 or equivalent. Cognitive processes. Thinking, problem solving, visual imagery, attention, and memory search. Both theory and application emphasized.

PSYC 3914
Experimental Psychology
Lab 2. Prerequisite(s): 1113, 3214 or equivalent and five additional hours in psychology. Problems, methods, and applications of experimental psychology.

PSYC 3990
Undergraduate Seminar
1-6 credits, 6 max. Prerequisite(s): Consent of instructor. For honors students and other outstanding students. Special topics in psychology.

PSYC 4123
(S)Psychology of Women
Prerequisite(s): 1113. Sex differences and the development of sex role behavior. Encompasses the psychological dynamics of developmental and social issues for women.

PSYC 4133
(S)Psychology of Minorities
Prerequisite(s): 1113. Review of psychological theories and research pertinent to minority group status.

PSYC 4143
Psychology and Law
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.

PSYC 4153
Psychology and Mass Media
Prerequisite(s): 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.

PSYC 4183*
Current Issues in Clinical Psychology
Prerequisite(s): 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.

PSYC 4213
(S)Conflict Resolution
Prerequisite(s): 1113. Interpersonal conflict studied from psychological perspectives. Types and uses of conflict, and conditions for constructive dispute settlement.

PSYC 4223*
Decision Making and Problem Solving
Prerequisite(s): 1113 or consent of instructor. An examination of the research literature on individual decision-making and problem solving with dual emphases on theory and application. A thorough prior understanding of the human cognitive system is desirable, but not required.

PSYC 4333*
Personality
Prerequisite(s): 1113, 3443, or consent of instructor. Basic assumptions, research, and clinical issues relating to the major personality theories.

PSYC 4343*
Language Development
Prerequisite(s): 1113 or consent of instructor. Current theory and research on the development of language throughout the lifespan. The nature of language, first language acquisition, second and third language acquisition, brain and language, language processing, social aspects of language, gender differences in language use and language processing, language use by older adults, language use directed at older adults, language disorders, and language use in special populations.

PSYC 4483
(S)Psychology of Parent Behavior
Prerequisite(s): 1113. Historical and contemporary conceptions of parent-child relationship and approaches to communication and discipline; special problems in parenting.

PSYC 4493*
History of Psychology
Prerequisite(s): 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.

PSYC 4813*
Psychological Testing
Prerequisite(s): 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.

PSYC 4880
Senior Honors Thesis
1-6 credits, max 6. Prerequisite(s): 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.*

PSYC 4883
Current Issues in Psychology
Prerequisite(s): 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.

PSYC 4990*
Special Problems
1-6 credits, max 6. Prerequisite(s): 1113, 3214 and consent of instructor. For honors students and other outstanding students. Experimental or library research.

PSYC 5000*
Thesis
1-6 credits, max 6. Required of all graduate students majoring in psychology and writing a thesis.

PSYC 5113*
Psychopathology
Prerequisite(s): Graduate standing in psychology or consent of instructor. Principles of diagnosis and treatment of major disorders.

PSYC 5120*
Psychology Workshop
2-6 credits, max 6. Provides an opportunity to study specific psychological problems, both applied and theoretical.

PSYC 5153*
Cognitive Assessment
Prerequisite(s): 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.

PSYC 5193*
Ethics and Professional Development in Psychology
Prerequisite(s): 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.

PSYC 5304*
Quantitative Methods in Psychology I
Lab 2. Prerequisite(s): 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.

PSYC 5314*
Quantitative Methods in Psychology II
Prerequisite(s): 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.

PSYC 5333*
Systems of Psychotherapy
Prerequisite(s): 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.

PSYC 5380*
Research
1-12 credits, max 24. Prerequisite(s): Consent of instructor. Research project on some psychological problem.

PSYC 5620*
Seminar in Psychology
1-12 credits, max 12. Prerequisite(s): Consent of instructor. Consideration of special topics that are particularly timely or technical in nature.

PSYC 5660*
Teaching Practicum
1-2 credits, max 2. Prerequisite(s): Consent of instructor. Primarily for graduate students with well-defined new teaching responsibilities.

PSYC 5823*
Cognitive Processes
Theory and experimental research findings dealing with human thought processes from a developmental and functional standpoint.

PSYC 6000*
Dissertation
1-16 credits, max 60. Research and report thereon by graduate students in partial fulfillment of requirements for the Doctor of Philosophy degree.

PSYC 6083*
Principles of Behavior Therapy
Prerequisite(s): Graduate standing in the clinical program of the Department of Psychology or consent of instructor. Principles and procedures of behavior therapy and modification.

PSYC 6133*
Ethnic and Cultural Diversity in Psychotherapy
Prerequisite(s): 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.

PSYC 6143*
The Psychology of Substance Abuse
Prerequisite(s): Consent of instructor. Introduction to psychological classification of psychoactive substance (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.

PSYC 6173*
Child Psychopathology and Treatment
Prerequisite(s): 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.

PSYC 6223*
Research Design
Prerequisite(s): 3914 and doctoral level standing. Experimental techniques in psychophysics, sensory processes, attention and perception, motivation and emotion, and learning and memory.

PSYC 6233*
Clinical Research Design
Prerequisite(s): 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.

PSYC 6253*
Seminar in Human Development
Prerequisite(s): Consent of instructor. Behavioral aspects of development from the prenatal period to senescence. Normal development contrasted to exceptional development.

PSYC 6353*
Psychology of Motivation
Prerequisite(s): 3914. Outline of theory and research in human and animal motivation.

PSYC 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.

PSYC 6443*
Behavioral Medicine
Prerequisite(s): Graduate standing in the clinical program of the Department of Psychology; consent of instructor. An advanced graduate course for students in training for a PhD 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.

PSYC 6453*
Pediatric Psychology
Prerequisite(s): 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.

PSYC 6483*
Neurobiological Psychology
Prerequisite(s): 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.

PSYC 6523*
Family Treatment Methods
Prerequisite(s): 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 emphasis on family dynamics.

PSYC 6563*
Advanced Social Psychology
Prerequisite(s): 2743. History, theory and experimentation of dynamic interaction of group membership and individual behavior.

PSYC 6583*
Developmental Psychobiology
Prerequisite(s): 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.

PSYC 6613*
Experimental Learning Theories
Prerequisite(s): Nine credit hours of psychology. Basic concepts and empirical findings in animal and human learning.

PSYC 6640*
Clinical Practicum
1-12 credits, max 17. Prerequisite(s): Graduate standing in the clinical program of the Department of Psychology. Practicum experience for graduate students in the clinical psychology program.

PSYC 6650*
Practicum
1-16 credits, max 16. Prerequisite(s): 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 in the clinical program of the Department of Psychology who are doing supervised practicum in specific clinical areas of specialization.

PSYC 6723*
Child Diagnostic Methods
Prerequisite(s): 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.

PSYC 6753*
Assessment of Personality
Prerequisite(s): Graduate standing in the clinical or counseling program 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.

Religious Studies (REL)

REL 1103
The Religions of Mankind
Major world religions such as Hinduism, Buddhism, Judaism, Christianity and Islam with a view to understanding the general nature of religion and its various dimensions.

REL 2013
(H)The Old Testament and Its Study
A study of the Hebrew Scriptures with emphasis upon content, historical background, the history of its study and the critical analysis and theological interpretation of selected passages.

REL 2023
(H)The New Testament and Its Study
A study of the writings of the New Testament in their historical contexts and the methods used in their study. Emphasis interpreting selected New Testament passages.

REL 3223
(H)The Teachings of Jesus in Historical Context
Prerequisite(s): 2023. The teachings of Jesus in light of modern historical research. Emphasis on interpreting selected passages from the Gospels.

REL 3243
(H)Paul and the Early Church
Prerequisite(s): 2023. The letters of Paul in their historical context with special emphasis on his theology and ethics.

REL 3573
(H)The Religions of Native Americans
Prerequisite(s): 1103. Selected tribal worldviews, belief systems and religious ceremonies as depicted in oral traditions, songs, and literature. Emphasis on Northern and Southern Plains Indians.

REL 3613
African Cultures and Religion
Key ideas, values and achievements in African culture and tradition as found in literature, art, and music viewed in historical and religious perspective.

REL 3713
Religion, Culture and Society
Prerequisite(s): 1103, ANTH 2353, SOC 1113. An introduction to the scientific study of religion. Religious activity in both tribal and technological societies studied in the light of contemporary interpretations of culture and of social behavior. ***(Same course as SOC 3713)***

REL 4050
Studies in Religion
1-6 credits, max 6. Independent studies, seminars and courses on selected topics in religion.

REL 4113
(H,I)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.

REL 4330
Seminar in Biblical Studies
3 credits, max 9. Prerequisite(s): Two courses in Biblical studies. Selected topics in the academic study of the Bible.

Research, Evaluation, Measurement and Statistics (REMS)

REMS 4052
Measurement and Evaluation in the School
Prerequisite(s): 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.

REMS 5000*
Master's Thesis
1-6 credits, max 6. Prerequisite(s): Consent of instructor.

REMS 5013*
Research Design and Methodology
Required of all graduate students in education. An introduction to the concepts of research design, methodology, sampling techniques, internal and external validity, and the scientific method in educational problem solving. Critical analysis of educational research studies and the writing of proposals. *No credit for student with credit in 5015.*

REMS 5320*
Seminar in
Research, Evaluation, Measurement and Statistics
3-6 credits, max 6. Prerequisite(s): Consent of instructor. In-depth exploration of contemporary problems of research, evaluation, measurement, and statistics.

REMS 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.

REMS 5953*
Statistical Methods in Education
Statistical methods needed by conductors and consumers of research in education and the behavioral sciences. Introduction to interpretation and application of descriptive and inferential statistics.

REMS 6000*
Doctoral Dissertation
1-25 credits, max 25. Prerequisite(s): Consent of instructor. Required of all candidates for doctorate in applied behavioral studies. Credit given upon completion and acceptance of dissertation.

REMS 6003*
Analyses of Variance
Prerequisite(s): 5013 and 5953 and admission to a doctoral level program or consent of instructor. A thorough examination of analysis of variance procedures as they relate to principles of experimental design in education and behavioral sciences.

REMS 6013*
Multiple Regression Analysis in Behavioral Studies
Prerequisite(s): 6003 or consent of instructor. Applications of multiple regression as a general data analysis strategy for experimental and non-experimental research in behavioral sciences.

REMS 6023*
Psychometric Theory
Prerequisite(s): 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.

REMS 6033*
Factor Analysis in Behavioral Research
Prerequisite(s): 6013 or equivalent. In-depth analysis of principal components and factor analysis methods, including maximum likelihood methods. Confirmatory factor analysis methods are also introduced.

REMS 6373*
Program Evaluation
Prerequisite(s): 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 nationwide multi-year projects. Special emphasis on evaluation requirements of federally funded programs.

REMS 6663*
Applied Multivariate Research in Behavioral Studies
Prerequisite(s): 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.

REMS 6850*
Directed Reading
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Directed reading for students with advanced graduate standing.

Russian (RUSS)

RUSS 1115
Elementary Russian I
Lab 1.5. Understanding, speaking, reading, and writing. Method of instruction is audio-lingual.

RUSS 1225
Elementary Russian II
Lab 1.5. Prerequisite(s): 1115 or equivalent. Continuation of 1115.

RUSS 2115
(I)Intermediate Russian I
Prerequisite(s): 1225 or equivalent. Continuation of 1225. Russian grammar, composition and conversation.

RUSS 2225
(I)Intermediate Russian II
Prerequisite(s): 2115 or equivalent. Continuation of 2115.

RUSS 3003
(I)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 situation. *Accessible to beginning undergraduates.*
(Same course as HIST 3003 & POLS 3003)

RUSS 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 GEOG 3053, HIST 3053 & POLS 3053)

RUSS 3113
Russian Conversation
Prerequisite(s): 2225 or equivalent. Development of conversational skills in formal and informal Russian language; study of oral communication and idioms; vocabulary enhancement.

RUSS 3123
Russian Culture and Civilization
Art, literature, music, architecture, and contemporary life of Russia. Course taught in English.

RUSS 3223
Russian Composition
Prerequisite(s): 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.

RUSS 4013
Survey of Russian Literature I
Prerequisite(s): 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.

RUSS 4023
Survey of Russian Literature II
Prerequisite(s): 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.

RUSS 4113
(H)Russian Literature in Translation I
Russian literature from its beginning to mid-19th century: Pushkin, Lermontov, Goncharov, Gogol, Turgenev, and Dostoevsky. Readings in English. Classes conducted in English.

RUSS 4123
Russian Literature in Translation II
Russian and Soviet literature from mid-19th century to present: Tolstoy, Chekhov, Gorky, Zamiatin, Sholokhov, Pasternak, Bunin, Solzhenitsyn, Arzhak (Daniel), Tertz (Sinyavsky), Voznesensky, and Evtushenko. Readings in English. Classes conducted in English.

RUSS 4223
Russian Reading Skills
Prerequisite(s): 20 hours. 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)

SCFD 3223
Role of the Teacher in American Schools
Prerequisite(s): 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.

SCFD 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.

SCFD 4913
(I)International Problems and the Role of the School
Prerequisite(s): 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.

SCFD 5000*
Master's Report or Thesis
1-6 credits, max 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.

SCFD 5720*
Education Workshop
1-8 credits, max 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.

SCFD 5850*
Directed Study
1-3 credits, max 3. Directed study for master's level students.

SCFD 5873*
Culture, Society and Education
Cultural assumptions, constructions and social practices in childhood and education in a variety of societies. Children's family, community and school lives. Anthropological and comparative perspective.

SCFD 5883*
Educational Sociology
The manner in which social forces and institutions influence education and the educational system in the United States.

SCFD 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.

SCFD 5990*
Problems and Issues in Social Foundations
1-3 credits, max 3. In-depth exploration of a contemporary problem or issue in the social foundations of education.

SCFD 6000*
Doctoral Dissertation
1-25 credits, max 25. Required of all candidates for the Doctor of Philosophy degree. Credit is given upon completion of the dissertation.

SCFD 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.

SCFD 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. Foundational doctoral-level research course.

SCFD 6123*
Qualitative Research I
Prerequisite(s): 6113 or consent of instructor. The traditions, philosophies, and techniques of qualitative research, including participant observation, interviewing and document analysis. Practice in qualitative techniques and in preliminary data analysis.

SCFD 6190*
Qualitative Research: Selected Methods
3 credits. 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.

SCFD 6193*
Qualitative Research II
Prerequisite(s): 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.

SCFD 6443*
Ethics and Moral Education
Interdisciplinary perspective of traditional and contemporary ethical theories, focusing on application to professional practice and moral education. Moral development, the moral life, feminist ethics, and character education.

SCFD 6501*
Curriculum and Social Foundations Doctoral Seminar I
Orientation to doctoral study primarily for students in the PhD program in Curriculum and Social Foundations.

