

**ENTOX (BIOSC) 854 Aquatic Toxicology 3(3,0)**

Combines concepts of solution chemistry with toxicology to establish stressor-response relationships for aquatic organisms at various trophic levels. Bioavailability is a unifying concept, and concepts of contaminant exposure and organism response are set in an ecological risk assessment framework.

**ENTOX 855 Sediment Toxicology and Chemistry 3(3,0)**

Focuses on the chemistry and toxicology of contaminants in freshwater sediments. Sediment geochemistry, ecology, toxicity bioassay methodology, and sediment sampling are discussed in a course framework that deals directly with contaminant bioavailability questions. *Preq:* ENTOX 854 or consent of instructor.

**ENTOX 860 Graduate Seminar 1(1,0)**

Recent research in environmental toxicology; presentation, review, and discussion of current issues by graduate students in an area of specialization selected by the instructor. May be repeated four times for credit. To be taken Pass/Fail only.

**ENTOX 861 Departmental Seminar 1(1,0)**

Presents current research by Department of Environmental Toxicology faculty, staff, finishing graduate students, and invited speakers. Improves students' skills in evaluation of research plans and oral presentations and increases their awareness of literature resources and employment opportunities in the field. May be repeated four times for credit.

**ENTOX 863 Selected Topics 1-4(0-4,0-6)**

Topics in environmental toxicology not covered in other courses. Topics vary with current developments in the discipline. May be repeated, but only if different topics are covered. *Preq:* Consent of instructor.

**ENTOX 891 Master's Thesis Research 1-12****ENTOX 991 Doctoral Dissertation Research 1-12****EXECUTIVE LEADERSHIP AND ENTREPRENEURSHIP****E L E 600 Technology Entrepreneurship 3(3,0)**

Introduction to technology entrepreneurship with emphasis on ideation, opportunity assessment, market and technology forecasting, intellectual property protection, financial modeling and business valuation, project management, and cross-functional team building. Open to science and engineering majors only. *Preq:* Junior standing.

**E L E 800 Special Topics in Technology Entrepreneurship 1-6(1-6,0)**

Comprehensive study of a topic of current interest in technology entrepreneurship. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* E L E 400.

**EXPERIMENTAL STATISTICS****EX ST 611 Statistical Methods for Process**

**Development and Control 3(3,0)** Experimental design techniques for use in process development, application of screening experiments and response surface experiments, techniques for process control with implications for product quality control. Includes discussions of the use of statistical computer analyses and interpretations including computer-generated graphics. *Preq:* MTHSC 206 or consent of instructor.

**EX ST 801 Statistical Methods I 4(3,3)**

Role and application of statistics in research; estimation, test of significance, analysis of variance, multiple comparison techniques, basic designs, mean square expectations, variance components analysis, simple and multiple linear regression, and correlation, and nonparametric procedures. *Preq:* Consent of instructor.

**EX ST 802 Statistical Methods II 3(3,0)**

Extended coverage of several methods introduced in EX ST 801: multiple regression model building and diagnostics, experiment design and analysis, and nonparametric methods; mixed models and repeated measures analyses; categorical data analysis; multivariate methods and sampling designs; appropriate use of statistical software. *Preq:* EX ST 801.

**EX ST 803 Regression and Least Squares**

**Analysis 3(3,0)** Regression analysis: simple and multiple linear, curvilinear and multiple curvilinear; curve fitting; least squares and computer techniques for fitting of constants and analysis of planned experiments. Offered spring semester only. *Preq:* EX ST 801.

**EX ST 804 Sampling 3(3,0)**

Principles of scientific sampling; finite population sampling; simple random, stratified, multistage, and systematic sampling; optimum allocation; methods of obtaining, processing, and reporting survey information; sampling as related to the environment, natural resources, and social and economic problems. *Preq:* EX ST 801.

**EX ST 805 Design and Analysis of Experiments**

**3(3,0)** Basic designs and analysis; data transformations; single degree of freedom, orthogonality and responses in ANOVA; covariance; response surfaces; incomplete blocks; introduction to least squares analysis of experiments; uses of standard computer programs for selected analyses. *Preq:* EX ST 801.

**EX ST 811 Special Problems in Experimental**

**Statistics 1-3(0,2-6)** Statistical aspects of an individualized research problem; determining an appropriate experimental design; performing proper analyses and generating effective reports.

**EX ST 812 Selected Topics 1-3(1-3,0)**

Topics in applied statistics not covered in other courses. May be repeated, but only if different topics are covered.

**FAMILY AND COMMUNITY STUDIES****FCS 810 Life in the Global Community 3(3,0)**

Examines global perspectives and trends related to social, psychological, and physical well being of children, youth, adults, families, primary institutions of society, and civil society. Considers accommodation and resistance to globalization as well as analysis and comparative review of the effects of globalization on everyday life in selected countries.

**FCS 811 Human Development and Family Life**

**in Cultural Context 3(3,0)** Examines cultural context in human development and family life; the impacts of culture on physical, cognitive, and social development; the influences of different environmental experiences on individual and family functioning; practical applications of a cross-cultural human and family development perspective; and the state of human development around the world. *Preq:* FCS 810.

**FCS 812 Democracy and the Growth of Civil**

**Society 3(3,0)** Study of democracy as a political system and a way of life. Examines the nature of civil society and its relation to the development and sustainability of democratic values and institutions and the cultural, economic, and political correlates of civic participation at various points in the lifespan. *Preq:* FCS 810 or consent of instructor.

**FCS 820 International Human Rights Law 3(3,0)**

Examines international human rights law, the origins of international human rights, the emergence of international human rights law, issues related to the implementation, the position of the U.S. regarding ratification of human rights treaties, processes for monitoring and implementing human rights, and treatment of human rights in the courts.

**FCS 821 International Law and Policy on**

**Children's Issues 3(3,0)** Comparative analysis of law and policy on children's issues. Attention is given to relevant international instruments, particularly the Convention on the Rights of the Child, and to related concepts in the law and policy of various nations, including the United States. *Preq:* FCS 820.

**FCS 822 Right to Health 3(3,0)**

Examination of the relationship between health and human rights emphasizing the application of a rights-based approach to health-related interests of children, families, and communities. Topics include discussion of the content and contours of a right to health and of emerging trends in health and human rights. *Preq:* FCS 820 or consent of instructor.

**FCS 830 Community Development: Principles**

**and Practices 3(3,0)** Comparative theory and practice of community development, community building, and community transformations that support child, youth, and family well-being. Includes U.S. community development examples with selected examples from other nations.

**FCS 831 Community Transformation 3(3,0)** Advanced course on community transformation theories, theologies, and practice. Discusses and illustrates major paradigm shifts within the last three decades in the way community development is thought about and done. Case studies on community transformation from selected nations are utilized. *Preq:* FCS 830 or consent of instructor.

**FCS 832 Policies and Programs in Human Services 3(3,0)** Philosophy, theories, and principles for organizing human services in and across selected nations, emphasizing strategies for and barriers to the development of collaborations among and between governmental and nongovernmental organizations. Discusses community-level child and family support, poverty alleviation, health care, early childhood education care, and old-age assistance. *Preq:* FCS 830 or consent of instructor.

**FCS 833 Humanitarian Assistance 3(3,0)** Introduction to humanitarian assistance. Topics include historical background, current status, determinants, legal issues, and health and social service delivery to current and past refugee and internally-displaced people, and ethnopolitical conflicts and terrorism as major sources of humanitarian crises. *Preq:* FCS 830 or consent of instructor.

**FCS 835 Religious Institutions in Community Life 3(3,0)** Focuses primarily on comparative review of religious organizations as core institutions in everyday life and community well-being; the personal, social, and political meaning of religious involvement; the theological frameworks motivating faith-based organizations' involvement in community development; the effects of globalization on normative religious behavior related to social action.

**FCS 840 Community, Societal, and International Research 3(3,0)** Covers issues and methods of community, societal, and international research and evaluation; macro-level assessment of the impact of interventions and the documentation of change; multi-method etic and emic strategies, theory-based evaluation, longitudinal designs, and collaborative, consultative models of research. *Preq:* PSYCH 810, 811; or consent of instructor.

**FCS 890 Research Project 1-6** Research in Family and Community Studies not related to a thesis.

**FCS 892 Special Topics 1-3(1-3,0)** Selected current and classic topics not covered in other courses. May be repeated for a maximum of 12 credits, but only if different topics are covered.

**FCS 893 Practicum 3** Comprehensive community building projects involving a group of Family and Community Studies majors working with a faculty member and community leaders. *Preq:* FCS 810, 820, 830, 840, or consent of instructor.

**FCS 894 Internship 0** Students spend at least one academic year in residence at an affiliated center outside North America. Capstone learning experiences are done in connection with the internship experience, in part through distance learning. To be taken Pass/Fail only. *Preq:* FCS 810, 820, 830, 840, consent of graduate studies coordinator.

**FCS 896 Independent Study 1-6(1-6,0)** Individual readings or research on a topics selected according to the student's interests or professional development needs. May be repeated for a maximum of six credits. To be taken Pass/Fail only. *Preq:* Consent of coordinator of graduate studies.

**FCS 991 Doctoral Research 1-18**

## FINANCE

**FIN 602 Advanced Corporate Finance 3(3,0)** Study of the decision process and analytical techniques used in evaluating corporate investment and making financial decisions. Topics include capital budgeting, real options, working capital management, mergers and acquisitions, bankruptcy and reorganization, and financial management in not-for-profit businesses. *Preq:* FIN 312 with a C or better or consent of instructor.

**FIN 606 Analysis and Use of Derivatives 3(3,0)** Consideration of the option pricing theory and strategy techniques most commonly used in the market for options. An overview of the futures markets is also considered. Special emphasis is given to interest-rate futures, stock-index futures, and foreign-exchange futures. *Preq:* FIN 305 with a C or better or consent of instructor.

**FIN 615 Real Estate Investment 3(3,0)** Focuses on the structure and analysis of real estate investment emphasizing financial theory and analysis technique. Case study and project-oriented homework assignments facilitate the understanding of real estate investments. *Preq:* FIN 307 with a C or better or consent of instructor.

**FIN 616 Real Estate Valuation 3(3,0)** Advanced course in commercial real estate valuation. Topics include income capitalization, cash equivalency, highest and best use analysis, the cost approach, the direct sales comparison approach, and DCF analysis. *Preq:* FIN 307 with a C or better or consent of instructor.

**FIN 617 Real Estate Finance 3(3,0)** Advanced course applying financial analysis and theory to real estate. Mortgage credit analysis and current financing techniques for residential and commercial properties are emphasized. Topics include financial institutions, syndications, and construction financing. *Preq:* FIN 307 with a C or better or consent of instructor.

**FIN (M B A) 832 International Financial Management 3(3,0)** See M B A 832.

**FIN (M B A) 836 Real Estate Principles 3(3,0)** See M B A 836.

**FIN 867 Advanced Financial Management 3(3,0)** Financial problem-solving skills developed through case analysis, class discussion, reading assignments, and a project. *Preq:* M B A (FIN) 807 or 857 or consent of instructor.

## FOOD SCIENCE

**FD SC 601 Food Chemistry I 4(3,3)** Basic composition, structure, and properties of food and the chemistry of changes occurring during processing utilization. Offered fall semester of even-numbered years only. *Preq:* BIOCH 305 or consent of instructor.

**FD SC 602 Food Chemistry II 4(3,3)** Application of theory and procedures for quantitative and qualitative analysis of food ingredients and food products. Methods for protein, moisture, lipid, carbohydrate, ash, fiber, rancidity, color, and vitamin analyses and tests for functional properties of ingredients are examined. Offered spring semester of odd-numbered years only. *Preq:* BIOCH 305 or consent of instructor.

**FD SC 604 Food Preservation and Processing 3(3,0)** Principles of food preservation applied to flow processes, ingredient functions, and the importance of composition and physical characteristics of foods related to their processing; product recalls and product development concepts. *Preq:* Physics and organic chemistry or biochemistry.

**FD SC 606 Food Preservation and Processing Laboratory 1(0,3)** Laboratory exercises on preservation methods, equipment utilized, and processes followed in food manufacture. *Coreq:* FD SC 404.

**FD SC 607 Quantity Food Production 2(1,3)** Principles of the production of food in quantity for use in food service systems, Emphasis is on functions of components of foods and of ingredients in food, on the quality of the final product, on safe production of food, and on proper use of equipment. *Coreq:* FD SC 306, 404.

**FD SC 608 Food Process Engineering 4(3,3)** Study of basic engineering principles and their application in food processing operations. The relation between engineering principles and fundamentals of food processing is emphasized. *Preq:* FD SC 214, CH 102, MTHSC 106, PHYS 207 or 200 or 122 or consent of instructor.

**FD SC 630 Dairy Processing I 4(3,3)** Processing and distribution of fluid milk and other dairy products with emphasis on composition, quality control, chemical, microbiological, and public health aspects. *Preq:* BIOL 104/106, CH 102.

**FD SC 631 Dairy Processing II 4(3,3)** Continuation of FD SC 430, with emphasis on processing of cultured dairy products and frozen dairy products. Discusses processing procedures, quality control, ingredients, formulations, and compositional and cultural characteristics of cultured and frozen dairy products. *Preq:* FD SC 430.

**FD SC 810 Chemical and Biochemical Aspects of Foods 4(4,0)** Chemical, biochemical, and functional properties of food components and their interactions in food emulsions, foams, colloids, and gel and solution states; the influences of processing on isolation, utilization, and production of the constituents using techniques based on constituent properties. *Preq:* BIOCH 623 and FD SC 401 or consent of instructor.

**FD SC 811 Physical and Thermophysical Properties of Foods 3(3,0)** Principles involved in relating physical and thermophysical properties to food quality. Includes standard methods and instruments to determine texture and the relationship of physical properties to sensory evaluation; interrelationships of chemical structure and physical properties in food processing operations. *Preq:* FD SC 810 or consent of instructor.

**FD SC 812 Microbiological Aspects of Food Systems 3(3,0)** Function and characteristics of microorganisms in the utilization and manufacture of food products; food fermentations, microbially induced chemical and physical changes, environmental aspects, and production of food ingredients and resources. *Preq:* MICRO 407 or equivalent or consent of instructor.

**FD SC 815 Food Service Systems Management 4(3,3)** Management of the procurement, production, distribution, and service of food that meets nutrition guidelines, cost parameters, and consumer acceptance criteria; supervision of customer satisfaction systems, marketing functions, and human resource systems.

**FD SC 820 Selected Topics in Food Science 1-3(1-3,0)** Special topics in food science not covered in other courses. May be repeated for a maximum of nine credits.

**FD SC 821 Selected Topics 1-4(0,3-12)** Independent research investigation in food science areas not conducted in other courses. May be repeated for a maximum of 12 credits. *Preq:* Consent of instructor.

**FD SC 851 Food Science Seminar 1(1,0)** Current research and related developments in food science reviewed by faculty, students, and invited lecturers.

**FD SC 852 Food Science Seminar 1(1,0)** Continuation of FD SC 851.

**FD SC 891 Master's Thesis Research 1-12**

## FOOD TECHNOLOGY

**FD TH 851 Food Technology Seminar 1(1,0)** Current and ongoing research and developments in food technology reviewed by faculty, students, and invited lecturers. *Preq:* Enrollment in the Food Technology PhD program or consent of instructor.

**FD TH 991 Doctoral Dissertation Research 1-12**

## FORESTRY

**FOR 600 Public Relations in Natural Resources 3(3,0)** Identifying relevant policies, their characteristics and acceptance to natural resource management, and techniques of maintaining appropriate public relations. *Preq:* Senior standing.

**FOR 613 Integrated Forest Pest Management 4(3,3)** Nature and control of pests of forest trees and products. Focuses on the relation of pests to silviculture, management, and natural forest ecosystems. Offered fall semester only. *Preq:* Junior standing in Forest Resource Management.

**FOR 615 Forest Wildlife Management 3(2,3)** Principles, practices, and problems of wildlife management with emphasis on upland forest game species. Habitat manipulation through use of appropriate silvicultural practices in association with other techniques is evaluated. *Preq:* FOR 460 or consent of instructor.

**FOR (E N R) 616 Forest Policy and Administration 2(2,0)** Introduction to development, principles, and legal provisions of forest policy in the United States and an examination of administrative and executive management in forestry.

**FOR 617 Forest Resource Management and Regulation 3(3,0)** Fundamental principles and analytical techniques in planning, management, and optimization of forest operations. *Preq:* FOR 302, 308, 418, 460.

**FOR 618 Forest Resource Valuation 3(3,0)** Analysis of capital investment tools and their application to decision making among forestry investment alternatives; valuation of land, timber, and other resources associated with forestry, including the impact of inflation and taxes. *Preq:* FOR 304 or consent of instructor.

**FOR 623 Current Issues in Natural Resources 2(2,0)** Lectures in various fields of forestry delivered by selected representatives from forestry industries, consultants, agencies, associations, and other forestry operations. Course will not be taught when enrollment is less than 15. To be taken Pass/Fail only. Offered fall semester only. *Preq:* Junior standing or consent of instructor.

**FOR (HORT) 627 Urban Tree Care 3(3,0)** Principles, practices, and problems of protecting and maintaining trees in urban and recreational areas. Examines environmental and biological factors affecting trees in high-use areas, their management and cultural requirements, and the practices necessary for their protection and care as valuable assets in the landscape. *Preq:* Junior standing or consent of instructor.

**FOR 631 Recreation Resource Planning in Forest Management 2(1,3)** Analysis of forest recreation as a component of multiple-use forest management; techniques of planning; physical and biological effects on forest environments; and forest site, user, and facility management. Offered spring semester of odd-numbered years only.

**FOR 633 GPS Applications 3(2,3)** Develops competence in global positioning system (GPS) technology including theory, methods, and application to natural resources mapping. Topics include basic concepts of GPS; projection systems; types of data; mission planning; and data capture, correction, and export to geographical information systems (GIS). *Preq:* Senior standing or consent of instructor.

**FOR (E N R) 634 Geographic Information Systems for Landscape Planning 3(2,3)** Develops competence in geographic information systems (GIS) technology and its application to various spatial analysis problems in landscape planning. Topics include data development and management, spatial analysis techniques, critical review of GIS applications, needs analysis and institutional context. GIS hardware and software, hands-on application. Credit may be received for only one of C R P 434, FOR (E N R) 434.

**FOR 641 Properties of Wood Products 3(3,0)** Basic properties of wood including the hygroscopic, thermal, electrical, mechanical, and chemical properties; standard testing procedures for wood. *Preq:* Junior standing or consent of instructor.