SCFD 6511*
Curriculum and Social Foundations Doctoral Seminar II
Orientation to the professoriate primarily for students in the PhD program in Curriculum and Social Foundations.

SCFD 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.

SCFD 6850*
Directed Reading
1-6 credits, max 6. Directed reading for students with advanced graduate standing to enhance students' understanding in areas where they wish additional knowledge.

SCFD 6880*
Internship in Education
1-8 credits, max 8. Directed off campus experiences designed to relate ideas and concepts to problems encountered in the management of the school program.

SCFD 6883*
Transforming Pedagogies
Contemporary pedagogical theories and school reform initiatives, including origins, purposes, underlying philosophical assumptions, cultural contexts, and implications for schooling.

SCFD 6910*
Practicum
1-6 credits, max 6. The student carries out an acceptable research problem (practicum) in a local school situation. Credit given upon completion of the written report.

SCFD 6983*
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.

SCFD 6990*
Seminar in Social Foundations
1-3 credits, max 3. In-depth seminar focusing on a contemporary problem or issue in the social foundations of education.

Sociology (SOC)

SOC 1113
(S)Introductory Sociology
Coming to terms with the requirements for living in a complex social world. Sociological concepts used to assist students in understanding the social influences in day-to-day life.

SOC 2123
Social Problems
Exploration in selected social issues in contemporary American society, such as deviance, poverty, sexism, racism and ageism.

SOC 3113
Theoretical Thinking in Sociology
Prerequisite(s): Six credit hours of sociology, including 1113. Sociological theory in three broad areas: the emergence of social theory, the major schools of social theory and the relevance of theory to sociological research.

SOC 3133
(S,D)Racial and Ethnic Relations
The historical and sociological dimensions of race and ethnicity in global society and understanding of the controversies and conflicts that race and ethnicity have generated in the global experience.

SOC 3213
(D,S)American Society and Culture
The social structure and organization of American society. Approaches to our contemporary national experience through the relational character of ideas and the social and historical experience of their producers.

SOC 3223
(S)Social Psychology
Social basis of personality development and behavior, including symbolic environment, self and group motivation, attitudes and opinions, and social roles.

SOC 3323
(S)Collective Behavior and Social Movements
Analyzes panics, crazes, riots and social movements emphasizing institutional and social psychological origins and consequences.

SOC 3423
(S)Urban Sociology
Urbanization as a worldwide process. The demography and ecology of cities and metropolitan regions. Urban planning and future development.

SOC 3523
(S)Juvenile Delinquency
Juvenile delinquency behavior in relation to family, school, church, peers, community and institutional structures. The extent of delinquent expressions, varieties of delinquency, comparative international perspectives and new trends of females in delinquency and gang behavior.

SOC 3713
Religion, Culture and Society
Recommended: 1113, ANTH 2353, REL 1103. An introduction to the scientific study of religion. Religious activity in both tribal and technological societies studied in the light of contemporary interpretations of culture and of social behavior. ***(Same course as REL 3713)***

SOC 3952
Applied Sociology
Prerequisite(s): Sociology majors or consent of instructor or adviser. Application of sociological theory and methods to various job situations.

SOC 3993
(S)Sociology of Aging
Sociological problems of aging, including the analysis of the behavior of the aged within the framework of social institutions.

SOC 4023*
Juvenile Corrections and Treatment Strategies
Prerequisite(s): 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.

SOC 4033
(I,S)Comparative Perspectives of Criminal Justice Systems
Study of criminal justice systems in different nation states and culture context from a different comparative perspective.

SOC 4043
(D,S)Gender and Work
Prerequisite(s): 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.

SOC 4133
Social Research Methods
Prerequisite(s): 1113 and 3113. 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.

SOC 4213
(S)Sexuality in American Society
Prerequisite(s): 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.

SOC 4243
Quantitative Methods in Sociology
Prerequisite(s): 1113, 3113, 4113. Strategies and procedures in the analysis of quantitative sociological data, including the use of statistical computer programs.

SOC 4313
Sociology of Law and Punishment
Focus on issues concerning the relationship between law, punishment and society. Examines both classical and contemporary sociological and legal scholars. Current penal policies will be examined as well.

SOC 4333
(S)Criminology
Summary of sociological and psychological research pertaining to crime causation and crime trends. Modern trends in control and treatment.

SOC 4383
(S)Social Stratification
Systems of class and caste, with special attention to the United States. Status, occupation, income, and other elements in stratification.

SOC 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, requiring an understanding of the structural conditions producing environmental problems and inhibiting resolutions.

SOC 4443
Sociology of Law and Legal Institutions
Prerequisite(s): 3523 or 4333. Criminal and civil law as mechanisms of social control; conflict and consensus models of legislation; legality doctrine and its application by police, prosecution and defense, courts and administrative agencies of control. Decision processes in the criminal justice system, personnel, case loads, and related areas. Native American law; federal policy and trust status, criminal and civil law, tribal jurisdiction, tribal courts.

SOC 4453
(S)Environmental Inequality
Prerequisite(s): 1113. Considers the connection between environmental problems and race/ethnicity and class inequality. Focuses on environmental justice/equity, social movements, health, policy and risk at the local, national and global levels.

SOC 4463
(S)Technology and Society
Exploration of various aspects of the relationship between society and technology. Analysis of arguments about the role of technology in society. Examination of the social contexts within which technology is created and discussion of the mechanisms and processes through which technology is embraced or discarded, such as peer review, politics, religion, and legal frameworks.

SOC 4473
Oklahoma Environmental Sociology
Critical assessment of the social causes and consequences of environmental problems in Oklahoma, both historical and contemporary. Examines the Land Run, the Dust Bowl, the Oil Boom, land ownership and use patterns.

SOC 4533
(I,S)World Population Problems
Fertility, mortality and migration, and other factors related to population size, density, and composition; the population explosion, worldwide famine, birth control, and other serious social issues.

SOC 4643
(S)Sociology of Gender
Explores the social organization of gender from diverse theoretical and empirical perspectives using a global experience.

SOC 4663
Undergraduate Capstone Seminar in Sociology
Prerequisite(s): Majors; senior standing; 3113, 4133, 4243. Concluding course for Sociology majors. Application of the skills, knowledge and expertise acquired in Sociology, including critical thinking, writing, theory and methods.

SOC 4723
(S)American Marriage, Family, and Male-Female Relationships
The sociological relationship between marriage and family and other institutional structures and systems, especially work and the economy. Male and female roles and relationships in mate selection, sexuality, marriage, divorce, and other intimate situations.

SOC 4850
Internship in Sociology
1-4 credits, max 4. Prerequisite(s): 3952, completion of 12 hours of sociology, or consent of internship coordinator. Field experience in a variety of work settings.

SOC 4923
Sociology of Punishment
An overview of correctional work focusing on probation, parole and institutions. A survey of contemporary alternatives to conventional imprisonment.

SOC 4950
Current Topics in Sociology
1-12 credits, max 12. Special topics in sociology; topics vary from semester to semester.

SOC 4990*
Exploration of Sociological Issues
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Examines sociologically significant topics and issues.

SOC 4993
Senior Honors Thesis
Prerequisite(s): 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.

SOC 5000*
Thesis in Sociology
1-6 credits, max 6.

SOC 5001*
Graduate Proseminar
Prerequisite(s): Admission to Sociology graduate program. Introduction and orientation to the graduate program in the Department of Sociology.

SOC 5013*
Creative Component in Sociology
A guided course serving as the final requirement for graduate students in the Department of Sociology's Master of Science degree, non-thesis option.

SOC 5063*
Seminar in Social Inequality and Stratification
Prerequisite(s): Graduate standing. Provides comprehensive overview and analysis of theories and research in social inequality and social stratification. Includes: study of classical and contemporary theories, development of research in the field, dynamics of inequalities and current and future perspectives.

SOC 5113*
Classical Sociological Theory
Prerequisite(s): 3113 or equivalent. Major trends in sociological thought. The emergence of sociological theory in Europe and America.

SOC 5123*
Contemporary Sociological Theory
Prerequisite(s): 3113 or equivalent. Critical examination of significant theoretical formulations, 1920 to the present. Relation between theoretical development and current research emphasis.

SOC 5213*
Techniques of Population Analysis
Prerequisite(s): Graduate standing. Examination of primary techniques and statistics employed in studies of population characteristics. Examination of sources of demographic data, methods employed in the collection and analysis of data on population characteristics, composition and change.

SOC 5223*
Culture, History and World Systems
Prerequisite(s): Admission to Graduate College and international studies program. The modern world system and its new social formations resulting from increasing globalization. Examination of cultural, socio-economic, and political changes in developed and developing societies. Modern societies, their historical developments, the cultural politics of difference, and the re-emergence of ethnic groups worldwide. Existing theoretical models of change for profit and non-profit organizations. ***(Same course as INTL 5223*)***

SOC 5243*
Social Research Design
Prerequisite(s): 3113; 4133 or equivalent; graduate standing. Techniques in design, data collection, and interpretation of data for sociological research.

SOC 5263*
Quantitative Analysis of Social Research
Prerequisite(s): 3133; 4133 or equivalent; graduate standing. Advanced techniques in sociological research and data analysis focusing on the formulation of substantive research questions and application of a variety of research procedures to answer such questions.

SOC 5273*
Qualitative Research Methods
Examination of ethnographic studies and implementation issues connected with qualitative research. *Research project required.*

SOC 5323*
Seminar on Collective Behavior and Social Movements
Prerequisite(s): Graduate standing. Examination of major theoretical and empirical approaches employed in the study of social movements. Exploration of problems on the nature and current theories of social movements including individual versus group approaches. Grassroots resistance, community organizing, political conflicts, and revolutions.

SOC 5333*
Global Population and Social Problems
Prerequisite(s): Graduate standing. Study in world, regional and national population characteristics, changes and associated problems and cultural influences.

SOC 5343*
Sociology of Law and Punishment
Advanced study in the sociology of law and punishment. Focus on both classical and contemporary sociological and legal research. An interdisciplinary and comparative approach is also emphasized.

SOC 5463*
Seminar in Environmental Sociology
Critical overview of contemporary developments in environmental sociology. Environment concern, disasters, health issues, risk assessment, and environmental conflict.

SOC 5473*
Seminar on the Contemporary Environmental Movement
Critical overview of contemporary theory and research on the environmental movement. Analysis of crucial movements dynamics, including historical development, central organizing themes, strategies and tactics, and movement activities, environmental health movements, and transnational movement campaigns.

SOC 5493*
Seminar in Environmental Justice
Considers racial, class and equity implications of environmental degradation and regulation. Includes discussion of controversies over the siting of hazardous facilities in urban and rural areas, the extraction of resources from native lands, national and transnational export of toxic waste to the South and the development of a distinct environmental justice movement.

SOC 5553*
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.

SOC 5573*
Seminar On Victimology
Critical overview of contemporary theory and research on victimology. Relationships between victim and offenders, social institutions such as media, police, business, advocacy groups, and various social movements.

SOC 5583*
Comparative Criminal Justice Systems
Examines crime and criminal justice in a global world. Compares the current major legal traditions with the US criminal justice system.

SOC 5593*
Seminar on Organization and Administration in Law Enforcement and Society
Critical overview of contemporary theory and research on administration in law enforcement and society.

SOC 5663*
American Pluralism, Race and Ethnicity in American Life
Prerequisite(s): 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.

SOC 5763*
Contemporary Organizational Theory
Prerequisite(s): Graduate standing. Advanced study of contemporary theories used to explain, predict and understand organizations. Behavior of populations of organizations.

SOC 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.

SOC 5813*
Myths and Realities of Organizational Change
Prerequisite(s): 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.

SOC 5950*
Seminar in Sociology
1-3 credits, max 25. Prerequisite(s): Graduate standing. Special seminar; topics vary from semester to semester.

SOC 5980*
Internship
1-6 credits, max 6. Supervised field placement.

SOC 5990*
Advanced Problems and Issues in Sociology
1-9 credits, max 9. Prerequisite(s): 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.

SOC 6000*
Dissertation
1-12 credits, max 18.

SOC 6213*
Theory of Social Structure
Prerequisite(s): Six hours of undergraduate sociology or equivalent. Relationship between human thought and the social context within which it arises.

SOC 6263*
Seminar on Community Policing
A critical overview of the current research literature devoted to community policing. The nature of community policing programs. Strategies of program evaluation. Emerging theoretical frameworks in assessing programmatic success. Police organizational dynamics and change.

SOC 6390*
Seminar in the Family, Marriage and Male-Female Roles in American Sociology
2-3 credits, max 6. Analysis of published research in sociology of family, marriage and male-female roles and relationships with special emphasis on American society.

SOC 6460*
Advanced Studies in Environmental Sociology
1-6 credits, max 6. Prerequisite(s): 5463 or consent of instructor. Intensive examination of selected topics in environmental sociology.

SOC 6463*
International Issues in Environmental Sociology
Prerequisite(s): Graduate standing. Advanced study of the international context of environmental issues.

SOC 6493*
Sociology of Disaster
Critical examination of contemporary theory and research on the social aspects of disasters. Social system response to large-scale crises. Vulnerability, warnings, preparedness, recovery, mitigation, and sustainability.

SOC 6653*
Seminar in Social Psychology
Development and critical analysis of theory and research in social psychology.

SOC 6673*
Development of Social Thought
Historical and analytical studies of major contributions to social thought leading toward the works of modern theorists.

SOC 6753*
Seminar in Deviance and Criminology
Current research and theory in criminology, penology and deviance in modern society.

SOC 6763*
Seminar in Theory of Criminal Behavioral Analysis
Critical overview of contemporary theory and research on criminal behavioral analysis.

SOC 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.

SOC 6950*
Seminar in Social Gerontology
2-3 credits, max 6. A theoretical and practical examination of the sociological implications, both individual and societal, of an aging population.

Soil Science (SOIL)

SOIL 2124
(N)Fundamentals of Soil Science
Lab 2. Prerequisite(s): 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.

SOIL 3433*
(N)Soil Genesis, Morphology, and Classification
Lab 3. Prerequisite(s): 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.

SOIL 4210*
Describing and Interpreting Soils
1 credit, max 3, Lab 3. Prerequisite(s): 2124. Describe and classify soil properties in the field and interpret for suitable agriculture, urban, and other land uses.

SOIL 4213*
Precision Agriculture
Lab 2. Prerequisite(s): 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*)***

SOIL 4234*
Soil Nutrient Management
Lab 2. Prerequisite(s): 2124. Soil fertility and use of fertilizer materials for conservation, maintenance, and improvement of soil productivity and to minimize environmental concerns.

SOIL 4363*
Environmental Soil Science
Prerequisite(s): 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.

SOIL 4463*
Soil and Water Conservation
Prerequisite(s): 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 hydrology cycle to improve water use efficiency of precipitation and irrigation resources. Examine resource mismanagement that have resulted in desertification, salinization and deforestation.