**FOR 642 Manufacture of Wood Products 3(3,0)** Manufacture of lumber, plywood, poles, piles; drying, preservation, grading, and uses of wood products. Manufacture of particleboard, flakeboard, oriented-strand board, fiberboard, and paper products. Includes physical, mechanical, and chemical properties and their applications. *Preq:* Consent of instructor.

**FOR 644 Forest Products Marketing and International Trade 3(3,0)** Study of marketing and international trade practices currently employed by the forest products industry and the application of basic marketing principles and global trade concepts in the industry's current and future environment. *Preq:* FOR 442 or consent of instructor.

**FOR 650 Woody Plant Stress Physiology 3(3,0)** Structure, function, and physiology of tree shoot and crown growth, wood formation, diameter growth, root growth, and reproduction especially as related to stress factors. *Preq:* BIOSC 401 or FOR 460 or consent of instructor.

**FOR (EE&S, B E) 651 Newman Seminar and Lecture Series in Natural Resources Engineering 1(0,2)** See B E 651.

**FOR 665 Silviculture 4(3,3)** Discussion of the theory and practice of manipulating forests to meet the needs and values of landowners and society in accordances with biological, ecological, and economic principles. *Preq:* FOR 206 and Forestry Summer Camp or consent of instructor.

**FOR 707 Special Problems in Forestry 1-3(1-3,0)** Directed individual study of a special problem in an applied field of forestry. Written report of study results is required.

**FOR 805 Forest Landscape Ecosystems 4(3,3)** Three basic landscape components of soils, landform, and vegetation; their interrelationships in forest ecosystems; factors and processes of soils as interacting components with landform and vegetation. Offered fall semester of even-numbered years only. *Preq:* Graduate standing or consent of instructor.

**FOR 806 Advanced Silviculture—Forest Tree Growth and Development 3(3,0)** Growth and development of economically important forest tree species; structure, function, phenology, and wood formation related under forest stand conditions emphasizing manipulation of forest tree growth by cultural practice; current research in growth and culture of forest trees and stands. Offered fall semester of odd-numbered years only. *Preq:* BIOSC 401, 402; or consent of instructor.

**FOR 807 Special Problems in Forestry 1-12** Special problems in forestry research methods that do not directly pertain to the candidate's thesis.

**FOR 808 Seminar 1(1,0)** Research and current developments in forestry. Students and staff participate. May be taken up to two semesters for credit. To be taken Pass/Fail only.

**FOR 811 Forest Wetland Ecology and Management 2(2,0)** Assessment of ecological processes and how they influence forest wetland productivity, management, and regulation. Offered spring semester only. *Preq:* Introductory ecology or consent of instructor.

**FOR 812 Fire Ecology and Management 3(2,3)**

Historical presence of fire in various regions of North America and its effects on forests; analysis of current fire management strategies with emphasis on usage of prescribed fire as an ecosystem management tool. *Preq:* Graduate standing or consent of instructor.

**FOR 814 Advanced Forest Resource Management and Planning 3(3,0)**

Current forest resource management and planning topics; operational emphasis on application of various quantitative tools to solve economic and management problems; advanced topics in forest regulation, forest valuation, mathematical programming and harvest scheduling, simulation, multiple-use alternatives, and selected areas. Offered spring semester of odd-numbered years only. *Preq:* FOR 417 or consent of instructor.

**FOR 815 Systems Processes in Natural Resources 3(2,3)**

Use of system thinking and system analysis to define the issues, model, simulate, and evaluate alternatives for forest landscape problems and opportunities.

**FOR (PRTM) 816 Remote Sensing and GIS in Natural Resources 3(2,3)**

Practical application of computer mapping, spatial analysis, and natural resource inventory using remote sensing and geographical information systems. Offered spring semester of odd-numbered years only. *Preq:* FOR (ENR) 434 or consent of instructor.

**FOR 845 Biodiversity in Managed Forests 3(2,3)**

Theory and practice of maintaining biodiversity are fundamental to successful management of forests. Conservation of biodiversity is viewed from the macro (landscape) and micro (stand) levels. Socioeconomic and policy as well as ecological perspectives are considered in design of appropriate management practices. *Preq:* FOR 415, 460, or consent of instructor.

**FOR 891 Master's Thesis Research 1-12****FOR 893 Selected Topics in Forest Resources 1-4(0-4,0-12)**

Specialized topics not covered in other courses which explore current areas of research and management in forest and natural resources in a format of lecture, lab, or both. May be repeated for a maximum of eight credits, but only if different topics are covered. *Preq:* Graduate standing or consent of instructor.

**FOR 991 Doctoral Dissertation Research 1-12****FORESTRY AND NATURAL RESOURCES****F N R 666 Stream Ecology 3(2,3)**

Covers the ecology of flowing water systems. Topics include geomorphology, physical and chemical factors of streams, biology of stream-dwelling organisms, trophic relationships, competition, colonization, drift, community structure, disturbance, and human impacts. *Preq:* Junior standing or consent of department chair.

**FRENCH****FR 151 French for Graduate Students 3(3,0)**

Intensive program only for graduate students preparing for the reading examination in French. A minimum grade of B on final exam will satisfy Graduate School foreign language requirement. To be taken Pass/Fail only. May be repeated once for credit. *Preq:* Graduate standing.

**FR 699 Selected Topics in French Literature 3(3,0)**

Selected topics that have characterized French literature, language, and culture. May be repeated for a maximum of six credits. *Preq:* Consent of department chair.

**GENETICS****GEN (BIOSC) 605 Molecular Genetics of Eukaryotes 3(3,0)**

Molecular genetic analyses of eukaryotes in relation to mutations and repair, complex phenotypes, biochemical pathways, short- and long-term regulation of gene expression, and evolution. *Preq:* GEN 302 or equivalent and one semester of biochemistry, or consent of instructor.

**GEN 610 Fundamentals of Genetics I 3(3,0)**

First in a two-semester sequence in genetics covering Mendelian genetics, topics in cytogenetics, extranuclear inheritance, quantitative, evolutionary, conservation, and population genetics. *Preq:* CP SC 120 (or equivalent), EX ST 301, GEN 302, or consent of instructor.

**GEN 611 Fundamentals of Genetics I Laboratory 1(0,3)**

Crosses are carried out using eukaryotic organisms (*C. elegans*, *Drosophila*, yeast) with appropriate markers to follow inheritance. Population and evolutionary genetics concepts are also examined. *Preq:* GEN 410 or concurrent enrollment.

**GEN (BIOSC) 616 Recombinant DNA 3(3,0)**

Familiarizes students with the most current facts and concepts of molecular genetics. Lectures focus on gene organization, structure, and expression in prokaryotes and eukaryotes, highlighting current technologies and research in these areas. *Preq:* GEN 302 or equivalent and one semester of biochemistry or consent of instructor. A developmental biology course is also strongly recommended.

**GEN (BIOSC, MICRO) 618 Biotechnology I: Nucleic Acids Techniques 4(2,4)**

Basic training in the manipulation of genetic information using recombinant DNA technology. Includes techniques in molecular cloning, Southern and Northern analyses, clone library construction. *Preq:* BIOCH 301 or 305, MICRO 305 or consent of instructor.

**GEN 620 Fundamentals of Genetics II 3(3,0)**

Second in a two-semester sequence in genetics covering molecular genetics, gene expression, recombinant DNA technology, genomics, bioinformatics, proteomics, developmental, human, cancer, and behavioral genetics. *Preq:* GEN 410 or consent of instructor.

**GEN 640 Bioinformatics 3(3,0)**

Theory and application of computational technology to analysis of the genome, transcriptome, and proteome. *Preq:* CP SC 120 (or equivalent), GEN 302, 410, or consent of instructor.

**GEN 650 Comparative Genetics 3(3,0)**

Outlines the genome structure, function, and evolution based on available complete genome sequences. Topics include evolution of multigene families, origin of eukaryotic organelles, molecular phylogeny, gene duplication, domain shuffling, transposition, and horizontal gene transfer. *Preq:* GEN 420 and 440, or consent of instructor.

**GEN (BIOSC, HORT) 665 Plant Molecular Biology 3(3,0)**

See HORT 665.

**GEN 670 Human Genetics 3(3,0)**

Basic principles of inheritance; population, molecular, and biochemical genetics; cytogenetics; immunogenetics; complex traits; cancer genetics; treatment of genetic disorders; genetic screening and counseling; and the Human Genome Project. *Preq:* GEN 302 or consent of instructor.

**GEN (ENT) 695 Insect Biotechnology 3(3,0)**

See ENT 695.

**GEN 730 Genetics Topics for Teachers 3(2,2)**

Lectures and laboratories focus on genetics and biotechnology. Restricted to elementary and secondary teachers. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.

**GEN 801 Cytogenetics 3(2,3)**

Classical and contemporary problems of chromosome structure, behavior, and transmission; recombination; interspecific hybridization; euchromatin and heterochromatin; polyploidy; mutable genetic systems; structural and numerical aberrations of chromosomes and their effects upon breeding systems of plants and animals. Offered spring semester of alternate years only. *Preq:* GEN 302 or equivalent.

**GEN 803 Quantitative Genetics 3(3,0)**

Quantitative genetics concepts, line crosses and inbreeding, detecting major genes, mapping quantitative trait loci, estimation of genetic variation and heritability. Offered spring semester only. *Preq:* GEN 814 or consent of instructor. (EX ST 801 is recommended.)

**GEN (BIOCH) 805 Issues in Research 2(2,0)**

See BIOCH 805.

**GEN 806 Special Problems in Genetics 1-3 (0,3-9)**

Research not related to a thesis.