SOIL 4470*
Problems and Special Study
1-3 credits, max 12, Lab 1-3. Prerequisite(s): 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.

SOIL 4483*
Soil Microbiology
Prerequisite(s): 2124 and BIOL 1114 or consent of instructor. An overview of microorganisms living in the soil and their activities which are significant to agricultural practices and the environment. *No credit for both 4483 and 5583.*

SOIL 4563*
Dynamics of Wetland, Forest and Rangeland Soils
Prerequisite(s): 2124. 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.

SOIL 4571*
Senior Seminar
Prerequisite(s): 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)***

SOIL 4683*
Physical Properties of Soils
Prerequisite(s): 2124 and PHYS 1114. Soil physical properties and processes, and their influence on plant growth.

SOIL 4863*
Animal Waste Management
Prerequisite(s): 2124. Aspects of animal waste management related to animal nutrition, system design, land application, and economic acceptance.

SOIL 4893*
Soil Chemistry and Environmental Quality
Prerequisite(s): 2124 and CHEM 1225. Chemical and colloidal properties of clays and organic matter in soil systems, including ion exchange, retention, and precipitation; soil acidity and salinity; mineral weathering and formation; oxidation-reduction reactions; trace and toxic elements, water quality, land application of wastes, and soil remediation.

SOIL 5000*
Master's Thesis
1-6 credits, 6 max total credits under Plan I, and 2 max total credits under Plan II. Prerequisite(s): Consent of adviser. Research planned, conducted and reported in consultation with a major professor.

SOIL 5020*
Graduate Seminar
1 credit, max per semester 1 credit on MS program and 2 credits on a PhD program required. Prerequisite(s): Graduate standing. Philosophy of research, methods of research, or interpretation of research.

SOIL 5110*
Problems and Special Study
1-4 credits, max 6. Prerequisite(s): Consent of instructor. Supervised study of special problems and topics not covered in other graduate courses.

SOIL 5111*
Research Methods in Plant and Soil Sciences
Prerequisite(s): Graduate standing. Exploration of various methodologies helpful in field scale research. Application and understanding biometry as it relates to research result interpretation.

SOIL 5193*
Spatial and Non-spatial Data Base Management of Natural Resources
Prerequisite(s): 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.

SOIL 5224*
Soil Chemical Processes and Impact on Environmental Quality
Lab 2. Prerequisite(s): 4893 and CHEM 2113 or CHEM 3324 or equivalent. Chemical and physical properties of soil minerals as they pertain to solution chemistry; nutrient and contaminant availability and speciation as dictated by ion exchange, precipitation/dissolution, and adsorption reactions; soil acidity; surface chemistry and adsorption reactions. Review of current research in soil and environmental chemistry literature and writing of scientific peer-reviewed articles.

SOIL 5230*
Research
1-4 credits, max 4. Prerequisite(s): Consent of a faculty member supervising the research. Supervised independent research on selected topics.

SOIL 5353*
Advanced Soil Genesis and Classification
Lab 2. Prerequisite(s): 3433. Processes and factors of soil formation. Comparison of world soil morphology and classification systems.

SOIL 5383*
Advanced Soil Microbiology
Prerequisite(s): 2124 and BIOL 1114 or consent of instructor. A comprehensive overview of microorganisms living in the soil and their activities which are of agricultural and environmental significance. Provide experience in analytical skills related to soil microbial processes. *No credit for both SOIL 4483 and 5383.*

SOIL 5483*
Soil Biodegradation and Bioremediation
Prerequisite(s): 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.

SOIL 5613*
Laboratory Methods of Soil, Plant and Environmental Analysis
Lab 4. Prerequisite(s): SOIL 4893 and CHEM 2113 or 3353 or equivalent. Methods in soil and environmental sample analysis. Presentation and discussion of the theory behind chemical analysis of soils, plants, and waste materials for agricultural and environmental purposes. Hands-on laboratory analysis of personal soil samples. Theory and practices of common laboratory techniques and equipment/instrumentation such as colorimetric spectroscopy, charge analysis of soils, forms of acidity, phosphorus extractions and behavior, ICP-AES. The course is heavily lab based.

SOIL 5813*
Soil-Plant Nutrient Cycling and Environmental Quality
Prerequisite(s): 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.

SOIL 5990*
Soil Physical Analyses
1-2 credits, max 2. Prerequisite(s): 4683. Principles and techniques.

SOIL 6000*
Doctoral Thesis
1-6 credits, max 36. Prerequisite(s): Consent of instructor. Independent research to be conducted and reported with the supervision of a major professor as partial requirement for the PhD degree.

SOIL 6010*
Advanced Topics and Conference
1-6 credits, max 12. Prerequisite(s): MS 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)

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.*

SPAN 1153
Accelerated Elementary Spanish I
Prerequisite(s): 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 1115.*

SPAN 1225
Elementary Spanish II
Prerequisite(s): 1115 or equivalent. Continuation of 1115. Includes language lab work.

SPAN 1253
Accelerated Elementary Spanish II
Prerequisite(s): 3-4 years high school Spanish or equivalent. Accelerated presentation of the second phase of Spanish language skills for students with previous experience, but who are not yet ready for SPAN 2115.

SPAN 2115
(I)Intermediate Spanish I
Prerequisite(s): 1225 or equivalent. Further development of speaking, listening, reading, and writing skills along with short cultural and literary readings.

SPAN 2233
(I)Intermediate Composition and Grammar
Prerequisite(s): 2115 or equivalent. Skill consolidation with emphasis on composition and grammar with some conversation. *May be taken concurrently with 2232.*

SPAN 2232
(I)Intermediate Reading and Conversation
Prerequisite(s): 2115 or equivalent. Skill consolidation with emphasis on short literary readings ad conversation. *May be taken concurrently with 2233.*

SPAN 3013
Survey of Latin-American Literature
Prerequisite(s): 20 hours of Spanish or the equivalent. Development of the literature written in Spanish in the new world.

SPAN 3023
Survey of Peninsular Literature I
Prerequisite(s): 20 credit hours of Spanish or equivalent. Development of literature in Spain from the medieval period to 1700.

SPAN 3033
Survey of Peninsular Literature II
Prerequisite(s): 20 hours of Spanish or the equivalent. Development of literature in Spain from 1700 to the present.

SPAN 3203
Advanced Conversation
Prerequisite(s): 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.

SPAN 3213
Advanced Grammar and Composition
Prerequisite(s): 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.

SPAN 3463
Advanced Diction and Phonetics
Lab 1. Prerequisite(s): 2232 and 2233, or equivalent. Required course for teacher certification/licensure. Spanish speech sounds and intonation patterns, with practice to improve the student's pronunciation.

SPAN 4123
Hispanic Poetry
Prerequisite(s): 3013 or 3023 or 3033. Detailed study of representative poetry from Spain or Latin America.

SPAN 4133
Hispanic Prose
Prerequisite(s): 3013, 3023 or 3033. Detailed study of representative prose works from Spain or Latin America.

SPAN 4163
Don Quixote
Prerequisite(s): One 3000- level Spanish course or equivalent. Seminar devoted to Cervantes' novel.

SPAN 4173
Hispanic Drama
Prerequisite(s): One 3000-level Spanish course or equivalent. Reading and interpretation of dramatic works selected from the Hispanic literatures.

SPAN 4223
20th Century Hispanic Literature
Prerequisite(s): One 3000-level Spanish course or equivalent. Major 20th century Hispanic writers.

SPAN 4253
Masterpieces of Hispanic Literature I
Prerequisite(s): One 3000-level Spanish course or equivalent. Reading and analysis of classics selected from the Hispanic literatures.

SPAN 4263
Masterpieces of Hispanic Literature II
Prerequisite(s): One 3000-level Spanish course or equivalent. Reading and analysis of classics selected from the Hispanic literatures. A continuation of 4253.

SPAN 4323
Hispanic Civilization I
Prerequisite(s): 2232 and 2233, or equivalent. Reading and discussion of selected texts outlining the development of contemporary Spanish civilization.

SPAN 4333
(I)Hispanic Civilization II
Prerequisite(s): 23 credit hours of Spanish or equivalent. Reading and discussion of selected texts outlining the development of contemporary Hispanic civilization outside the Iberian peninsula.

SPAN 4413
Advanced Stylistics
Prerequisite(s): 3213. Continuation of 3213, emphasizing further development of grammar and composition in a variety of contexts.

SPAN 4550
Seminar in Spanish
1-3 credits, max 9. Prerequisite(s): One 3000-level Spanish course, or equivalent. Readings and discussion of vital subjects in Spanish.

SPAN 5110*
Advanced Hispanic Studies
1-3 credits, max 9, Lab TBA. Prerequisite(s): 22 hours of Spanish or graduate standing in foreign language.

Special Education (SPED)

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.

SPED 4723*
Transition into Adulthood for Individuals with Disabilities
Strategies for preparing youth and young adults with disabilities for transitioning into adulthood.

SPED 4753*
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.

SPED 5000*
Master's Thesis
1-6 credits, max 6.

SPED 5320*
Seminar in Counseling Psychology
3-9 credits, max 9. In-depth exploration of contemporary problems of applied behavioral studies.

SPED 5573*
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.

SPED 5620*
Practicum with Exceptional Learners
1-8 credits, max 8, Lab 1-8. Prerequisite(s): 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.

SPED 5623*
Characteristics of Students with Mild/Moderate Disabilities
Educational, psychological and physiological characteristics of individuals with mild and moderate disabilities. Professional roles of the teacher, professional ethics, and assessment of children with disabilities.

SPED 5633*
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.

SPED 5643*
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.

SPED 5653*
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.

SPED 5673*
Improving Literacy Skills of Individuals with Disabilities
Normal language development and variations from norms demonstrated by exceptional learner. 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.

SPED 5683*
Models of Instruction in the Inclusive Classroom
Current techniques, models and approaches used to teach students with mild and moderate disabilities and the theoretical bases for these techniques and approaches in inclusive classrooms. Professional roles of the teacher of students with mild and moderate disabilities, including communication with other teachers.

SPED 5733*
Teaching Strategies for Students with Physical and Health Disabilities
Prerequisite(s): 5523 and graduate student standing. Design and implementation of educational programs, collaboration with families and other professionals, and advocacy for students with disabilities.

SPED 5743*
Planning and Instruction in Special Education
Knowledge and skills related to research-based, validated "best" practices for determining curriculum and implementing instruction for students with exceptionalities.

SPED 5783*
Psycho-educational Testing of Exceptional Individuals
Intensive practice in the selection, administration and interpretation of individual tests, appropriate for exceptional individuals.

SPED 5824*
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.

SPED 5883*
Classroom and Behavior Management
Classroom and behavior management strategies designed to improve learning and behavior within instructional settings.

SPED 5993*
Culturally Responsive Teaching 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. Teaching attitudes and expectations, and curricular and instructional strategies for improving students' school performance.

SPED 6000*
Doctoral Thesis
1-25 credits, max 25. Required of all candidates for doctorate in applied behavioral studies. Credit given upon completion and acceptance of thesis.

SPED 6183*
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.

SPED 6543*
School and Interagency Collaboration
Prerequisite(s): Graduate student status or instructor permission. An advanced course to examine models for interdisciplinary teamwork in the design, delivery and evaluation of services for students with disabilities and at risk. Both school-based and interagency collaborative services and strategies for communicating with multiple stakeholders are emphasized.

SPED 6603*
Current Trends and Issues in Special Education
Current research and literature regarding the education of exceptional children.

SPED 6850*
Directed Reading
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Directed reading for students with advanced graduate standing.

SPED 6880*
Internship in Education
1-8 credits, max 8, Lab 3-24. Directed off-campus experiences designed to relate ideas and concepts to problems encountered in the management of the school program.

Speech Communication (SPCH)

SPCH 2713
(S)Introduction to Speech Communication
Principles and techniques of preparing for, participating in and evaluating communication behavior in the conversation, the interview, group discussion and the public speech. A competency-based approach.

SPCH 3703
Small Group Communication
General systems approach to small group processes. Special consideration given to group roles, norms, leadership and decision-making. Participation in various types of discussion groups.

SPCH 3723
Business and Professional Communication
Oral communication encounters in business and professional settings. The interview, informative briefing, talking-paper, small group interaction and informative, integrative and persuasive speeches.

SPCH 3733
(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.

SPCH 3743
Advanced Public Speaking
The preparation and delivery of various types of public speeches.

SPCH 3793*
Communication in Interviews
General principles of interviewing. Specific guidelines for the interviewer in survey, journalistic, counseling, selection, appraisal, legal, medical, and sales interviews.

SPCH 4010
Independent Study in Speech Communication
1-3 credits, max 3. Prerequisite(s): Consent of instructor. Supervised research projects in speech communication.

SPCH 4710
Topics in Speech Communication
1-3 credits, max 6. Selected current topics in speech communication.

SPCH 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.

SPCH 4753
(I)Intercultural Communication
Social and cultural differences between individuals from diverse backgrounds as possible barriers to effective communication.

SPCH 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.

SPCH 4793
(S)Nonverbal Communication
Nonverbal aspects of speech communication.

Statistics (STAT)

STAT 2013
(A)Elementary Statistics
Prerequisite(s): MATH 1483 or 1513. No credit for business majors. An introductory course in the theory and methods of statistics. Descriptive measures, elementary probability, samplings, estimation, hypothesis testing, correlation and regression. *No credit for students with credit in 2023 or 2053.*

STAT 2023
(A)Elementary Statistics for Business and Economics
Prerequisite(s): MATH 1483 or 1513. Basic statistics course for undergraduate business majors. Descriptive statistics, basic probability, discrete and continuous distributions, point and interval estimation, hypothesis testing, correlation and simple linear regression. *No credit for students with credit in 2013 or 2053.*

STAT 2053
(A)Elementary Statistics for the Social Sciences
Prerequisite(s): MATH 1483 or MATH 1513. No credit for business majors. An introductory course in the theory and methods of statistics. Descriptive measures, elementary probability, sampling, estimation, hypothesis testing, correlation and regression. *No credit for students with credit in STAT 2013 or 2023.*

STAT 2331
SAS Programming
Prerequisite(s): 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.
(Same course as CS 2331)

STAT 3013*
Intermediate Statistical Analysis
Prerequisite(s): 2013, 2023 or 2053. Applications of elementary statistics, introductory experimental design, introduction to the analysis of variance, simple and multiple linear regression, nonparametric statistics, survey sampling and time series. Data analysis using Excel included.

STAT 4013
(A)Statistical Methods I
Prerequisite(s): 60 credit hours including MATH 1513. Basic experimental statistics, basic probability distributions, methods of estimation, tests of significance, linear regression and correlation, analysis of variance for data that are in a one way, a two-way crossed, or in a two-fold nested classification. *No credit for students with credit in 4053.*

STAT 4023
Statistical Methods II
Prerequisite(s): 3013 or 4013 or 4033 or 4053. Basic concepts of experimental design. Analysis of variance, covariance, split-plot design. Factorial arrangements of treatments, multiple regression in estimation and curvilinear regression, enumeration data. *No credit for students with credit in 4063.*

STAT 4033
Engineering Statistics
Prerequisite(s): MATH 2163. Probability, random variables, probability distributions, estimation, confidence intervals, hypothesis testing, linear regression. *No credit for students with credit in STAT 4073.*

STAT 4043*
Applied Regression Analysis
Prerequisite(s): One of 4013, 4033, 4053, 5013 or equivalent. Matrix algebra, simple linear regression, residual analysis techniques, multiple regression, dummy variables.

STAT 4053
(A)Statistical Methods I for the Social Sciences
Prerequisite(s): MATH 1513. Basic experimental statistics, basic probability distributions, methods of estimation, tests of significance, linear regression, calculation and analysis of variance for one and two-way classifications. *No credit for students with credit in STAT 4013.*

STAT 4063*
Statistical Methods II for the Social Sciences
Prerequisite(s): 3013 or 4013 or 4033. Basic concepts of experimental design. Analysis of variance, covariance, split-plot design. Factorial arrangements of treatments, multiple and curvilinear regression, enumeration data. *No credit for students with credit in STAT 4023.*

STAT 4073
Engineering Statistics with Design of Experiments
Prerequisite(s): MATH 2163. Random variables and basic probability distributions, estimation, confidence intervals, hypothesis testing, basic analysis of variance, factorial arrangement of treatments and fractional factorial experiments, elementary quality control. *No credit for students with credit in STAT 4033.*

STAT 4091*
Statistical Analysis System
Prerequisite(s): 4013 or equivalent. SAS dataset construction, elementary statistical analysis, and use of statistics and graphics procedures available in the SAS package. ***(Same course as CS 4091*)***

STAT 4203*
Mathematical Statistics I
Prerequisite(s): MATH 2163. Introduction to probability theory for students who are not graduate majors in statistics or mathematics. Probability, dependence and independence, random variables, univariate distributions, multivariate distributions, moments, functions of random variables, moment generating functions.

STAT 4213*
Mathematical Statistics II
Prerequisite(s): 4203 and MATH 3013. Statistical inference for students who are not graduate majors in statistics or mathematics. Sampling distributions, maximum likelihood methods, point and interval estimation, hypothesis testing.

STAT 4910*
Special Studies
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Special subjects in statistics.

STAT 4993
Senior Honors Project
Prerequisite(s): Departmental invitation, senior standing, Honors Program participation. A guided reading and research program ending with an honors project under the direction of a faculty member, with a second faculty reader and an oral examination. *Required for graduation with departmental honors in statistics.*

STAT 5000*
Research in Statistics
1-6 credits, max 6. Methods of research and supervised thesis or report.

STAT 5013*
Statistics for Experimenters I
Prerequisite(s): Graduate standing and MATH 1513. Introductory statistics course for graduate students. Descriptive statistics, basic probability, probability distributions, fundamentals of statistical inference, hypothesis testing, regression, one-way classification, analysis of variance, comparative experiments, correlation and linear regression, introduction to categorical data analysis.

STAT 5023*
Statistics for Experimenters II
Prerequisite(s): Graduate standing and 4023 or 5013. Analysis of variance, covariance, use of variance components and their estimation, completely randomized, randomized block and Latin square designs, multiple comparisons.

STAT 5033*
Nonparametric Methods
Prerequisite(s): One of 4023, 4043, 5023 or consent of instructor. A continuation of 4013 and 4023, concentration on nonparametric methods. Alternatives to normal-theory statistical methods; analysis of categorical and ordinal data, methods based on rank transforms, measures of association, goodness of fit tests, order statistics.

STAT 5043*
Sample Survey Designs
Prerequisite(s): One of 4013, 4033, 5013 or consent of instructor. Constructing and analyzing personal, telephone and mail surveys. Descriptive surveys including simple random, stratified random designs. Questionnaire design, frame construction, non-sampling errors, use of random number tables, sample size estimation and other topics related to practical conduct of surveys.

STAT 5053*
Time Series Analysis
Prerequisite(s): 4043. An applied approach to analysis of time series in the time domain and the frequency domain. Descriptive techniques, probability models for time series, autoregressive processes and forecasting. Box-Jenkins methods, spectral analysis and use of computers.

STAT 5063*
Multivariate Methods
Prerequisite(s): 4043 and 4023 or 5023. Use of Hotelling's T-squared statistic, multivariate analysis of variance, canonical correlation, principal components, factor analysis and linear discriminant functions.

STAT 5073*
Categorical Data Analysis
Prerequisite(s): 5223, 5023 or equivalent or concurrent enrollment. Analysis of data involving variables of a categorical nature. Contingency tables, exact tests, binary response models, loglinear models, analyses involving ordinal variables, multinomial response models. Computer usage for analysis is discussed.

STAT 5093*
Statistical Computing
Prerequisite(s): 5123 or 4203, 5013 or equivalent, CS 1113 or equivalent. Random variable generation; numerical calculations of maximum likelihood estimators, quasi-likelihood estimators, probabilities, and quantiles; computer intensive exact tests and distributions; randomized tests; bootstrap and jack knife methods, Monte Carlo simulations Markov Chain Monte Carlo methods for Baysian estimation.

STAT 5123*
Probability Theory
Prerequisite(s): MATH 2163 and one other course in MATH that has either 2144 or 2153 as a prerequisite. Basic probability theory, random events, dependence and independence, random variables, moments, distributions of functions of random variables, weak laws of large numbers, central limit theorems.

STAT 5133*
Stochastic Processes
Prerequisite(s): 5123 and MATH 2233, MATH 3013. Definition of a stochastic process, probability structure, mean and covariance function, the set of sample functions, stationary processes and their spectral analyses, renewal processes, counting processes, discrete and continuous Markov chains, birth and death processes, exponential model, queuing theory.
(Same course as IEM 5133* & MATH 5133*)

STAT 5213*
Bayesian Decision Theory
Prerequisite(s): 5223. Statistical spaces, decision spaces, loss and risk, minimum risk decisions, conjugate families of distributions, Bayesian decisions.

STAT 5223*
Statistical Inference
Prerequisite(s): 5123 and MATH 3013. Sampling distributions, point estimation, maximum likelihood methods, Rao-Cramer inequality, confidence intervals, hypothesis testing, sufficiency, completeness.

STAT 5303*
Experimental Design
Prerequisite(s): 5023 or 4023 with consent of instructor. Review of basic concepts and principles of comparative ex-periments, the role of randomization in experimentation, interpretation of effects and interactions in multi-factor designs, error term selection principles, multiple comparisons, split-unit experiments, incomplete block designs, confounding of factorial effects in 2^n and 3^n series of factorials, single and fractional replication optimum seeking designs, pooling of experiments over time and space, crossover and switch back designs.

STAT 5323*
Theory of Linear Models I
Prerequisite(s): 5223, and MATH 3013, and one of 4023 or 5023. Multivariate normal distributions of quadratic forms, general linear models, Markov theorem, variance components, general linear hypotheses of full rank models.

STAT 5333*
Theory of Linear Models II
Prerequisite(s): 5323. Maximum likelihood estimation; missing data structures; balanced incomplete block design; less than full rank models; general mixed models; intrinsically linear models; sequential estimation.

STAT 5513*
Multivariate Analysis
Prerequisite(s): 5323. Multivariate normal distribution, simple, partial and multiple correlation, multivariate sampling distributions. Wishart distribution, general T-distribution, estimation of parameters and tests of hypotheses on vector means and covariance matrix. Classification problems, discriminate analysis, and applications.

STAT 5910*
Seminar in Statistics
1-6 credits, max 12. Special studies for master's students. Survey and discussion of research in mathematical statistics and statistical methods.

STAT 6000*
Research and Thesis
2-10 credits, max 30. Prerequisite(s): Consent of advisory committee. Directed research culminating in the PhD thesis.

STAT 6113*
Probability Theory
Prerequisite(s): 5123 and MATH 5143. Measure theoretical presentation of probability, integration and expectation, product spaces and independence, conditioning, different kinds of convergence in probability theory, statistical spaces, characteristic functions and their applications.

STAT 6203*
Large Sample Inference
Prerequisite(s): 5223 and 6113. Different types of convergence in probability theory, central limit theorem, consistency, large sample estimation and tests of hypotheses, concepts of asymptotic efficiency, nonparametric tests.

STAT 6223*
Advanced Statistical Inference
Prerequisite(s): 6113. Point estimation, maximum likelihood, Cramer-Rao inequality, confidence intervals, Neyman-Pearson theory of testing hypothesis and power of test.

STAT 6910*
Special Problems
1-6 credits, max 12. Investigation of special problems in the theory and application of statistics using current techniques. Special studies for PhD level students.

Student Development (SDEV)

SDEV 1113
Orientation in Student Athletics
To assist students to better understand and comply with the academic and athletic demands on student-athletes at a NCAA Division I university, including NCAA compliance issues.

SDEV 3013
Leadership Concepts
Prerequisite(s): 12 hours completed course work. Increases undergraduate student competence through the study of leadership concepts. Stresses communications, decision-making, leadership styles and theories and group dynamics. Attempts integration of theoretical concept with reality of application within the university community.

SDEV 3091
Student Development Theory for Orientation Leaders
Prerequisite(s): Consent of instructor. Theories of student development. Topics include helping skills, student leadership community building, communication skills, and multicultural sensitivity. Application of theory to university orientation programs.

SDEV 3092
Student Development Training for Resident Assistant
Theories of student development. Topics include helping skills, community building, communication skills, and multicultural sensitivity. Application of theory to living groups.

SDEV 5000*
Master's Thesis
1-6 credits, max 6. Prerequisite(s): Consent of instructor.

SDEV 5173*
Introduction to Student Affairs
History, philosophy, and goals of student affairs units in colleges and universities; emphasis on practitioner roles and responsibilities.

SDEV 5213*
Student Development Theory
Examination of theories describing patterns of growth and development during the college years. Implications for the design of education practice on the college campus.

SDEV 5223*
Career Development for College Students
In-depth exploration of issues and contemporary theory related to the topic of career development for college students.

SDEV 5320*
Seminar in Student Development
3-6 credits, max 6. Prerequisite(s): Consent of instructor. In-depth exploration of contemporary problems of applied behavioral studies.

SDEV 5333*
Effective Leadership in Student Services
Prerequisite(s): 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.

SDEV 5433*
Group and Cultural Interventions in Student Affairs
Prerequisite(s): Consent of instructor. Explores group theory, dynamics and cultural dimensions as these factors relate to working with college students and advising student groups in a higher education environment.

SDEV 5463*
Legal Issues in Student Affairs
Prerequisite(s): 5173 or 6173. Legal issues confronted by entry-level student affairs practitioners, how to reconize these issues, and how to act within the parameters of the law.

SDEV 5733*
Environmental Theory and Student Affairs
Prerequisite(s): Consent of instructor. Examination of campus environmental theory providing an understanding of campus environments approach to student affairs practice.

SDEV 6000*
Doctoral Dissertation
1-9 credits, max 9. Prerequisite(s): Consent of instructor. Required of all candidates for doctorate in applied behavioral studies. Credit give upon completion and acceptance of dissertation.

SDEV 6173*
Administrative Issues in Student Affairs
Develops an understanding of the history, philosophy, student life, critical issues and administration of student personnel work in higher education.

SDEV 6213*
Higher Education Student Personnel Services
Prerequisite(s): 6173 or consent of instructor. Higher education student personnel services such as: admissions, orientation, student activities, financial aids, housing, and counseling.

SDEV 6220*
Internship in Higher Education Student Personnel
3 credits, max 3. Prerequisite(s): 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.

SDEV 6850*
Directed Reading
1-6 credits, max 6. Prerequisite(s): Consent of instructor. Directed reading for students with advanced graduate standing.

Telecommunications Management (TCOM)

TCOM 3153
international Telecommunications Business Environment
Prerequisite(s): 2103 or consent of instructor. This course concentrates on understanding the implications and challenges of utilizing telecommunications networks in today's global business environment. Emphasis will be placed on identifying the major players in the global information infrastructure, standards setting bodies and procedures, and the various regulatory processes encountered. Students will research the telecommunications industry in other countries and develop comprehensive written reports.

TCOM 3203
Telecommunications Industry Foundations
Prerequisite(s): Consent of instructor. Emerging trends in the telecommunications industry. Past events, regulatory and legal implications, strategic direction of organizations with respect to telecommunications.

TCOM 3223
Network Design Principles
Prerequisite(s): MSIS 3223. Management science principles applied to telecommunications network design. Specific topics will include mathematical programming, network models, simulation, and queuing theory.

TCOM 5012*
Telecommunications Laboratory
Prerequisite(s): 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, and attachment 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 lab 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 media for transmitting data, voice and video signals. Handling information problems within selected environments.

TCOM 5113*
Industry Overview and Telecommunications Applications
Prerequisite(s): 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.

TCOM 5123*
The Upper Layers of Telecommunications Systems
Applied technical coverage of selected topics from the upper layers of the OSI model. Network and Transport layers using, TCP/IP, IPX/SPX, as well as security issues and other multi-layer protocol suites. Other topics include flow control, RSVP, encryption, compression, and LAN/WAN applications.

TCOM 5143*
Telecommunications Systems Analysis, Planning and Design I
Prerequisite(s): 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.

TCOM 5153*
International Telecommunications Management
Prerequisite(s): 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.

TCOM 5163*
Telecommunications Practicum
Lab 3. Prerequisite(s): 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.

TCOM 5173*
Global Telecommunications Regulation
Historical review of the classical "PTT (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.

TCOM 5193*
Capstone: Telecommunications Systems Analysis and Design
Prerequisite(s): 5113, 5123, ECEN 5553, 23 hours of relevant graduate course work, and consent of program director. Application of knowledge gained throughout the curriculum to basic systems analysis tools and techniques to perform an analyses and designs in a telecommunications context. Knowledge of technology, management, international aspects, and regulatory environment to provide an overall view of impact that a given system may have on an organization. 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 may be used.

TCOM 5213*
Telecommunications Systems Analysis, Planning and Design II
Prerequisite(s): 5143, ECEN 5553, and consent of program director. The fundamentals behind systems analysis and design of telecommunication 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.

TCOM 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.

TCOM 5233*
Applied Information Systems Security
Prerequisite(s): 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 includes 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 examined.