**GEN (BIOCH) 810 Principles of Molecular Biology 3(3,0)**

See BIOCH 810.

**GEN 812 Physiological Genetics 3(3,0)**

Advanced topics in the molecular aspects of physiological genetics including genes and metabolism, genes and signal transduction, oncogenes and growth, chromosomal aberrations, immunogenetics, and others. *Preq:* A semester of biochemistry and introductory genetics.

**GEN 814 Advanced Genetics 3(3,0)**

Topics include organization of DNA in prokaryotes and eukaryotes, mutation, extranuclear inheritance, recombination, control of gene activity, systems of mating, genes and development, genetics of behavior, population genetics, genetics and disease. *Preq:* GEN 302 or equivalent, graduate enrollment in Genetics, or consent of instructor.

**GEN 815 Developmental Genetics 3(3,0)** Current research in developmental genetics including model systems, homeotic genes of *Drosophila*, primary induction, adhesion, molecules and cancer, axis formation, global pattern mutants in plants, homeobox genes in plants, and photo regulation. *Preq:* GEN 814 or consent of instructor.

**GEN (BIOCH) 820 Genomics and Proteomics 3(3,0)** Genomes, transcriptomes, and proteomes of a variety of organisms are studied along with the technology used to obtain them. Bioinformatics tools and access to this information are developed, and the significance of this information for the life sciences is made clear. *Preq:* BIOCH 814 or GEN 814 or consent of the instructor.

**GEN (BIOCH) 825 Seminar I 1(1,0)** Special topics and original research in genetics reviewed by students, faculty, and invited lecturers. May be repeated for credit. *Preq:* One semester of genetics.

**GEN 830 Population Genetics 3(3,0)** Topics include statistical methodology in the study of population genetics, probability as applied to genetic systems, gene and zygotic frequencies, derivation of genetics expectation, forces that change gene frequency, inbreeding, estimation, and testing of genetic parameters. *Preq:* GEN 814 or consent of instructor. (EX ST 801 is recommended.)

**GEN (BIOCH) 851 Seminar II 1(1,0)** See BIOCH 851.

**GEN 890 Special Topics in Genetics 1-3(1-3,0)** Group discussion of recent developments in genetic research. May be repeated for a maximum of six credit hours. *Preq:* GEN 302 and consent of instructor.

**GEN 891 Master's Thesis Research 1-12**

**GEN 991 Doctoral Dissertation Research 1-12**

## GEOGRAPHY

**GEOG 601 Studies in Geography 3(3,0)** Intensive study of the geography of a selected world regions, such as North America, Europe, or the Middle East or the geography of a topic, such as the geography of oil or the geography of underdevelopment. May be repeated once for credit with departmental consent. *Preq:* GEOG 101 or 103 or consent of instructor.

**GEOG 610 Geography of the American South 3(3,0)** Study of geography of the American South in its changing complexities of almost 400 years of development. *Preq:* GEOG 101 or 103 or consent of instructor.

**GEOG 620 Historical Geography of the United States 3(3,0)** Survey that places the spatial concepts of geography into a time sequence with emphasis on the United States. *Preq:* GEOG 101 or 103 or consent of instructor.

**GEOG (PRTM) 630 World Geography of Parks and Equivalent Reserves 3(3,0)** See PRTM 630.

**GEOG 640 Geography of Historic Preservation 3(3,0)** Aspects of historic preservation with emphasis on sites and structures in their geographical, historical, and socioeconomical contexts. Examples are drawn from American architectural styles and settlement forms. *Preq:* GEOG 101 or 103 or consent of instructor.

**GEOG 710 Teaching Geography 3(3,0)** Investigates world regions as a set of problems posed to teachers of geography; comparative analysis of basic geographic concepts. Oriented to public school teachers of geography.

## GEOLOGY

**GEOL 603 Invertebrate Paleontology 3(2,3)** Study of life of past geologic ages, as shown by fossilized remains of ancient animals, with emphasis on the invertebrates. *Preq:* GEOL 101 or consent of instructor.

**GEOL 605 Surficial Geology 4(3,3)** Study of surface features of the earth and the processes that produce them. Analysis of landforms including their form, nature, origin, development, and rates and patterns of change. Laboratory studies emphasize terrain analysis and the mechanics of surficial geological processes. *Preq:* GEOL 102, 300, or consent of instructor.

**GEOL 608 Geohydrology 3(3,0)** Study of the hydrologic cycle, aquifer characteristics, theory of groundwater movement, mechanics of well flow, experimental methods, and subsurface mapping. *Preq:* GEOL 101, 102.

**GEOL 613 Stratigraphy 3(2,2)** Analysis of stratified rocks as the repository of earth history and the conceptual framework used to synthesize the world geologic record as a coherent whole. Emphasis is placed not only on traditional lithostratigraphy but also on modern seismic stratigraphy, biostratigraphy, magnetostratigraphy, and current stratigraphic issues. *Preq:* GEOL 314 or consent of instructor.

**GEOL 615 Analysis of Geological Processes 3(3,0)** Introduction to methods for analyzing geological processes. Mathematical methods are introduced to solve problems related to stream flow, reaction kinetics, radioactive decay, heat flow, diffusion, fluid flow through geologic media and related processes. *Coreq:* MTHSC 206 or consent of instructor.

**GEOL 621 GIS Applications in Geology 3(1,4)** Introduction to geographic information systems with applications to current geological and hydrological problems. Topics include use of global positioning systems, spatial analysis, and image analysis. Hands-on training with GIS software and techniques is covered. *Preq:* Senior standing, strong computer skills.

**GEOL 651 Selected Topics in Hydrogeology 1-4(1-3,0-3)** Selected topics in hydrogeology, with emphasis on new developments in the field. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* GEOL 300 or 408 or consent of instructor.

**GEOL 790 Selected Topics in Earth Sciences 1-6(0-6,0-18)** One or more earth science topics. Lecture and laboratory emphasize the incorporation of new or updated subject matter into classroom instruction. Restricted to elementary and secondary school teachers. May be repeated for credit, but only if different topics are covered.

**GEOL 800 Groundwater Geochemistry 3(2,3)** Lectures and project-oriented field work focusing on processes controlling natural impurities in groundwater and the occurrence of inorganic, organic, and radioactive contaminants; solution equilibria, chemical weathering, oxidation-reduction, utilization of radioactive isotopes as tracers and studies of contamination plumes. *Preq:* CH 102 or equivalent.

**GEOL 801 Field Geophysics Techniques and Interpretation 3(2,3)** Project-oriented field study of basic geophysical methods used for shallow geological investigations and for environmental site characterization; seismic, electrical, and electromagnetic sounding, ground-penetrating radar, magnetics, gravity, self-potentials, and borehole geophysics. Emphasis is on basic principles and physical understanding of the geophysical methods with applications in mind. *Preq:* Consent of instructor.

**GEOL 803 Geostatistics 3(3,0)** Numerical and statistical treatment of geological data emphasizing the analysis of spatially and temporally distributed variables and unique aspects of geological variables; methods of sampling geological data, quantitative procedures for reducing the dimensionality of geological data sets, and techniques for presentation and interpretation of results. *Preq:* EX ST 301 or MTHSC 301.

**GEOL 805 Advanced Stratigraphy 3(3,0)** Classification, distribution, chronologic succession, and correlation of sedimentary rocks; interpretation of features of strata in terms of their origin, depositional environment, paleogeography, and relation to organic evolution; Atlantic Coastal Plain stratigraphy. *Preq:* GEOL 413 or consent of instructor.

**GEOL 806 Aquifer Characterization 3(3,0)** Characterization of aquifers from the microscopic scale to the regional scale; geological origin of aquifers and modification by diagenetic and deformational processes; application of subsurface geological techniques to data acquisition and interpretation; prediction of fluid occurrence and flow by integrating results of subsurface analysis.

**GEOL 807 Tectonics 3(3,0)** Deformation processes and features of the Earth's crust at the regional to global scale; characteristic structures of active rift, transform and convergent margins; origin of mountain belts and sedimentary basins within a plate-tectonic framework. *Preq:* GEOL 302 or consent of instructor.

**GEOL (EE&S) 808 Groundwater Modeling 3(3,0)** Mathematical and computer modeling of groundwater flow and nonreactive solute transport through geological formations; conceptual flow-models for geologic systems; formulation of governing mass and energy conservation equations; application of analytical, numerical, and stochastic models to real-world problems. *Preq:* Consent of instructor.

**GEOL (EE&S) 809 Subsurface Remediation Modeling 3(3,0)** Lectures and computer exercises involving subsurface remediation methods including groundwater extraction, soil vapor extraction, stream flooding, and a variety of other techniques; modeling flow of multiphase and multicomponent mixtures in porous medium. *Preq:* GEOL (EE&S) 808 or consent of instructor.

**GEOL (EE&S) 810 Analytical Methods for Hydrogeology 3(3,0)** Analytical mathematical methods for modeling subsurface fluid flow and transport processes including saturated water flow, unsaturated zone gas flow, chemical transport, and heat transfer, emphasizing the derivation and solution of governing equations for modeling subsurface flow and transport. *Preq:* GEOL (EE&S) 808 or graduate-level groundwater course or consent of instructor.

**GEOL 811 Rock Physics 3(3,0)** Experimental and theoretical rock physics; electrical, fluid-transport and seismic properties; rock/solution interface and how that interface affects electrical, fluid transport, and seismic properties; magnetic, mechanical, and thermal responses. *Preq:* Consent of instructor.