TCOM 5273*
Legal and Ethical Issues in Information Technology
This course reviews the current status of information systems law in regard to rights of privacy, freedom of information, confidentiality, work product protection, copyright, security, legal liability, ethical issues and a range of additional legal and information policy topics. We will investigate the legal difficulties that technological innovations are causing in all of these areas. Legal options for dealing with the conflicts caused by technological change and likely adaptations of the law over time in response to societal changes will be explored. *No credit for students having completed MSIS 4273.*

TCOM 5283*
Operating Systems for Information Assurance
Operating Systems (OS) concepts for security. Vulnerabilities and threats. Security models. User authentication. Smart cards: architectures, technologies, application environments, and case studies. System availability. Software and data integrity. Auditing. Sensitive data confidentiality. Access control. Secure OS development: design principles, design methodologies, security certification. Case studies: Unix/Linux, MS-Windows XP/2000.

TCOM 5310*
UNIX Administration Laboratory
1-3 credits, max 9, Lab 16-48. Prerequisite(s): Must have taken or currently enrolled in 5223 or 5233 and have consent of program director. Common administration level tasks associated with managing systems that run Unix and Unix derivatives. Utilities and resources commonly deployed in support of network infrastructure.

TCOM 5320*
Infrastructure Security Lab
1-3 credits, max 9, Lab 16-48. Prerequisite(s): Must have taken or currently enrolled in 5223 or 5233 and have consent of program director. Hands-on experience with various technical aspects of managing the perimeter of a connected network. Network hardware, such as routers, switches and firewalls. Course content variable, but includes computer, network, and data protection technologies.

TCOM 5330*
UNIX Security Lab
1-3 credits, max 9, Lab 16-48. Prerequisite(s): Must have taken or currently enrolled in 5223 or 5233 and have consent of program director. Hands-on experience with various technical aspects of managing security, protecting information technology assets, and both attacking and guarding against attacks and failures in UNIX and Linux systems. Course content variable, but includes computer, network, and data protecting technologies.

TCOM 5340*
Security Lab
1-3 credits, max 9, Lab 16-48. Prerequisite(s): Must have taken or currently enrolled in 5223 or 5233 and have consent of program director. Hands-on experience with various technical aspects of managing security, protecting information technology assets, attacking and of guarding against attacks and failures in information systems. Course content variable but includes computer, network, and data protection technologies (e.g. firewalls, packet filters, proxy severs, user authentication and validation techniques, data encryption, establishing virtual private networks, creating and using digital certificates for authentication, using encrypted email technologies). Several threats and attack methods explored (e.g. sniffers, password crackers, network scanners, etc.).

TCOM 5343*
Information Technology Forensics
Prerequisite(s): 5123, consent of department head. Review of systems for vulnerabilities and analysis of systems that have been breached. This course will cover the many related issues and have a heavy hands-on component.

TCOM 5350*
Advanced Telecommunications Management Lab
2-3 credits, max 3, Lab 2-3. Prerequisite(s): 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.

TCOM 5353*
Information Technology Risk Analysis, Planning and Mitigation
Prerequisite(s): Consent of department head. Examination of factors of risk analysis in information technology and how management can plan to achieve an acceptable level of risk in the face of corporation desiring to further open up their networks to partners, customers and mobile workers.

TCOM 5360*
Wireless Communications Laboratory
1-3 credits, max 9, Lab 16-48 Prerequisite(s): ECEN 4523, ECEN 5553 and consent of program director. Conducting wireless-modem and wireless-networking experiments and analyzing the problems that result in improved designs for wireless systems and networking performance.

TCOM 5370*
Windows Security Lab
1-3 credits, max 9, Lab 16-48. Prerequisite(s): Must have taken or currently enrolled in 5223 or 5233 and have consent of program director. Hands-on experience with various technical aspects of managing security, protecting information assets, and both attacking and guarding against attacks and failures in Windows systems. Course content variable, but includes computer, network, and data protection technologies.

TCOM 5380*
System Technologies for Information Assurance
1-3 credits, max 3, Lab 1-3. Prerequisite(s): 5223, consent of director. The basic parts of an operating system, including memory handling, processing and I/O functions. Areas of the OS most often exploited in information assurance breaches, as well as those that serve as the building blocks for upper-layer attacks. OS structures, process management, memory management, storage management, protection and security, distributed systems, and special purpose systems. For non-computer science majors, and may not be taken for credit if another course in operating systems has already been completed.

TCOM 5410*
Advanced Topics in Telecommunications Management
3 credits, max 3. Prerequisite(s): 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.

TCOM 5990*
Directed Studies in Telecommunications Management
1-6 credits, max 6. Prerequisite(s): Graduate standing and consent of program director. Special advanced topics, projects and independent study in telecommunications management.

Theater (TH)

TH 1322
Acting I
Lab 1. 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.

TH 1332
Voice and Movement I
Lab 4. 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.

TH 1500
Theater Practicum
1 credit, max 6, Lab 2. Laboratory experience in theater production, acting and crew assignments. *Graded on a pass-fail basis.*

TH 1664
Stage Technology
Lab 4. Elementary techniques of stagecraft for the stage. Basic stagecraft skills. Practical experience preparing departmental productions.

TH 1674
Costume Technology
Lab 4. Elementary techniques of costume craft for the stage. Basic costuming skills. Practical experience preparing departmental productions.

TH 2322
Acting II
Lab 4. Prerequisite(s): 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.

TH 2332
Voice and Movement II
Lab 1. Prerequisite(s): 1332. Continued development of strength of the vocal and physical instrument. Introduction to analysis and interpretation of heightened text. Study of the International Phonetic Alphabet, General American Speech, and the American Stage Speech dialect.

TH 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.

TH 2553
Introduction to Stage Design
Lab 2. Prerequisite(s): 1664, 1674 or consent of instructor. An integrated overview of the theory and practice of design for the stage.

TH 3373
Acting III
Lab 2. Prerequisite(s): 1322, 2322. Continuation and refinement of 2322. Performance techniques in classic to modern styles. Shakespeare to Miller.

TH 3383
BFA Acting Studio I
Lab 2. Prerequisite(s): 3373 and admission to Bachelor of Fine Arts program. In-depth acting study for BFA candidates. Special emphasis on performing classic and poetic realism.

TH 3400
Upper-division Projects
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Individual or group study of techniques, history, or literature of the theater. Required written survey of the project and self-evaluation of its results, or a term paper.

TH 3412
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. ***(Same course as 5400*)***

TH 3422
Theatrical Dance: Jazz II
Lab 4. Prerequisites: 3412 or consent of instructor. Techniques for theatrical performance at the intermediate level emphasizing stamina, control, speed, and dynamics. Artistic development of dance performers.

TH 3432
Theatrical Dance: Tap I
Lab 4. Fundamentals of tap dance techniques for theatrical performance emphasizing coordination, rhythm, and dance vocabulary in simple tap combinations. Artistic development of dance performers.

TH 3442
Theatrical Dance: Tap II
Lab 4. Prerequisite(s): 3432 or consent of instructor.Tap dance techniques for theatrical performance at the intermediate level emphasizing stamina, control, speed, and dynamics. Artistic development of dance performers.

TH 3500
Theater Practicum II
1-2 credits, max 4. Prerequisite(s): 1322; 1332 or 1664; 1674. Advanced laboratory experience in theatre production, design, acting, and/or major crew assignments.

TH 3903
History of Costume and Decor for the Stage
Comprehensive history of theatrical costume and interior decor from ancient Egypt to the present.

TH 3913
Dramatic Literature and Analysis
Survey of critical approaches to dramatic literature focusing on the transfer of literature to live theatrical production and performance.

TH 3923
(H)Theater History I
Aesthetic and social relationships of theater and western civilization from Ancient Greece to the 18th century.

TH 3933
(H)Theater History II
Aesthetic and social relationships of theater and western civilization from the 19th century to the present.

TH 3971
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.

TH 4183*
Scene Design for Theater and Television
The designer's approach to the script; execution of sketches, models, and working drawings.

TH 4223*
Sound Design and Technology
Prerequisite(s): 2553, 2663. Use and design of sound in theatrical productions, including voice reinforcement, scoring, script analysis, and effects.

TH 4363
BFA Acting Studio II
Lab 2. Prerequisite(s): 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.

TH 4373
BFA Acting Studio III
Lab 2. Prerequisite(s): 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.

TH 4383*
Stage Combat
Lab 2. Prerequisite(s): 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.

TH 4393*
Stage Dialects
Prerequisite(s): 1332, 2332. Development of techniques for learning and speaking dialects commonly required in theatrical productions, as well as an application of these dialects.

TH 4403
Senior Honors Project
Prerequisite(s): 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.*

TH 4593*
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.

TH 4653
Advanced Stage Mechanics
Lab 2. Prerequisite(s): 1664. Advanced study in theatrical stage mechanics and production techniques, including special steel fabrication, automated scenery, and structural support systems.

TH 4663
Scenographic Techniques
Lab 2. Prerequisite(s): 1664, 1674, 2553. 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.

TH 4673*
Seminar in Advanced Costume Construction
Lab 2. Prerequisite(s): 1674. Sewing and craft techniques for the construction of period costumes. Boned garments, fabric manipulation, and millinery.

TH 4683
Costume and Prop Crafts
Lab 2. Prerequisite(s): 1664 and 1674. Use of advanced materials and techniques in the fabrication of specialized stage and costume props.

TH 4753*
Stage Management
Prerequisite(s): 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; scene shifts; 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.

TH 4953*
Directing
Prerequisite(s): 2543. Play analysis for production, problems in staging, and the role of the director. Planning and direction of scenes in laboratory situations.

TH 4963*
Theater Graphic Techniques
Fundamental theater graphic techniques to communicate theatrical design ideas.

TH 4973*
Stage Costume Design
Lab 4. Approaches to basic costume design including research, conceptual analysis, figure drawing, and executions of sketches and renderings.

TH 4983*
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.

TH 4990
BFA Jury
1 credit, max 4. Prerequisite(s): Consent of the department. Business for the performing artist: professional portfolio/audition preparation; career development, internships and national/international organizations; graduate school preparation; resume, application and interviewing. *4 hours required for all BFA candidates.*

TH 5000*
Masters Thesis and Research
1-6 credits, max 6. Prerequisite(s): Consent of department head. Master's level research in theater for thesis option graduate students.

TH 5013*
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.

TH 5063*
Scenography
Investigation of design styles and theories and the designers whose work advances the artform. Special emphasis will be placed on collaboration strategies for developing visual and directorial production concepts.

TH 5213*
Script Analysis
Analytical and interpretive techniques in studying play scripts for theatrical production. Emphasis on writing skills appropriate to script analysis.

TH 5223*
Seminar in Theater History
Prerequisite(s): Undergraduate degree or instructor consent. Specific topics in theater history with focus on theater production in one historical or artistic era (e.g. Russian Silver Age, Post War French Absurdism, Imperial Roman), or the comparative study of theater and drama in various nations.

TH 5243*
Problems in Advanced Acting
Lab 2. Experimentation in psychological realism. Concentration on analysis, technical skills, and contacting the emotions. Special preparations for professional interviews and auditions.

TH 5253*
Problems in Advanced Acting II
Prerequisite(s): 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.

TH 5400*
Seminar in Theater
1-3 credits, max 12. Prerequisite(s): Consent of instructor. Individual or group studies of techniques, history or literature of the theater. A term paper or written report and self-evaluation of the study or project required.
(Same course as 3400)

TH 5413*
Dramatic Theory
Concepts of play construction and audience effects: classic, neoclassic, romantic, realist, to post-modern.

TH 5500*
Individual Theater Projects
1-3 credits, max 6. Prerequisite(s): Consent of instructor. Individual projects in directing, acting, or design and technology for a specified theater production, with concept, realization, and self-evaluation under faculty guidance.

TH 5953*
Problems in Advanced Directing
Prerequisite(s): 4953, consent of instructor. Problems in directing period styles, especially Shakespeare. Restoration comedy, absurdist drama, and avant garde drama. Preparation, rehearsal and staging of a complete production by each student.

University (UNIV)

UNIV 0023
Concepts of Algebra
Previous study in algebra is not assumed. Linear equations, laws of exponents, factoring, factoring applications, story problems, and substituting data into formulas. A comprehensive review of arithmetic procedures incorporated throughout the course. Students must complete the COMPASS test and score 45 or less to enroll in this course. *Does not count for college credit. Graded on a satisfactory-unsatisfactory basis.*

UNIV 0111
Developmental Science Process Skills
Study and investigate the natural world. Emphasis on critical thinking processes. Observation, classification, metric measurement, data table construction, graph construction, and interpretation. May be used to fulfill the science remediation requirement as established by State Regents policy. *Graded on a satisfactory-unsatisfactory basis.*

UNIV 0123
Intermediate Algebra
Prerequisite(s): One year of high school algebra or equivalent. In-depth coverage of applications of factoring, arithmetic operations with polynomial and rational algebraic expressions, review of laws of exponents (integers, fractions), simplifying radical expressions, equations (linear, radical, quadratic, rational), and graphing linear equations in two variables. Students must complete the COMPASS test before enrolling in this course. *Does not count for college credit but satisfies high school curricular deficiency in mathematics. Graded on a satisfactory-unsatisfactory basis.*

UNIV 0133
Basic Composition
Intensive instruction in sentence and paragraph structure, punctuation, grammar and word usage. Does not count for college credit but will satisfy high school curricular deficiency in English composition. *Graded on satisfactory-unsatisfactory basis.*

UNIV 0143
Improving College Reading Skills
Instruction to improve reading comprehension, vocabulary building, study and reference skills, and critical thinking. Does not count for college credit but will satisfy high school curricular deficiency in reading. *Graded on satisfactory-unsatisfactory basis.*

UNIV 1111
University Academic Services Freshman Orientation
Prerequisite(s): Beginning freshman standing in University Academic Services. Designed to help students ease the transition from high school to college; become aware of campus resources and administrative structures; explore various majors and careers; increase awareness of current issues in education; and enhance study skills and attitudes which can contribute to academic success.

UNIV 2001
Academic Assessment and Evaluation
Required for students in University Academic Assessment Program and available campus wide to students on academic probation. Identification of reasons for experiencing academic difficulty; assessment of reading ability and individual learning styles; understanding university policies and procedures and current issues in American education; development of goals, attitudes, and study skills needed to achieve academic success; and exploration of careers, majors, and alternative educational experiences.

UNIV 2510
Innovative Studies
1-3 credits, max 6, Lab 0-6. May be used for not more than two semesters for new or experimental topics or techniques.

UNIV 2511
Introduction to Health Careers
An introduction to medical professions related to all areas of human and animal health. *Graded on pass-fail basis.*

UNIV 2910
Niblack Research Scholars
1 credit, max 4, Lab 2. Prerequisite(s): Current recipient of the Niblack Research Scholar Award. Scientific research in a laboratory environment at an early stage of an academic career.

UNIV 3110
Directed Study
1-18 credits, max 18. Prerequisite(s): Written application approved by instructor, the department head, and the dean of the student's college. Independent study, research, field work or internship. *Some sections will be graded on a pass-fail basis.*

UNIV 3511
Health Profession School Preparation
Prerequisite(s): Junior/senior prehealth students. This seminar targets the junior/senior prehealth professional primarily premedical, predental, and preoptometry. The seminar will provide the student with the necessary tools needed for the following to apply to their professional program: the application process; interview process, including a mock interview; composition of a personal statement; MCAT, DAT & OAT preparation; shadowing/volunteer experience. *Graded on a pass-fail basis.*

Veterinary Biomedical Sciences (VBSC)

VBSC 5000*
Masters Research and Thesis
1-6 credits, max 6. Prerequisite(s): Graduate standing. Research problem for meeting requirements of the Masters degree.

VBSC 5010*
Career Skills in Veterinary Biomedical Sciences
1-3 credits, max 3. Prerequisite(s): Graduate standing in veterinary biomedical sciences program, consent of instructor. Acquiring skills that are usually not taught in other courses but are essential to be successful in the graduate program as well as in a career in science. Writing and publishing a scientific paper, writing a successful grant proposal, preparing effective oral and poster presentations, and understanding professional ethics in the conduct of scientific research.

VBSC 5102*
Biochemical Toxicology
Prerequisite(s): Consent of instructor. In-depth overview of biochemical and molecular mechanisms of interactions between exogenous chemicals and living systems. Transport, distribution, elimination and alteration of exogenous chemicals within the body and mechanisms whereby exogenous chemicals disrupt biochemical processes critical for cell/organ/organismal integrity and function.

VBSC 5110*
Special Problems
1-6 credits, max 20. Prerequisite(s): Graduate standing and consent of instructor. Special research problems in the various fields of veterinary biomedical sciences.

VBSC 5120*
Current Topics in Veterinary and Biomedical Science
1 credit, max 4. Prerequisite(s): A minimum of one undergraduate introductory course in microbiology. Development of oral presentation skills, critical thinking and deductive reasoning through the use of discussion of current literature from the field of veterinary and biomedical science as it pertains to the study of infectious disease in humans and animals.

VBSC 5202*
Evaluation of Biomedical Research Data
Prerequisite(s): STAT 5013 or consent of instructor. Statistical analysis of biomedical data with emphasis on selection of appropriate biometrical procedures and interpretation of results rather than on computational aspects of procedures. Exploration of experimental design, data collection, and analysis within the context of biomedical investigation methodologies.

VBSC 5404*
Techniques in Parasitology
Lab 1. Prerequisite(s): Graduate standing and general parasitology; helminthology or concurrent enrollment. Experimental application of basic research and teaching techniques in helminthology and protozoology. Individual participation and analysis of experimental situations and techniques applicable to all areas of zoology.

VBSC 5554*
Bacterial Pathogenesis
Prerequisite(s): Undergraduate 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 evasion of host immunity. Lecture and discussion of directed reading of classic and current literature.

VBSC 5613*
Biology of Parasites
Prerequisite(s): Graduate standing, general parasitology, or consent of instructor. A systematic and ecologic approach to the study of parasitology. Host-parasite relationships, physiology, ecology and behavioral aspects of parasitic organisms.

VBSC 5723*
Parasitic Protozoa
Lab 3. Prerequisite(s): Graduate standing in zoology or entomology or consent of instructor. Structure, life cycle, physiology, host-parasite relationships, and diagnosis concerned with protozoan parasites.

VBSC 6000*
PhD Research and Thesis
1-15 credits, max 45. Prerequisite(s): Graduate standing. Research problem for meeting requirements of the PhD degree.

VBSC 6110*
Seminar
1-6 credits, max 6. Prerequisite(s): Graduate standing. Literature and research problems pertaining to veterinary biomedical sciences.

VBSC 6120*
Advanced Physiology of Selected Systems
3-15 credits, max 15. Prerequisite(s): Graduate standing or consent of instructor. Advanced studies in gastrointestinal, cardiovascular, respiratory, excretory and neuroendocrine physiology. Each part of this sequential course may be taken for two hours credit. Student should ascertain the topics before registering for this course a second time.

VBSC 6200*
Topics in Advanced Pharmacology and Toxicology
1-4 credits, max 4. Prerequisite(s): Consent of instructor. Selected topics in advanced pharmacology, including xenobiotic kinetics and dynamics.

VBSC 6201*
Xenobiotic Disposition
Prerequisite(s): Graduate standing and consent of instructor. Discussion of xenobiotic absorption, distribution, metabolism, and excretion. Analysis of xenobiotic concentration-time data using pharmacokinetic software.

VBSC 6203*
Advanced Concepts in Veterinary Immunology
Prerequisite(s): 5113 or BIOC 3653 or MICR 3254. Induction of immune responses, host defense mechanisms, immunoregulation, antigen presentation and immune recognition by B and T lymphocytes, using contemporary research publications.

VBSC 6213*
Advanced Toxicology
Prerequisite(s): Graduate standing, consent of instructor. An integrated systems-based approach to toxicology from molecular, cellular, organ, organismal, and ecological perspectives.

VBSC 6220*
Advanced Topics in Cell Biology
1-5 credits, max 12. Prerequisite(s): Consent of instructor. Selected topics in cell biology including membrane traffic, cell signaling, ion transport, cytoskeleton, cell cycle, cell junctions, and adhesion.

VBSC 6233*
Laboratory in Electron Microscopy
Lab 12. Prerequisite(s): Consent of instructor. Student learns to prepare specimens for, and to operate, the electron microscope, and techniques for printing and preparation of electron micrographs for publication.

VBSC 6550*
Problems in Functional Morphology
1-3 credits, max 3, Lab 3-9. Prerequisite(s): Consent of instructor. Investigations in compar-ative, gross, developmental or histologic morphology for graduate students.

VBSC 6560*
Advanced Pathology Techniques and Special Problems
1-6 credits, max 6. Prerequisite(s): Graduate standing in biological sciences and consent of instructor. Investigations of contemporary techniques and methods used in diagnosis, technical work and research in pathology.

VBSC 6650*
Current Topics in Bacterial Pathogenesis
1-10 credits, max 10. Prerequisite(s): VBSC 5552 or equivalent and consent of instructor. Selected mechanisms in bacterial pathogenesis and host response using recent literature, such as genetic organization of virulence; regulation of virulence factors; attachment, adhesion, and invasion; capsules and outer membrane proteins; intracellular parasitism; endotoxin; exotoxins; iron acquisition and host sequestration; antibiotic resistance mechanisms; innate immunity; acquired immunity; and evasion of host immunity on a rotating basis. Lecture and discussion of directed reading of current literature.

VBSC 6710*
Seminar in Veterinary Clinical Sciences
1-3 credits, max 3. Prerequisite(s): Graduate standing in the College of Veterinary Medicine, or internship or residency training program in the Department of Veterinary Clinical Sciences. Literature and research of problems pertaining to veterinary clinical sciences.

VBSC 6712*
Advances in Veterinary Medicine I
Prerequisite(s): Graduate standing in the College of Veterinary Medicine, or internship or residency training program in the Department of Veterinary Clinical Sciences. Special problems course emphasizing organ system physiology, selected diagnostic and therapeutic topics, and requiring a publication-quality paper on an approved subject.

VBSC 6722*
Advances in Veterinary Medicine II
Prerequisite(s): Graduate standing in the College of Veterinary Medicine, or internship or residency training program in the Department of Veterinary Clinical Sciences. Special problems course emphasizing organ system physiology, selected diagnostic and therapeutic topics, and requiring a publication-quality paper on an approved subject.

VBSC 6910*
Veterinary Pathology Slide Conference
1-2 credits, max 6. Prerequisite(s): Medical degree. Guided weekly exercises based on veterinary diagnostic microscopy.

VBSC 6920*
Diagnostic Pathology
1-4 credits, max 4, Lab 3-9. Prerequisite(s): Graduate standing in the College of Veterinary Medicine or written consent of department head. Weekly review of current cases submitted to the department and the methods employed in diagnosis. Examination of necropsy reports, specimens, and preparations. Students required to formulate diagnoses.

VBSC 6930*
Comparative Anesthesiology
1-3 credits, max 3. Prerequisite(s): Graduate standing in the College of Veterinary Medicine or consent of the head of the department. Anesthesiology of animals.

VBSC 6950*
Advanced Systemic Pathology
2-4 credits, MS max 6, PhD max 12. Prerequisite(s): VMED 5264, graduate standing, consent of instructor. Total credit not to exceed six for the MS degree and 12 for the PhD Re-enrollment permits the study of two to four different groups of organs and systems of the animal body. A consideration of the pathogenesis and the morphological, biochemical, and comparative aspects of lesions found in organs and tissues of the domesticated animals.

VBSC 6960*
Current Topics in Veterinary Clinical Pathology
1-3 credits, max 9. Prerequisite(s): DVM or equivalent, graduate standing and consent of instructor. Obtaining current knowledge and developing critical thinking and reasoning skills through seminars and discussions of current literature from the field of veterinary clinical pathology and general pathology.

VBSC 6963*
Advanced Clinical Pathology
Prerequisite(s): VMED 5362 or equivalent, graduate standing and consent of instructor. Applied clinical biochemistry, organ function tests and related cytologic examination.

VBSC 6973*
Advanced Hematology
Prerequisite(s): VMED 5362 or equivalent, graduate standing and consent of instructor. The etiology and pathogenesis of the diseases of the blood and bone marrow.

Veterinary Clinical Sciences (VCS)

VCS 6900*
Clinical Problems and Investigation
1-6 credits, max 6. Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Diseases of animals.

VCS 7003
Elective I
Lab 3. Prerequisite(s): 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.*

VCS 7013
Elective II
Lab 3. Prerequisite(s): 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.*

VCS 7023
Elective III
Lab 3. Prerequisite(s): 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.*

VCS 7033
Elective IV
Lab 3. Prerequisite(s): 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.*

VCS 7700
Preceptorship Clinic
1-8 credits, max 8. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Diagnosis, prognosis, prevention and treatment of diseases of animals presented in the preceptorship program. *Graded on a pass-fail basis.*

VCS 7703
Intensive Care Clinic
Lab 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Clinical rotation in small animal intensive care/critical and emergency medicine. *Letter graded.*

VCS 7710
Non-OSU Clinic
1-8 credits, max 8. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Approved clinical rotations off the OSU campus. *Graded on a pass-fail basis.*

VCS 7713
Radiology Clinic
Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Diagnostic radiography, ultrasound, and other special imaging modalities.

VCS 7720
Special Clinics
3 credits. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine or graduate veterinarian. Special assignments for introductory clinical studies in the following: selected species clinic; herd-health program; necropsy, clinic pathology and parasitology; diagnostic laboratory; and special aspects of the basic sciences. *Graded on a pass-fail basis.*

VCS 7723
Equine Medicine Clinic
Lab 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Diagnosis, prognosis, treatment and prevention of equine medical diseases.

VCS 7730
Anesthesiology Clinic
3 credits, max 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Management of clinical anesthesia in various domestic species.

VCS 7733
General Medicine and Surgery Clinic
Lab 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Receiving and managing emergency and general medical and surgical cases in companion animals.

VCS 7743
Small Animal Medicine Clinic
Lab 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Diagnosis, treatment and prevention of companion animal medical diseases.

VCS 7753
Small Animal Surgery Clinic
Lab 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Diagnosis, prognosis, treatment, and prevention of companion animal surgical diseases.

VCS 7763
Food Animal Medicine Clinic
Lab 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Diagnosis, prognosis, treatment and prevention of diseases of food animal medical and surgical diseases.

VCS 7770
Large Animal Theriogenology Elective
3-6 credits, max 6, Lab 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Management of breeding cattle and horses at the Center for Veterinary Health Sciences Ranch, including artificial insemination, treatment of infertility, periparturient management, and pediatrics.

VCS 7780
Zoological Medicine Clinical Elective
3 credits, max 6, Lab 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Health maintenance, diagnosis and treatment of medical or surgical conditions in zoo, exotic pet and wildlife species.

VCS 7790
Clinical Pathology and Parasitology Elective
3-6 credits, max 6, Lab 10. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Students will work with clinical pathology residents and laboratory personnel. Emphasis is placed on cytology,hematology, and parasitology. Each student will spend one week in each area. *Graded on a pass-fail basis.*

VCS 7793
Equine Surgery Clinic
Lab 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Diagnosis, prognosis, treatment, and prevention of equine surgical diseases.

VCS 7803
Clinic Pool
Lab 3. Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Semi-elective clinical assignment. *Graded on a pass-fail basis.*

VCS 7912
Clinical Conference
Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Presentation and discussion of selected clinical topics by fourth-year students, departmental faculty, and invited experts. *Letter graded.*

Veterinary Medicine (VMED)

VMED 7110*
Veterinary Physiology I
3-6 credits, max 6, Lab 15. Prerequisite(s): 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.

VMED 7120*
Veterinary Physiology II
3-6 credits, max 6, Lab 15. Prerequisite(s): 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.

VMED 7123*
Veterinary Histology
Lab 45. Prerequisite(s): First-year standing in the College of Veterinary Medicine or consent of instructor. Organization and structure of cells and tissues of domestic animals.

VMED 7144*
Gross and Developmental Anatomy
Prerequisite(s): First-year standing in the College of Veterinary Medicine or consent of instructor. Embryology and anatomy of domestic mammals using the dog as the primary model. Integrated lecture-dissection-laboratory format. The integration of developmental gross, radiographic and applied aspects of veterinary anatomy as they relate to a topographical appreciation of the living individual. An overview of domestic bird and laboratory animal anatomy.

VMED 7152
Zootechnology
Prerequisite(s): First-year admission to College of Veterinary Medicine fall semester. Animal breeds and identification, animal production and marketing systems and animal handling and restraint as it applies to production and marketing.

VMED 7162
Jurisprudence and Ethics
Prerequisite(s): First-year standing in College of Veterinary Medicine. Introduction to veterinary jurisprudence, ethics, licensing, government regulations, human-animal bond, and evolving issues in animal law and animal welfare.

VMED 7223*
Veterinary Parasitology I
Lab 2. Prerequisite(s): First-year standing in the College of Veterinary Medicine or consent of instructor. Introduction to the general principles of parasitism and parasites of veterinary medical importance including taxonomy morphology, biology of parasites, modes of transmission, host-parasite relationships, infectious processes and pathogenicity, diagnostic methods, treatment and control measures and public health importance.

VMED 7230*
Veterinary Physiology III
3-6 credits, max 6. Prerequisite(s): 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.

VMED 7243*
Comparative Anatomy
Prerequisite(s): First year standing in the College of Veterinary Medicine or consent of instructor. Comparative and functional gross anatomy and developmental anatomy of domestic mammals. The integration of developmental, gross, radiographic, and applied clinical aspects of veterinary anatomy as they relate to a topographical appreciation of the living individual. Integrated lecture-dissection-laboratory format.