**GEOL 813 Environmental Geochemistry 3(3,0)** Inorganic geochemistry, specifically the distribution of trace elements in rocks, regolith, and water. Topics include micronutrients and concepts of essentiality; health problems related to natural occurrence of toxic elements; environmental pollution arising from nonferrous metal mining, coal mining and coal use, and gasoline additives; urban and regional geochemistry. *Preq:* GEOL 318 or consent of instructor.

**GEOL 814 Environmental Sedimentology 3(3,0)** Environmental-based applications of sedimentology to developing an understanding of heterogeneity and scale, fluid flow and saturation, sediment-fluid interactions, and modeling approaches; field and laboratory methods; case studies; implications to environmental sustainability. *Preq:* Consent of instructor.

**GEOL 816 Aquifer Systems 3(3,0)** Hydrogeologic characteristics of selected major aquifer systems in the U.S. and elsewhere; conceptual models for the controls of recharge, discharge, and flow-through aquifers in different geologic settings; development of numeric models to simulate natural and stressed aquifers. *Preq:* GEOL 408 and (EE&S) 808 or consent of instructor.

**GEOL 818 Hydrogeology of Fractured Aquifers 3(3,0)** Processes and characteristics of fluid flow through naturally and artificially fractured subsurface formations; principles of flow in dual porosity materials, characterizing fractures and fractured aquifers, mechanics of fracture formation, methods of inducing fractures from wells; case studies and applications. *Preq:* GEOL 408 and (EE&S) 808 or consent of instructor.

**GEOL 850 Selected Topics in Environmental Geology 1-4(1-3,0-3)** Selected topics in environmental geology emphasizing the subsurface contamination. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.

**GEOL 851 Geology Seminar 1(1,0)** Students review current topics in geology and make oral presentations. May be taken twice for credit.

**GEOL 875 Hydrogeology Summer Field Camp 6(4,6)** Groundwater geology field techniques including examination of surface exposures, analysis of cores and geophysical well logs, subsurface mapping, aquifer performance test, and groundwater remediation. *Preq:* Consent of instructor.

**GEOL 891 Master's Thesis Research 1-12**

## GERMAN

**GER 151 German for Graduate Students 3(3,0)** Intensive program only for graduate students preparing for the reading examination in German. Minimum grade of B on final exam will satisfy Graduate School foreign language requirement. To be taken Pass/Fail only. May be repeated once for credit. *Preq:* Graduate standing.

**GER 698 Independent Study 1-3(1-3,0)** Selected topics in German literature, language, or culture. May be repeated for a maximum of six credits. *Preq:* Consent of department chair.

## GRADUATE STUDIES

**G S 799 Comprehensive Studies 1-15(1-15,0)** Independent studies in preparation for comprehensive examinations; credit hours to be determined by the department or program chair. To be taken Pass/Fail only.

**G S 800 Research Proposal Development Seminar 1(1,0)** Principles and techniques for the preparation of research proposals. Does not count toward a graduate degree. To be taken Pass/Fail only. *Preq:* Second year or graduate standing in current major.

## GRAPHIC COMMUNICATIONS

**G C 605 Package and Specialty Printing 2(2,0)** Problems and processes for printing and converting in package, label, and specialty printing industries. Flexographic preparation, printing, die making, diecutting, transfer printing, screen container printing, pad printing, and bar code production are covered. New developments and trends are discussed. To be taken concurrently with G C 606. *Preq:* G C 245, 310, 350; or consent of instructor.

**G C 606 Package and Specialty Printing Laboratory 2(0,6)** Laboratory in techniques for printing and converting in package, label, and specialty printing industries. Experiences in flexographic prepress; printing; die design, die making, and diecutting for label, folding cartons, and corrugated; and glass, plastic, and metal container printing. *Preq:* G C 245, 310, 350 or consent of instructor; concurrent enrollment in G C 605.

**G C 607 Advanced Flexographic Methods 4(2,6)** In-depth study of the methods used in flexographic printing and converting porous and nonporous substrates. Theory and laboratory applications include setting standards for process color, preparation of plate systems, ink mixing and color matching, testing of films and foils, analysis of recent developments, and prediction of future markets. *Preq:* G C 606 or consent of instructor.

**G C 640 Commercial Printing 5(2,9)** Advances skills learned in previous graphic communications courses and applies the knowledge to large format presses. Students work from the design conception stage through all aspects of preparation, production, and finishing. Emphasis is on understanding and incorporating emerging technologies into the production workflow. *Preq:* G C 310 and 350 or consent of instructor.

**G C 644 Current Developments and Trends in Graphic Communications 4(2,6)** Advanced course for Graphic Communications majors. Emphasis is on the theory and technical developments that affect process and equipment selection. Topics include color theory and application, electronic color scanning, electronic prepress and communications, gravure color quality control and analysis. *Preq:* G C 605, 606, 640.

**G C 645 Advanced Screen Printing Methods 3(2,3)** Systems and materials used in the screen printing process emphasizing techniques of control and procedures for establishing screen printing methods and standards. *Preq:* G C 207 or consent of instructor.

**G C 646 Ink and Substrates 3(2,3)** Covers components, manufacturing, process use, and end use of ink and substrates used in lithography, flexography, gravure, and screen printing. Examines the interrelationship among inks, substrates, and the printing process. Through controlled testing and examination, the optimum conditions for improved printability are determined. *Preq:* G C 605; 606 or 640; or consent of instructor.

**G C 648 Planning and Controlling Printing Functions 3(2,3)** Study of systems for setting printing production standards, estimating, scheduling, job planning, and the selection of new hardware and technologies. *Preq:* G C 350, 450, 605, 606, 640, or consent of instructor.

**G C 690 Graphic Communications Selected Topics 1-3(1-3,0)** Subjects not covered in other graphic communications courses; organized according to industry trends and student needs. May be repeated for a maximum of 18 credits, but only if different topics are covered. *Preq:* Consent of instructor.

**G C 801 Process Control in Color Reproduction 3(2,3)** Techniques and rationale for procedures used in reproducing color originals for printed media. Topics include color systems, measurement, reproduction characteristics, proofing systems, process evaluation/analysis for offset, gravure, flexographic, and screen printing processes. *Preq:* G C 644 or equivalent.

**G C 811 Printing Industry Operations 3(2,3)** Concepts and principles of operations and applications of technology and trends within the printing, publishing, packaging, and allied industries. Twelve plant visits supplement study of the organization, management, marketing, economics, production, environmental issues, and products of modern graphic communications firms.

**G C 831 Color Science Applied to Graphic Communications 3(2,3)** Color reproduction applications found in both photomechanical and digital workflows for print production; foundation in color science principles, measurement, and integration relative to the printing, publishing, and packaging industry; color systems development, application, and integration. *Preq:* Consent of instructor.

**G C 850 Graphic Communications Internship 1(1,0)** Full-time employment for hands-on experiences in manufacturing, marketing, or managing within the graphic communications industry. For Graphic Communications graduate students only. May be repeated for a maximum of two credits. *Preq:* G C 310 or equivalent and consent of instructor.

**G C 891 Master's Thesis Research 1-6(1-6,0)**  
Student participation in a research project. Basic skills in a selected research methodology are developed. *Preq:* G C 894.

**G C 894 Graphic Communications Graduate Seminar I 1(1,0)** Discussions on relevant topics and guidance to prepare research proposals in the graphic communications field. May be repeated for a maximum of two credits, but only if different topics are covered. *Preq:* Graduate standing and consent of instructor.

**G C 897 Graphic Communications Research Problems I 3(3,0)** In-depth investigation of phenomena relative to the printing, publishing, packaging, or allied industries. *Preq:* G C 894, acceptance of a written proposal, approval of advisor.

**G C 898 Graphic Communications Research Problems II 3(3,0)** Continuation of G C 897. In-depth investigation of phenomena relative to the printing, publishing, packaging, or allied industries. *Preq:* G C 894, 897, acceptance of a written proposal, approval of advisor.

## HEALTH

**HLTH 600 Selected Topics in Health 1-3(1-3,0)**  
Topics selected to meet special and individualized interest of students in health. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Junior standing, consent of instructor.

**HLTH 601 Health Consumerism 3(3,0)** Exploration of consumer decisions regarding health products and services with emphasis on strategies for decision making. Health majors and minors will be given enrollment priority. *Preq:* Two-semester sequence in science or consent of instructor.

**HLTH 610 Maternal and Child Health 3(3,0)**  
Focuses on key issues concerning the health status and needs of mothers and children. Topics include primary health care, measurement and indicators of health status, health of minorities, role of families, and major programmatic interventions towards the health needs of these two groups.

**HLTH 615 Public Health Issues in Obesity and Eating Disorders 3(3,0)** In-depth review of prevalence, risk factors, consequences, and treatments of obesity and other eating disorders. Focuses on the public health importance of cultural norms, prevention, and early intervention as it relates to obesity and eating disorders. *Preq:* Junior standing in Health Science or consent of instructor.

**HLTH 620 Health Science Internship 1-6(0,3-18)** Under supervision in an approved agency, students have an opportunity for on-the-job experiences. Students are placed in an agency and develop personal/professional goals and objectives appropriate to the setting, population, and health issues. Students create a comprehensive exit portfolio in a digital format. *Preq:* HLTH 419, minimum grade-point ratio of 2.0, Junior standing in Health Science, consent of instructor.