VMED 7250*
Veterinary Immunology
3-4 credits, max 4, Lab 2. Prerequisite(s): First-year standing in College of Veterinary Medicine or consent of instructor. Basic principles of immunology and their application to veterinary medicine. Variable credits hours distributed among Veterinary Immunology, Infectious Diseases I and II not to exceed a total of 11 credit hours.

VMED 7264
General Pathology
Prerequisite(s): First-year standing in the College of Veterinary Medicine or consent of instructor. Cellular and tissue pathology, pigments, inflammation, immunopathology, disturbances of growth and circulation, and neoplasia. Functional disturbances that accompany changes in structures as well as the causes and pathogenesis of diseases.

VMED 7311
Introduction to Clinics I
Lab 3. Prerequisite(s): Second-year standing in College of Veterinary Medicine. Rotations through instructional and service areas including the Veterinary Teaching Hospital of the College of Veterinary Medicine or consent of instructor. Clinical orientation including rotations in instruction and service units in the College. *Graded on a pass-fail basis.*

VMED 7323*
Veterinary Parasitology II
Lab 2. Prerequisite(s): Second-year standing in the College of Veterinary Medicine or consent of instructor. Principles of diagnostic, treatment, control and prevention of animal diseases produced by arthropod, protozoan, rickettsial, and helminth parasites. A problem-based approach to parasitic diseases affecting the integumentary, respiratory, hemic-lymphatic, reproductive, urinary, nervous/sensory, musculoskeletal, and alimentary systems with emphasis on diseases of domestic animals.

VMED 7333*
Pharmacology I
Prerequisite(s): Second-year standing in the College of Veterinary Medicine or consent of instructor. Introduction of the principles of pharmacodynamics, drug disposition and pharmacokinetics. pharmacological effects, mechanisms of actions, metabolism, disposition, clinical indications and toxic effects of drugs acting on the autonomic, central nervous, cardiovascular, respiratory, and renal systems.

VMED 7342*
Clinical Anatomy
Lab 6. Prerequisite(s): Second-year standing in the College of Veterinary Medicine. Aspects of gross anatomy as they relate to clinical applications.

VMED 7350*
Infectious Diseases I
3-4 credits, max 4, Lab 2. Prerequisite(s): Second-year standing in College of Veterinary Medicine or consent of instructor. Important animal diseases caused by bacteria, fungi and viruses covered on a systems basis. Mechanisms of infectious disease processes and the relationship of such processes to disease development, diagnosis, treatment and control. The relationship of zoonotic diseases to community and environmental health as well as important zoonoses. Variable credit hours distributed among Veterinary Immunology, Infectious Diseases I and II not to exceed a total of 11 credit hours.

VMED 7363*
Clinical Pathology
Lab 30. Prerequisite(s): Second-year standing in the College of Veterinary Medicine or graduate standing with consent of instructor. Basic concepts pertinent to data interpretation and laboratory methods used in evaluation of disease.

VMED 7412*
Anesthesiology
Lab 6. Prerequisite(s): second-year standing in the College of Veterinary Medicine. Application of the principles of veterinary anesthesiology to incorporate fundamental aspects of physiology and pharmacology in the anesthetic management of important domestic species.

VMED 7413*
Epidemiology, Food Safety and Public Health
Prerequisite(s): Second-year standing in the College of Veterinary Medicine or consent of instructor. Principles and uses of epidemiology in veterinary medicine. Introduction to public health and diseases transmissible to humans. Potential human health hazards in foods of animal origin and principles of safe food production, processing, handling, and inspection, including pathogen reduction, HACCP regulations, and pre-harvest food safety.

VMED 7432*
Pharmacology II
Prerequisite(s): Second-year standing in the College of Veterinary Medicine or consent of instructor. Continuation of 7333 that includes the mechanisms of action, disposition, adverse effects, and indications for groups of pharmacological agents used in veterinary medicine.

VMED 7443*
Diagnostic Imaging
Lab 13. Prerequisite(s): Second-year standing in the College of Veterinary Medicine. Radiographic theory, techniques, and interpretation. Introduction to alternate methods, including ultrasonography.

VMED 7450*
Infectious Diseases II
3-4 credits, max 4, Lab 2. Prerequisite(s): Second year standing in the College of Veterinary Medicine. Continuation of Infectious Diseases I (VMED 7350). Variable credit hours distributed among Veterinary Immunology, Infectious Diseases I and II not to exceed a total of 11 credit hours.

VMED 7482*
Hemolymphatic and Oncology
Prerequisite(s): Second-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, pathology, medical and surgical treatment, and prevention of diseases related primarily to the blood and lymphatic system (six-week module).

VMED 7501*
Ophthalmology
Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, medical and surgical treatment, and prevention of ophthalmic disease in small animal and equine patients.

VMED 7510*
Research Elective
1-4 credits, max 8, Lab 30-90. Prerequisite(s): Second-or-third-year standing in the College of Veterinary Medicine. Participation in faculty-directed projects to enhance career development in veterinary biomedical research. Students participate in a process mimicking investigator-initiated research by developing a research proposal, participating in a competitive peer-review process, and reporting on completed research project. *Letter grade to be assigned.*

VMED 7512*
Laboratory Animal Medicine
Introductory course focusing on the biology and major diseases of commonly used laboratory animals.

VMED 7521*
Veterinary Practice Management
Prerequisite(s): Second-or third-year standing in College of Veterinary Medicine. Skills and background for success as an employee in private veterinary practice. Successful practice is defined in terms of the perceived value received in the delivery of veterinary medical services, doctor-client communication skills, and aesthetic quality of the environment in which services are delivered. Business management of private practice, personal finances, and personnel management.

VMED 7522*
Signs and Symptoms of the Small Animal Medical Diagnosis
Prerequisite(s): Second-or-third-year standing in the College of Veterinary Medicine. Introduction to clinical problem solving through application of a problem-oriented approach to clinical diagnosis. Discussion of major problems (clinical signs and symptoms) affecting animals, and the pathophysiology of each clinical sign, its differential diagnosis and symptomatic management. Review of key anatomical, pathological and immunological concepts learned in basic science courses.

VMED 7523*
Surgery
Lab 48. Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Introduction to fundamental principles of surgery. Didactic material followed by surgical laboratories.

VMED 7531*
Avian Biology for Veterinarians
Prerequisite(s): Second- or third-year standing in the College of Veterinary Medicine. Topics in avian biology of value to veterinary students who will be treating birds in their practice or those planning to be active in raptor rehabilitation. Feather anatomy and molt; bill and claw anatomy; characteristics of the avian skeleton; weight saving adaptations; recondition atrophied flight muscles in raptors; anatomy of the digestive system; how birds breathe; avian aerodynamics; taste and olfaction in birds; reproductive biology; raptor natural history; identification, rehabilitation.

VMED 7532*
Molecular Genetics
Prerequisite(s): Second-or third-year or higher in good standing in the College of Veterinary Medicine. The expression, purification, characterization, and application of biological macromolecules in therapeutics and diagnostics relevant to animal health.

VMED 7533*
Toxicology
Lab 3. Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Diagnosis and management of intoxications involving plant, chemical and biological toxins.

VMED 7542*
Clinical Endocrinology I
Prerequisite(s): Second or third-year standing in the College of Veterinary Medicine. Advanced medical endocrinology addressing diagnostic endocrinology and therapeutic endocrinology. Diagnostic endocrinology shall examine the physiological and medical basis for selecting provocative or non-provocative testing procedures as an adjunct to completing a definitive diagnosis. Therapeutic endocrinology involves the use of diagnostic endocrinology to evaluate the efficacy of medical treatment of endocrinopathies and the medical use of hormonal preparations to control animal physiology or endocrinology and non-endocrine diseases.

VMED 7562*
Avian and Exotic Pet Medicine
Prerequisite(s): 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.

VMED 7563*
Musculoskeletal System
Lab 9. Prerequisite(s): 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.

VMED 7564*
Alimentary System
Lab 12. Prerequisite(s): 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.

VMED 7571*
Introduction to Behavioral Medicine
Prerequisite(s): Second-or third-year standing in College of Veterinary Medicine. Introduction to behavioral veterinary medicine. Normal behavior of the dog and cat, basic procedures and methods for diagnosing and treating behavioral problems.

VMED 7583*
Dermatology and Endocrinology
Prerequisite(s): 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).

VMED 7610*
Basic Science Elective
1-8 credits, max 8. Prerequisite(s): Second-or-third-year standing in the College of Veterinary Medicine. Problems in the basic sciences taught as lecture or lab.

VMED 7611*
Applied Pharmacology
Lab 7. Prerequisite(s): Second-or third-year standing in College of Veterinary Medicine. Criteria applicable to the rational selection of pharmacological agents used in the therapy of animal diseases, adverse reactions and interactions that may complicate therapy, and issues relevant to the ethical use of drugs and avoicance of residues in food products.

VMED 7612*
Clinical Neurology
Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Pathogenesis, diagnosis, pathology, medical and surgical treatment and prevention of nervous system diseases.

VMED 7614*
Cardiopulmonary System
Lab 24. Prerequisite(s): 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.

VMED 7620*
Clinical Science Elective
1-8 credits, max 8. Prerequisite(s): Second-or-third-year standing in the College of Veterinary Medicine. Problems in the clinical sciences taught as lecture or lab.

VMED 7621*
Zoonotic Diseases
Prerequisite(s): Second or third year standing in the College of Veterinary Medicine or consent of instructor. Overview of zoonotic aspects of infectious diseases, including the transmission to man, incidence and prevalence, prevention and control strategies, assessment of risk, and governmental and regulatory aspects of these public health threats. Diseases of all veterinary species will be balanced according to various aspects of importance, east of transmission, incidence, and other current concepts.

VMED 7622*
Problem Solving in Internal Medicine
Prerequisite(s): Second-or-third-year standing in the College of Veterinary Medicine. Clinic cases that provide a review of basic pathophysiology.

VMED 7631*
History of Veterinary Medicine
Prerequisite(s): Second-or third-year standing in the College of Veterinary Medicine. History of the veterinary medical profession, especially in North America.

VMED 7632*
Exercise Physiology
Prerequisite(s): 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.

VMED 7651*
Equine Theriogeneology Laboratory
Lab 3. Prerequisite(s): Third year standing in the College of Veterinary Medicine. Introduction to palpation, ultrasonographic examination and breeding preparation of the mare reproductive tract.

VMED 7652*
Introduction to Clinics II
Lab 2. Prerequisite(s): 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.*

VMED 7661*
Infectious and Parasitic Diseases of Wild Animals
Lab 11. Prerequisite(s): Second-or-third-year standing in the College of Veterinary Medicine. Systematic approach to infectious and parasitic diseases affecting wild animals. Capture, restraint, and disease recognition in wild species, population management implications of disease diagnosis.

VMED 7662*
Urinary System
Prerequisite(s): 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).

VMED 7671*
Clinical Endocrinology II
Prerequisite(s): Second or third year standing in the College of Veterinary Medicine. Advanced medical endocrinology, focusing on endocrine diseases associated with (1) dysfunction of the endocrine pancreas, (2) selected endocrineopathies of the reproductive system, and (3) therapeutic use of hormones to control reproductive activity of animals.

VMED 7672*
Swine Production and Diseases
Prerequisite(s): Second or third-year standing in the College of Veterinary Medicine. Problem-based course related to swine diseases and production systems.

VMED 7674*
Theriogenology
Lab 2. Prerequisite(s): 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.

VMED 7681*
Advanced Neurology
Prerequisite(s): Second or third year standing in the College of Veterinary Medicine. Case based, problem oriented clinical diagnosis, management, treatment and prevention of small animal neurological diseases.

VMED 7682*
Small Ruminant Production, Management, Medicine and Surgery
Prerequisite(s): 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.

VMED 7691*
A Focus on Zoonotic Diseases
Prerequisite(s): Second or third year standing in the College of Veterinary Medicine or consent of instructor. Overview of zoonotic aspects of infectious diseases, including the transmission to man, incidence and prevalence, prevention and control strategies, assessment of risk, and governmental and regulatory aspects of these public health threats. Diseases of all veterinary species will be balanced according to various aspects of importance, ease of transmission, incidence, and other current concepts.

VMED 7701*
Small Animal Diagnostic Ultrasound
Lab 10. Prerequisite(s): 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 function, and common diseases that can be diagnosed sonographically in small animals.

VMED 7702*
Whales and Dolphins
Prerequisite(s): Second- or third-year standing in the College of Veterinary Medicine. Review of functional morphology of whales, dolphins and porpoises. Families and species, evolution, skeleton, feeding, diving, reproduction, echoimaging, brain and special senses, thermoregulation, life histories, veterinary perspectives and human impact. Functional and comparative structural adaptations of cetaceans to the marine environment. Discussion of comparisons with terrestrial mammals.

VMED 7711*
Problem and Case Based Learning in Advanced Ophthalmology
Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Case-based, problem-oriented discussions of small animal and equine ophthalmology cases. Key points in the case history, the significance of signalment in the diagnosis, clinical diagnosis, supportive diagnostic tests, and treatment. General discussion of the specific disease following the case discussion.

VMED 7731*
Advanced Small Animal Medicine I: Problem-based Learning
Lab 3. Prerequisite(s): 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.

VMED 7732*
Advanced Medical and Surgical Oncology
Lab 7. Prerequisite(s): 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.

VMED 7741*
Bovine Theriogenology Laboratory
Lab 27. Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Palpation techniques in cows. An elective restricted to students entering food animal practice.

VMED 7751*
Poultry Medicine and Diseases
Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Poultry medicine and common diseases of poultry. Disease diagnosis based in clinical signs and lesions. Disease prevention and treatment. Application of diagnostic techniques through problem oriented case studies.

VMED 7752*
Applied Bovine Nutrition
Lab 14. Prerequisite(s): 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.

VMED 7771*
Advanced Equine Medicine I
Lab 3. Prerequisite(s): 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.

VMED 7781
Professional Veterinary Medicine
Prerequisite(s): Third year standing in the College of Veterinary Medicine. A capstone course preparing third-year veterinary students for clinical training. Topics include: non-technical skills, knowledge, aptitudes, and attitudes; veterinary career opportunities in public practice, and preparation for the North American Veterinary Licensing Examination (NAVLE).

VMED 7801*
Business Management for Veterinary Practice
Prerequisite(s): Third-year standing in the College of Veterinary Medicine. VMED 7521 recommended. Business and financial management of private veterinary practice.

VMED 7811*
Advanced Equine Medicine II
Lab 3. Prerequisite(s): 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.

VMED 7821*
Equine Radiology
Lab 12. Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Diagnostic imaging (radiology, nuclear scintigraphy and ultrasound) of horses.

VMED 7822*
Food Animal Production Medicine
Prerequisite(s): 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.

VMED 7831*
Advanced Small Animal Medicine II: Problem-based Learning
Prerequisite(s): 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 weekly at a time determined by the individual groups.