**HLTH 630 Health Promotion of the Aged 3(3,0)**  
Focuses on analysis and evaluation of health issues and health problems of the aged. Emphasis is on concepts of positive health behaviors. Health majors and minors will be given enrollment priority. *Preq:* Developmental psychology; a two-semester sequence in science; or consent of instructor.

**HLTH 650 Applied Health Strategies 3(3,0)**  
Students plan, implement, and evaluate strategies to promote health through individual behavior changes. Both healthful and unhealthful behaviors are included. Examples include smoking cessation, weight management, and stress management. *Preq:* HLTH 480, Health Science major.

**HLTH 698 Improving Population Health 3(3,0)**  
Critical examination of current and emerging issues in improving public health practice and population health. Covers examples in empirical and applied research, revealing future trends in population health. Health majors and minors will be given enrollment priority. *Preq:* HLTH 240, 298, 380, or consent of instructor.

**HLTH 802 Health Economics 3(3,0)** Provides in-depth exposure to economic concepts and theory as applied to the health services sector. Topics include health-care demand and supply analysis, consumer behavior, production and costs, perfect competition vs. health-care competition, price discrimination, and regulation. *Preq:* Undergraduate course in principles of economics.

**HLTH (MICRO) 809 Epidemiological Research 3(3,0)** See MICRO 809.

**HLTH 810 Health Policy 3(3,0)** Provides experience in analysis of decisions in health-care management policy, problems, resources, and alternative courses of action for health service organizations. Students participate in analysis of organization objectives and means for achieving health service goals. *Preq:* HLTH 807 or M B A (FIN) 807, M B A 803, 806, 808, MGT (M B A) 809 or equivalent.

## HEALTH ADMINISTRATION

**M H A 717 Selected Topics in Health Administration 1-3(1-3,0)** Variable topics are taught to reflect current state-of-the-art issues. May be repeated for a maximum of six credits, but only if different topics are covered.

**M H A 719 Health Care Management 3(3,0)**  
Focuses on the structure and function of the well managed and appropriately led acute care hospital. Other health service organizations are also considered, and general management and operations theory are discussed.

**M H A 721 Health Care Delivery Systems 3(3,0)**  
Overview of the development of the health services delivery system in the United States.

**M H A 722 Health Behavior and Epidemiology 2(2,0)** Focuses on understanding the health behavior of a population and individuals. Introduces the concept of the health status of a population and discusses both methods of measurement and sources of data.

**M H A 724 Health Care Ethics 3(3,0)** Examination and analysis of the professional standards, laws, and political and economic forces that establish a context for health care ethics.

**M H A 732 Outcomes Assessment and Evaluation in Health Services 3(3,0)** Introduces the general application of evaluative research in a variety of health care settings, administrative purposes of evaluation of organizational components and/or programs, and the design and implementation of evaluative efforts.

**M H A 735 Health Law and Risk Management 2(2,0)** Introduces legal concepts and issues related to health care management.

**M H A 741 Seminar in Community and Rural Health 3(3,0)** Introduces community health planning concepts and explores methods and the unique aspects of rural health among the population residing there.

**M H A 743 Managing with Health Professionals 3(3,0)** Devoted to learning about clinical professionals and exploring ways to facilitate effective and efficient team relationships in the management and delivery of health services.

**M H A 752 Health Administration Field Project 3(3,0)** Provides an opportunity to apply principles, theories, and concepts to a well-defined problem or issue currently confronting the health service administrator.

**M H A 853 Seminar in Health Administration and Leadership 2(2,0)** Integrates knowledge and skills acquired across all courses in the context of strategic management.

## HEALTH, EDUCATION, AND HUMAN DEVELOPMENT

**HEHD 800 Theories of Youth Development: An Applied Perspective 3(3,0)** Examines theories of positive youth development with an emphasis on how to apply them to "real world" issues facing young people. Students explore existing models, read theoretical and applied literature, and examine current social changes that impact positive youth development.

**HEHD 801 Child and Adolescent Development 3(3,0)** Focuses on child and adolescent development emphasizing a strength-based approach. Students develop an understanding of early childhood and adolescent growth and development from a social, cultural, and psychological perspective.

**HEHD 802 Youth Development Programming in a Contemporary Society 3(3,0)** Focuses on programs and administrative policies and procedures that govern youth development programs at the local, state, and national levels. Model programs emphasizing "best practices" are studied. A cross-sectional approach is used to examine assets and protective factors in the contexts of family, school, and community.

**HEHD 803 Creative and Ethical Leadership in a Changing Society 3(3,0)** Focuses on the development of leadership skills and group dynamics in program development and supervision of staff and volunteers. Students engage in listening, empowerment, and process skills utilizing the latest approaches in the field of communications. Professional ethics related to human service professionals are integrated.

**HEHD 804 Assessment and Evaluation of Youth Programs 3(3,0)** Focuses on developing knowledge of rationale, procedures, and tools for conducting intake, needs, and environmental assessments of youth, families, and communities. Effective skills for mastering comprehensive program evaluation strategies are taught. Students explore statistical packages specifically appropriate for evaluation of youth programs.

**HEHD 805 Youth Development in the Context of Family 3(3,0)** Focuses on youth development in the context of family development and interpersonal relationships. Students gain knowledge and skills in development issues and family functioning. Students become aware of and respect diverse family structures, parental involvement, and the influence of culture and ethnicity on family dynamics.

**HEHD 806 Youth Development in the Context of a Global and Diverse Society 3(3,0)** Focuses on specific circumstances and issues related to youth in at-risk environments. Students learn methods, strategies, and techniques to address diversity issues (i.e. racial, ethnic, gender, disability, sexual preference). Issues of poverty, mass culture, physical environment, etc. are examined globally.

**HEHD 807 Internship in Youth Development 3(0,9)** Practical experience in youth-serving agencies/organizations. Students are required to complete a minimum of 150 hours of experiential education in a supervised setting. Upon approval, exceptions are given to students with experience working in youth-related fields. To be taken Pass/Fail only. *Preq:* Consent of program coordinator.

**HEHD 808 Grantsmanship 3(3,0)** Students conduct searches to identify youth-related funding sources. They write proposals to include purpose, rationale, background information, literature review, identification of collaborators/partners, budget, budget justification, and human subjects review. *Preq:* Admission into the MS in Youth Development Program.

**HEHD 892 Master's Project 3(0,9)** Students conduct evaluative research projects to include writing an article for submission to a professional journal. Students present articles to instructor for review. To be taken Pass/Fail only. *Preq:* Consent of program coordinator.

## HISTORIC PRESERVATION

**H P 610 History and Theory of Historic Preservation 3(3,0)** Survey history of preservation that explores a variety of theoretical issues that impact the discipline. Provides a basis for critical evaluation of historic preservation. *Preq:* Three semesters of Art and Architectural History or equivalent or consent of instructor.

**H P 611 Research and Documentation in Historic Preservation 3(3,0)** Introduction to documenting and recording historic buildings and landscapes. Charleston and its environs provide case study projects for archival research, field investigation, and preparation of final documentation. *Preq:* Three semesters of Art and Architectural History or equivalent or consent of instructor.

**H P 612 Materials and Methods of Historic Construction 3(3,0)** Survey of traditional materials and methods of construction in America from the 18<sup>th</sup> through the early 20<sup>th</sup> century. Scientific examination of historic construction provides case studies. *Preq:* Three semesters of Art and Architectural History or equivalent or consent of instructor.

**H P 800 Historic Preservation Internship 1-3(1-6, 3-18)** Six credits of approved internship in Historic Preservation are required during the course of the graduate program and can be completed in one summer of the program. May be repeated for a maximum of six credits. To be taken Pass/Fail only. *Preq:* Consent of supervising faculty.

**H P 801 Legal and Economic Issues in Historic Preservation 3(3,0)** Examines historic preservation against the backdrop of contemporary legal and economic issues. *Preq:* ARCH 405, H P 410, 411, 412; or consent of instructor.

**H P 802 Historic Preservation Research Seminar 3(3,0)** Advanced documentation and analysis of historic resources in preparation for thesis project. *Preq:* H P 801, 805.

**H P 803 Advanced Materials and Methods in Conservation 3(3,0)** Advanced study of historic building materials and conservation techniques. *Preq:* H P 805. *Coreq:* H P 810.

**H P 804 Management and Administration of Historic Preservation 3(3,0)** Praxis on the management of historic properties with emphasis on administering a preservation project in the field and establishing a maintenance program for a historic property. *Preq:* H P 810.

**H P 805 Preservation Studio 6(0,18)** Examines Charleston and its environs through the development of a comprehensive preservation project for a specific site. *Preq:* ARCH 405, H P 410, 411, 412. *Coreq:* H P 801.

**H P 810 Conservation Lab in Historic Preservation 6(0,18)** Conservation of historic materials on site and in the lab. *Preq:* H P 805. *Coreq:* H P 803.

**H P 811 Readings in Historic Preservation 3(3,0)** Critical overview of the history, development, and current practice of historic preservation focusing on the United States. Topics include American and European perspectives; the development of preservation as a profession; current theory and practice; and the use, abuse, and fetishization of history. *Preq:* Enrollment in MS or certificate program in Historic Preservation.

**H P 833 Cultural and Historic Landscape Preservation 3(3,0)** Overview of cultural historic landscape preservation principles and practices. Includes inventory and analysis of historic resources from a cultural landscape perspective. Qualities of integrity are studied in correspondence to location, design, setting, materials, workmanship, and feeling and association. *Preq:* Enrollment in MS in Historic Preservation program or consent of instructor.