VMED 7841*
Food Animal Surgery
Lab 9. Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Detailed examination and review of commonly utilized local anesthetic techniques, injectable anesthetic techniques, and surgical procedures in food animal practice. Major topics include digital, mammary, gastrointestinal, and urethral surgery as well as cesarean section.

VMED 7842*
Special Surgical Problems and Techniques, Advanced Wound Management and Introduction to Reconstructive Surgery
Lab 9. Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Principles of wound management and reconstructive surgery. Lecture and laboratory format.

VMED 7851*
Advanced Small Animal Neurology
Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Elective course with in-depth discussion of diseases affecting the neuromuscular system of dogs and cats. For students intending to enter predominately small animal practice or small animal internships. Lecture and case discussion formats.

VMED 7861*
Cytology
Lab 10. Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Case discussion and diagnosis by cytologic methods. Cases predominately small animals.

VMED 7871*
Advanced Equine Reproduction
Lab 3. Prerequisite(s): Third-year student in the veterinary medicine curriculum. The practical application of recent research in the breeding management, estrous cycle manipulation, and reproductive disease diagnosis and treatment of the mare. The stallion will be studied with respect to semen quality, endocrine-associated infertility, and breeding accidents and injuries.

VMED 7872*
Special Surgical Problems and Techniques, Advanced Small Animal Orthopedics and Neurosurgery
Lab 12. Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Diagnosis and surgical management of small animal orthopedic and neurological diseases. Lecture and laboratory format.

VMED 7891*
Equine Surgical Laboratory
Lab 12. Prerequisite(s): Third-year standing in the College of Veterinary Medicine. Surgical techniques directly supervised by the instructor. Fundamental enclosed surgical techniques. Abdominal procedures on live animals. Orthopedic procedures on cadavoric limbs.

VMED 7933
Diagnostics
Prerequisite(s): Fourth-year standing in the College of Veterinary Medicine. Participation in animal necropsy, clinical pathology, and other investigative methods to study diagnosis, prognosis, prevention, and treatment of diseases. *Graded on a pass-fail basis.*

Women's Studies (WMST)

WMST 2113
(S)Introduction to Women's Studies in the Social Sciences
Introduction to research on women and gender in a variety of social science fields. Interpersonal relationships, socioeconomic status, power and authority as women experience them, myths and realities of differences between women and men, and among women of different races, classes, ethnicities, sexual orientation, ages, and physical abilities.

WMST 2123
(H)Introduction to Women's Studies in the Arts and Humanities
Introduction to critical thinking about the construction of gender and the intersections of gender with race, ethnicity, class, and sexuality. Basic methods of humanistic inquiry in general and humanistic women's studies in particular.

WMST 3450
Topics in Women's Studies
1-3 credits, max 12. Prerequisite(s): 2113 or 2123 or permission of instructor. Suggested topics include: women and health, women and science, women and religion.

WMST 3513
Gender and Sexuality
Prerequisite(s): 2113 or 2123 recommended. An introduction to how people think about and enact genders and sexualities from an interdisciplinary perspective.

WMST 3713
Gender and Representation
Cultural analysis of gender representation and gender relations. Using cultural texts and practices in several areas such as children's culture, sport, music, film and TV.

WMST 3823
Intersections to Gender, Race and Class
Prerequisite(s): 2113 or 2123 recommended. Interdisciplinary, cross-cultural survey of the ways in which gender interacts with race, age, class and sexuality to shape human consciousness, culture and society.

WMST 4013*
Approaches to Feminist Research
Prerequisite(s): 2113 or 2123 or consent of instructor. Examines the ethics and epistemologies of methodologies and theoretical frameworks most conducive to feminist analysis. This course prepares students to conceptualize their own research projects.

WMST 4113*
Feminist Theories
Examines the different types of feminist theories and the role theory plays in the production of knowledge. A variety of feminist theories will be considered from an interdisciplinary perspective.

WMST 4950*
Special Topics in Global Feminism
1-3 credits, max 6. Prerequisite(s): 2113 or 2123 or permission of instuctor. Selected topics in the problems and issues of global women's and feminist activism. Highlights the continuing fight to secure gender equality, especially in developing nations. Exploration of the women's movement links with other human rights struggles across the globe.

WMST 4990*
Directed Readings in Women's Studies
1-3 credits, max 12. Prerequisite(s): Permission of instructor. Examines women's studies issues and topics.

Zoology (ZOOL)

ZOOL 1604
(N)Animal Biology
Lab 2. Prerequisite(s): 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.

ZOOL 2104
Human Anatomy
Lab 3. Prerequisite(s): 1604, 3204. 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.

ZOOL 3104*
Invertebrate Zoology
Lab 4. Prerequisite(s): 1604. Morphology, physiology, reproduction and ecology of major invertebrate groups.

ZOOL 3113
(N)Human Evolution
An evolutionary perspective on human biology.

ZOOL 3114*
Vertebrate Morphology
Lab 3. Prerequisite(s): 1604. Comparative morphology of representative vertebrates with emphasis on phylogeny and ontogeny and consideration of histology and function.

ZOOL 3123
(N)Human Heredity
The impact of genetics on human endeavor. *No credit for students with prior credit in BIOL 3023.*

ZOOL 3143
(N)Oceanography
Prerequisite(s): CHEM 1225. Ocean basins, geology, chemistry, biology, waves, tides, ocean exploration, ocean communities, and resources.

ZOOL 3153
Animal Behavior
Prerequisite(s): 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.

ZOOL 3204
Physiology
Lab 2. Prerequisite(s): 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.*

ZOOL 3513
Principles of Conservation Biology
Application of ecological principles to the maintenance and restoration of biological diversity at genetic, population, and community levels.
(Same course as NREM 3513)

ZOOL 3700
Readings and Special Studies in Zoology
1-3 credits, max 6. Prerequisite(s): ZOOL 1604 and consent of instructor. Discussion of selected readings.

ZOOL 4103*
General Parasitology
Lab 2. Prerequisite(s): ZOOL 1604; ZOOL 3104 recommended. Fundamentals of parasitism with emphasis on: life cycles, disease conditions, epidemiology, diagnosis, treatment, historical significance, terminology, taxonomy, and parasitological techniques.

ZOOL 4113
Conservation Genetics
Prerequisite(s): BIOL 3023 or equivalent, MATH 1513. 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, and META populations. *No credit for students with credit in 5113.* ***(Same course as 5113*)***

ZOOL 4115*
Biology of Fishes, Amphibians and Reptiles
Lab 5. Prerequisite(s): ZOOL 1604. Systematics, evolution, and natural history of fishes, amphibians and reptiles; laboratory emphasis on Oklahoma species. Offered spring semester of even-numbered years. *Weekend field trips required.*

ZOOL 4133*
Evolution
Prerequisite(s): BIOL 3023. Development of the evolutionary concept; speciation evolutionary mechanisms and phylogenetic concepts.

ZOOL 4134*
Embryology
Lab 2. Prerequisite(s): 3114, MICR 3033. Biochemical basis of development with emphasis on gene regulation. Comparative development of sea urchin, frog, chick and pig. Experiments using frog and mouse, including the molecular level.

ZOOL 4174*
Mammalogy
Lab 3. Prerequisite(s): 1604. Taxonomy, identification, evolution, zoogeography, life history traits, and techniques of study of wild mammals. *Weekend field trips required.*

ZOOL 4215*
Mammalian Physiology
Prerequisite(s): ZOOL 1604; CHEM 3015 or CHEM 3053. Descriptive and functional analysis of the mammalian nervous, cardiovascular, musculoskeletal, respiratory, renal, endocrine, and digestive organ systems. *For majors in biological, agricultural, or human environmental (including premedical, predental and preveterinary) sciences.*

ZOOL 4222*
Mammalian Physiology Laboratory
Lab 6. Prerequisite(s): 4215. Laboratory experiments that illustrate function of organs, organ systems or mechanisms of whole body physiological control. *For students majoring in basic biological sciences.*

ZOOL 4231*
Seminar in Physiology
Prerequisite(s): 3204 or 4215. Oral and written communication in the physiological sciences; critical review of physiological literature.

ZOOL 4273
Environmental Physiology
Prerequisite(s): 3204 or 4215. Environmental, comparative 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. *No credit for students with credit in 5273.*
(Same course as 5273*)

ZOOL 4283
Endocrinology
Prerequisite(s): 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. *No credit for students with credit in 5283.* ***(Same course as 5283*)***

ZOOL 4293
Behavioral Neuroendocrinology
Prerequisite(s): 3204 or 4215. Examination of the influences of nervous and endocrine systems on behavior, and vice-versa, in vertebrates, including humans. Historical roots and current techniques relating to topics, including male and female reproductive behavior patterns, sex differences in behavior and neuroendocrine causation. No credit for students with credit in ZOOL 5293. ***(Same course as 5293*)***

ZOOL 4303
Ecotoxicology
Prerequisite(s): BIOL 1114 or equivalent; CHEM 1215 or 1314; junior standing. Comparative study of the major groups of environmental contaminants (e.g. heavy metals, PCB's, insecticides) and an introduction to the basic theories, principles and techniques associated with the study of contaminant fate and effects in the environment. ***(Same course as 5303*)***

ZOOL 4434*
Limnology
Lab 3. Prerequisite(s): BIOL 3034. Physical, chemical, and biological factors in lakes and streams.

ZOOL 4464*
Ornithology
Lab 3. Prerequisite(s): 1604. Classification, evolution, distribution, identification, life histories, and morphological, ecological, and behavioral adaptations of birds. *Two weekend field trips required.*
(Same course as NREM 4464)

ZOOL 4483
Aquatic Entomology
Prerequisite(s): ENTO 2993 or ZOOL 1604. Biology, taxonomy and ecology of insects and other invertebrates inhabiting freshwater environments. Emphasis is placed on identification and biology of individual taxa. Roles of insects in aquatic ecology, as a forage base, and as indicators of biotic integrity of aquatic systems. Linkages between aquatic systems and terrestrial systems are also examined. No credit for students with credit in 5483 or ENTO 5483. ***(Same course as ENTO 4483)***

ZOOL 4503
Genetics Laboratory Investigations
Lab 6. Prerequisite(s): Completion of BIOL 3023 with a minimum grade of "C" or consent of instructor. Laboratory course to complement BIOL 3023 General Genetics. Experiments on Mendelian, microbial, Drosophila, molecular and population genetics. Techniques including, Drosophila manipulations, DNA isolation, electrophoresis, PRC, DNA sequencing and analyses, cloning and biotechnology.

ZOOL 4533*
Zoo Biology and Management
Prerequisite(s): Four 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.

ZOOL 4700
Undergraduate Research Problems
1-4 credits, max 4. Prerequisite(s): Consent of instructor. Participation in faculty research or execution of a problem formulated by the student.

ZOOL 4710
Internships in Zoology
1-3 credits, max 3. Prerequisite(s): 2.50 GPA and consent of department head. Zoology related experiences in professional work settings. *Graded on a pass-fail basis.*

ZOOL 4720
Zoo Careers Internship
1-3 credits, max 3. Prerequisite(s): 4533. Hands-on career experience working under the direction of zoo professionals.

ZOOL 4750
Honors Study in Zoology
1-5 credits, max 5. Prerequisite(s): 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.

ZOOL 5000*
Research for Master's Thesis
1-6 credits, max 6. Independent research for the MS thesis under the supervision of graduate faculty member.

ZOOL 5010*
Graduate Seminar
1-3 credits, max 10. Discussion of selected topics.

ZOOL 5020*
Special Problems
1-4 credits, max 10. Prerequisite(s): Graduate standing and consent of instructor. A report of results obtained is to be placed in department files.

ZOOL 5030*
Teaching Zoology
1-4 credits, max 4. Prerequisite(s): Consent of instructor. Supervised teaching in the department laboratories. Attendance at seminar on problems involved in teaching zoology in college.

ZOOL 5112*
Advanced Herpetology
Selected advanced aspects of evolution, systematics, biogeography, natural history, physiology, husbandry, nutrition, ecology, behavior, and population biology of reptiles and amphibians as drawn from the primary literature.

ZOOL 5113*
Conservation Genetics
Prerequisite(s): 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.*
(Same course as 4113)

ZOOL 5123
Behavioral Ecology
Prerequisite(s): 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.

ZOOL 5133*
Evolutionary Ecology
Lab 2. Prerequisite(s): Course in ecology strongly recommended. Ecological concepts dealing with contemporary evolutionary processes, not phylogeny. Life history traits, 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.

ZOOL 5173*
Systematic Mammalogy
Lab 1. Basic principles of systematics as they apply to advanced aspects of mammalian biology including evolution, bigeography, ecology; spring-break field trip required to meet laboratory requirement.

ZOOL 5273*
Environmental Physiology
Prerequisite(s): 3204 or 4215 or equivalent. Environmental, comparative 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. *No credit for students with credit in 4273.*
(Same course as 4273)

ZOOL 5283*
Endocrinology
Prerequisite(s): 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. *No credit for students with credit in 4283.* ***(Same course as 4283)***

ZOOL 5293*
Behavioral Neuroendocrinology
Prerequisite(s): 3204 or 4215. Examination of the influences of nervous and endocrine systems on behavior and vice-versa, in vertebrates including humans. Historical roots and current techniques relating to topics, including male and female reproductive behavior patterns, sex differences in behavior and neuroendocrine causation. *No credit for students with credit in 4293.* ***(Same course as 4293)***

ZOOL 5303*
Ecotoxicology
Comparative study of the major groups of environmental contaminants (e.g. heavy metals, PCB's, insecticides) and an introduction to the basic theories, principles and techniques associated with the study of contaminant fate and effects in the environment. ***(Same course as 4303)***

ZOOL 5424*
Techniques in Environmental Toxicology
Lab 4. Practical understanding of modern techniques used to quantify exposure and effects of environmental toxicants. Laboratories include gas chromatography, HPLC, atomic absorption spectroscopy, protein/nucleic acid isolation, immunoassay, gentic toxicology, and immunotoxicology.

ZOOL 5483*
Aquatic Entomology
Prerequisite(s): ENTO 2993 or ZOOL 1604. Biology, taxonomy and ecology of insects and other invertebrates inhabiting freshwater environments. Emphasis is placed on identification and biology of individual taxa. Roles of insects in aquatic ecology, as a forage base, and as indicators of biotic integrity of aquatic systems. Linkages between aquatic systems and terrestrial systems are also examined. No credit for students with credit in 4483 or ENTO 4483. ***(Same course as ENTO 5483)***

ZOOL 5523*
Population Ecology
Lab 2.5. Prerequisite(s): 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. ***(Same course as NREM 5523)***

ZOOL 6000*
Research for PhD Dissertation
1-15 credits, max 30. Independent research for the PhD dissertation under the supervision of a graduate faculty member.