**H P 891 Thesis Research 1-6** Thesis proposals are defended in the third semester and completed as a multimedia project in the fourth semester of the program. Projects using the historic resources of Charleston and its environs, or other suitable historic sites, are encouraged. To be taken Pass/Fail only. *Preq:* H P 802, 810.

## HISTORY

**HIST 600 Studies in United States History 3(3,0)** Topics and problems in the history of the United States from the Colonial era to the present.

**HIST 620 History and Film 3(2,3)** Analyzes the role of the cinema in the construction and dissemination of history.

**HIST 624 Topics in History of Medicine and Health 3(3,0)** Selected topics in the development of medicine and health care including public attitudes towards health and medicine.

**HIST 636 The Vietnam Wars 3(3,0)** Wars in Vietnam are seen in two phases. The First Indochina War, 1946–54, is covered briefly. Main body of the course covers the Second Indochina War, which began as a guerrilla conflict in 1959–60 and ended as a mostly conventional war in the Communist victory of 1975.

**HIST 638 Problems in African Historiography and Methodology 3(3,0)** Concentrates on major issues in the field of African history with an additional focus on methodological concerns.

**HIST 640 Studies in Latin American History 3(3,0)** Consideration of selected and varied topics in Latin American history through readings, class discussions, and individual or group projects. Special attention is given to the use of an inquiry or problem-solving method of historical analysis and to the cultivation of a comparative perspective.

**HIST 651 Alexander the Great 3(3,0)** Focuses on the career of Alexander the Great and deals with the history and archaeology of ancient Macedonia.

**HIST 660 Studies in British History 3(3,0)** Examination of selected themes, topics, or periods in British history from Anglo-Saxon times to the present.

**HIST 670 Studies in Early European History 3(3,0)** Studies of selected topics or themes in European history from the fall of the Roman Empire to the age of industrialization.

**HIST 671 Studies in Modern European History 3(3,0)** Study of selected topics or problems in European history from the end of the Old Regime to the present.

**HIST 691 Studies in the History of Science and Technology 3(3,0)** Selected topics in the development of science and technology, with emphasis on their social, political, and economic effects.

**HIST 692 Studies in Diplomatic History 3(3,0)** Selected topics and problems in international conflict and conflict resolution among nations. Concentration is usually on 20<sup>th</sup> century history.

**HIST 693 Studies in Social History 3(3,0)** Studies in the ways people have earned their livings and lived their lives, individually and as communities, in the confines of different societies.

**HIST 694 Studies in Comparative History 3(3,0)** Selected topics in comparative history, contrasting and comparing similar historic developments in different nations, geographic areas, or civilizations.

**HIST 695 Studies in the History of Ideas 3(3,0)** Selected topics and themes in the development of ideas that have had an impact on the behavior of individuals and civilizations.

**HIST 696 Studies in Legal History 3(3,0)** Selected problems in the development of law and the system of criminal and civil justice.

**HIST 710 United States Since 1865 3(3,0)** Problems in U.S. history since 1865 with attention given to bibliography and teaching methods. Primarily for Master of Education candidates, but open to all graduate students. May be repeated with consent of graduate program director.

**HIST 775 Europe Since the 18<sup>th</sup> Century 3(3,0)** Problems in European history since 1700 with attention given to bibliography and teaching methods. Primarily for Master of Education candidates, but open to all graduate students. May be repeated with consent of graduate program director.

**HIST 800 Seminar in United States History 3(3,0)** Training in historical research and writing. May be repeated for credit with consent of graduate program director.

**HIST 810 Culture and Society 3(3,0)** Training in historical research and writing with a focus on the social and cultural underpinnings of U.S. history. May be repeated for credit as topics change with consent of graduate program director.

**HIST 820 American Historiography 3(3,0)** Graduate seminar designed to familiarize students with the major overarching themes, scholarly interpretations, and issues of American history that historians have presented over the last century.

**HIST 830 Seminar in Asian History 3(3,0)** Training in historical research and writing with focus on Asian history. May be repeated for credit with consent of graduate program director.

**HIST 840 Seminar in Latin American History 3(3,0)** Training in historical research and writing with focus on Latin American history. May be repeated for credit with consent of graduate program director.

**HIST 860 Seminar in British History 3(3,0)** Training in historical research and writing with focus on British history. May be repeated for credit with consent of graduate program director.

**HIST 870 Seminar in European History 3(3,0)** Training in historical research and writing with focus on European history. May be repeated for credit with consent of graduate program director.

**HIST 872 Issues and Methods in European and Non-Western History 3(3,0)** Seminar discussion of contemporary approaches to European and non-Western history; exploration of theoretical and empirical debates.

**HIST 880 Special Topics in History 3(3,0)** Training in historical research and writing. May be repeated for credit with consent of graduate program director.

**HIST 881 Historiography 3(3,0)** Seminar discussion of contemporary approaches and methodologies used by historians; exploration of current debates over major issues confronting the discipline of history.

**HIST 885 Independent Study 3(3,0)** Critical study of a historical topic, selected according to needs of the student and with approval of graduate program director. May be repeated for credit with consent of graduate program director.

**HIST 887 Archival Management: An Introduction 3(3,0)** Introduction to basic concepts of archival theory and management.

**HIST 890 Thesis Prospectus Workshop 1(1,0)** Workshop to help students prepare for writing their master's thesis by producing a prospectus that includes historiographical argumentation and sources.

**HIST 891 Master's Thesis Research 1-12**

**HIST 893 Practicum in Archival Management 3(0,9)** Hands-on experience in the operations of an archival program, including acquisitions, arrangements, descriptions, conservation, and reference service. *Preq:* HIST 887 or consent of instructor.

**HIST 894 Practicum in Historical Editing 3(3,0)** Practicum for applying methodologies learned in introductory editing course to a specific body of original sources such as family correspondence, diaries, or journals in order to become a historical editor.

## HORTICULTURE

**HORT 606 Nursery Technology 3(2,3)** Principles and techniques in handling nursery crops. Offered spring semester only. *Preq:* HORT 303, 305.

**HORT 612 Advanced Turfgrass Management 3(2,3)** Advanced principles and practices associated with turfgrass management for golf courses, sports fields, sod production, and commercial lawn care. Topics include turfgrass physiology, plant growth and development, construction, turfgrass nutrition, irrigation, drainage, pesticide use and fate, and development of effective management systems. *Preq:* CSENV 202, HORT 212, or consent of instructor.

**HORT 620 Applied Turfgrass Physiology 3(3,0)** Advanced course in turfgrass science and management. Provides the current status and development of turfgrass stress physiology and research. Main topics include temperature, drought, traffic, edaphic stresses, new developments in the turf industry, and environmental stewardship. *Preq:* HORT 212, 213.

**HORT (FOR) 627 Urban Tree Care 3(3,0)** See FOR 627.

**HORT (CSENV) 633 Landscape and Turf Weed Management 3(2,2)** Weed management strategies that include cultural, biological, and chemical methods are studied for landscape and turfgrass areas. Problem-solving skills and herbicide characteristics are emphasized. *Preq:* HORT 212 or consent of instructor.

**HORT 655 Just Fruit 3(3,0)** Students explore the origins, biology, culture, and production of major temperate zone fruits—apples, berries, and cherries to pawpaws, peaches, and pomegranates, the familiar to the forbidden. They discover principles, practices, and technologies employed to grow, protect, and harvest the fruits that feed us from commercial orchards, organic farms, and backyards. *Preq:* HORT 101 or consent of instructor.

**HORT 656 Vegetable Crops 3(3,0)** Principles and practices employed in the commercial growing and marketing of vegetable crops with emphasis on plant characteristics, cultivars, management practices, harvest, quality factors and grading, storage, economic importance, and areas of production.

**HORT 661 Problems in Landscape Design 4(3,3)** Landscape planning for larger residential properties, schools, industrial plants, real estate developments; detailed finished plans; further study of materials used; original problems; field study. Offered spring semester only. *Preq:* HORT 308 or consent of instructor.

**HORT (BIOSC, GEN) 665 Plant Molecular Biology 3(3,0)** Study of fundamental plant processes at both the cellular and molecular levels including genome structure and organization (both nuclear and organellar); regulation of gene expression and its role in cellular and whole-plant processes; transposable genetic elements; applications for biotechnology. *Preq:* Junior standing or consent of instructor, BIOSC 304 or 305; GEN 302.

**HORT 671 Advanced Internship 1-6(0,2-12)** Preplanned work experience under competent supervision in approved agency dealing with horticultural endeavors. Gives advanced students on-the-job learning opportunities to apply acquired knowledge and skills. Monthly reports and final departmental seminar required. Undergraduates may accumulate a maximum of six credits for participation in HORT 271 and/or 471. *Preq:* Junior standing and consent of instructor.

**HORT 672 Garden Experiences in Youth Development 2(1,3)** Exploration of the role of gardening and related outdoor experiences in enhancement of educational development, self-esteem, and pro-social behavior in elementary school children. *Preq:* Senior standing and consent of instructor.

**HORT 701 Horticulture: Plant and Environmental Science 3(2,3)** Scope of South Carolina horticulture and how it affects the quality of life economically and aesthetically; environmental responsibilities; methods of teaching plant principles. Three-day statewide field trip to horticultural industries is included. Not to be taken for credit by graduate students in Horticulture. Offered summer session only.

**HORT 812 Special Problems in Horticulture 1-4(1-4,0)** Research not related to a thesis. May be repeated for a maximum of four credits. *Preq:* Consent of instructor.

**HORT 814 Environmental Plant Stress Physiology 3(2,2)** Environmental stresses associated with water (drought, waterlogging), temperature, light, and air pollution with quantitative treatment of stress effects on plants; mechanisms by which plants may avoid, tolerate, or modify stress effects on plant growth and function at the molecular, cellular, and whole-plant levels. Offered fall semester only. *Preq:* BIOSC 401 and 402 or consent of instructor.

## HUMAN RESOURCE DEVELOPMENT

**H R D 820 Human Performance Improvement 3(3,0)** Theory and practice of both instructional and noninstructional interventions and techniques used to improve human performance in the workplace. Covers fundamentals of human performance improvement, general processes of human performance improvement, and human performance interventions of a noninstructional nature.

- H R D 825 Organizational Performance Improvement 3(3,0)** Provides concepts and skills employed by managers and change agents to promote and sustain productive organizations. Students learn how to perform behavior analysis and management, how to determine criteria for performance appraisals, and how to establish leadership in the workplace. *Preq:* H R D 820, 830.
- H R D 830 Concepts of Human Resource Development 3(3,0)** Theory and practice of contemporary applications of human resource development (HRD) programs; training and development functions; strategies for designing and developing programs; and application of methods, techniques, and resources in the context of changing needs, technologies, demographics, and economic circumstances that create the need for different skills and knowledge in the work force. *Preq:* Consent of instructor.
- H R D (CTE) 845 Needs Assessment for Education and Industry 3(3,0)** Theory and practice of needs assessment activities in human resource development (HRD) programs; importance of the process to the identification of content/curricula topics and the overall training environment; specific methodologies used in the needs assessment process; supportive components of various program planning systems. *Preq:* H R D 830 or consent of instructor.
- H R D (CTE) 846 Applied Public Relations 3(3,0)** Practical and theoretical approaches to problem identification and the development of respective solutions in the public relations process; action and message generation, media development and evaluation of public relations techniques in existing organizations. *Preq:* Employment or ready access to an employer and place of employment; CTE 468 or 668 is desirable.
- H R D (CTE) 847 Instructional Systems Design 3(3,0)** Theory and practice of instructional systems development activities in human resource development (HRD) programs; identification, selection, and organization of subject matter appropriate for competency-based training (CBT) programs; occupational analysis techniques; rationale statements, goals, and objectives; related instructional materials; participant evaluation; and instructional scheduling. *Preq:* H R D (CTE) 845 or consent of instructor.
- H R D 849 Evaluation of Training and Development/HRD Programs 3(3,0)** Theory and practice of evaluation processes related to training and development in human resource development programs; developing a results-oriented approach based on specific criteria or standards; designing instruments; determining program costs; and collecting, analyzing, and interpreting data to ascertain return on investment. *Preq:* AG ED (CTE, ED) 889, H R D (CTE) 847, (CTE) 860 or consent of instructor.
- H R D (CTE) 860 Instructional Materials Development 3(3,0)** Development and application of instructional materials and laboratory activities for training programs in education and industry; reinforcement of instructional training concepts and materials development procedures that are applied across human resource development (HRD) programs. *Preq:* H R D (CTE) 845.
- H R D (CTE) 870 Consulting for Education and Industry 3(3,0)** Theory and practice of external and internal consulting practices in human resource development programs; dynamics of a professional helping relationship; methods and techniques for initiating and terminating consulting relationships; diagnosing client situations; identification, selection, and implementation of alternative problem solutions; evaluation of professional consulting relationships. *Preq:* H R D 830 or consent of instructor.
- H R D 880 Research Concepts and Skills 3(3,0)** Introductory course in research to familiarize human performance improvement professionals with the nature of research and reporting processes and to help develop the necessary criteria to become critical, analytical consumers of published research. *Preq:* H R D 820, 830.
- H R D 882 Knowledge Management for Improved Performance 3(3,0)** Introduction to knowledge management to familiarize students with organizational competencies required to adapt and prosper in a chaotic, global environment. Focuses on contemporary theory, research, and application of knowledge management as a strategy for improving personal and organizational performance. *Preq:* H R D 880.
- H R D 890 Instrumentation for Human Performance Improvement 3(3,0)** Introduction to commercially available instruments used to assess and evaluate human performance in the workplace. Students develop critical judgment skills to determine the adequacy and use of instruments in modern organizations. *Preq:* H R D 880.
- H R D 897 Applied Research and Development 3(3,0)** Study of a specific topic under the direction of a faculty member. Students identify a special problem related to the human resource development profession based on their personal interests, experiences, needs, and goals. *Preq:* Submission of a written proposal, prior approval of advisor, satisfactory completion of 12 hours of graduate H R D courses, AG ED (CTE, ED) 889.

## HUMANITIES

**HUM (ENGL) 656 Literature and Arts of the Holocaust 3(3,0)** See ENGL 656.

## HYDROGEOLOGY

*See courses listed under Geology.*

## INDUSTRIAL ENGINEERING

**I E 600 Honors Thesis 1-6(1-6,0)** Individual or joint research project performed with a faculty mentor or committee of faculty. May be repeated for a maximum of six credits. *Preq:* I E H300 or consent of mentor.

**I E 640 Decision Support Systems in Industrial Engineering 4(3,2)** Design of decision support systems for production and service systems based on operations research models. Use of spreadsheets, databases, and integrated software development environments to implement decision support systems. *Preq:* I E 280; CP SC 161 or I E 220.

**I E 652 Reliability Engineering 3(3,0)** Probabilistic approach to assessing system reliability. Methods for analyzing serial, parallel, and complex systems. Reliability life testing and its acceleration are covered. Essential elements of maintainability are identified and related to system availability. *Preq:* I E 360.

**I E 656 Supply Chain Design and Control 3(3,0)** Industrial engineering aspects of supply chains including design and control of material and information systems. *Preq:* I E 386.

**I E 657 Transportation and Logistics Engineering 3(3,0)** Introduces transportation and logistics systems analysis from both analytical and practical perspectives. Covers methods for identifying level-of-service metrics and measuring system performance. Discusses key aspects of modeling, simulation, and other techniques for economic and quantitative analysis of transportation and logistics planning issues. *Preq:* Senior standing in engineering, science, or management program.

**I E 660 Quality Improvement Methods 3(3,0)** Study of modern quality improvement techniques presented in an integrated, comprehensive context. *Preq:* Junior standing.

**I E 661 Quality Engineering 3(3,0)** Design aspects of quality and the engineer's role in problems of quality in production systems. *Preq:* I E 360.

**I E 662 Six Sigma Quality 3(3,0)** Study of DMAIC (Define, Measure, Analyze, Improve, and Control) elements of Six Sigma, project management, process analysis, quality function deployment, hypothesis testing, gage R&R, data analysis, multivariate analysis, design of experiments, statistical process control, and process capability analysis. *Preq:* EX ST 301, 411, I E 360, MTHSC 301, 302, or 309.

**I E 665 Facilities Planning and Design 3(3,0)** Study of the principles and techniques of facility planning and design. Discusses economic selection of materials handling equipment and integration of this equipment into the layout plan to provide effective product flow in production, distribution, and service contexts. Includes quantitative techniques for evaluation of facilities design. *Preq:* I E 280.

**I E 677 Systems Safety 3(2,3)** Introduces the issue of safety and response to significant events. Provides exposure to and experience in hazard and accident causes and mitigation. Emphasizes current theories applied to large, complex systems. *Preq:* Senior standing.

**I E 682 Systems Modeling 4(4,0)** Modeling of discrete industrial systems using a digital computer. The purpose, theory, and techniques of system modeling are presented. *Preq:* I E 381.

**I E 685 Industrial Systems Engineering 3(3,0)** Modeling and analysis of multistage decision processes, recursive optimization, process and system design, and control problems. *Preq:* I E 280, 381.

**I E 687 Industrial Safety 3(3,0)** Recognition and prevention of hazards; recognition and control of hazardous materials; developing and managing a safety program; designing inherently safe equipment and workplaces. *Preq:* Junior standing.

- I E 688 Human Factors Engineering 3(3,0)** Introduction to human performance and limitations in the design of effective and efficient systems. Covers issues related to changes in technology, impact of design on society, ethical issues in design of systems, and the cost benefits from designing systems and environments that often challenge perceived notions of benefits. *Preq:* Junior standing.
- I E 689 Industrial Ergonomics and Automation 3(2,3)** Physical ergonomics and ergonomics in industrial settings including work physiology, the physical environment, automated systems, and hybrid work systems. *Preq:* I E 210 or Senior standing.
- I E 691 Selected Topics in Industrial Engineering 1-3(0-3,0-9)** Comprehensive study of any timely or special topic in industrial engineering not included in other courses. May be repeated for a maximum of six credits. *Preq:* Consent of instructor.
- I E 800 Human Factors Engineering 3(3,0)** Fundamentals of design for human use; human performance; applications of abilities, and limitations to the design of tools, machines, facilities, tasks, and environments for efficient, safe, and comfortable human use. *Preq:* Consent of instructor.
- I E 801 Design and Analysis of Human-Machine Systems 3(3,0)** Methodologies used in the design and evaluation of human-machine systems including function and task analysis; questionnaires and interviews; scenarios, mock-ups, and prototypes; participative design, empirical testing, and iterative design; models of human-system interaction; analysis and classification of human error; and design of job performance and training aids. *Preq:* Graduate standing and consent of instructor.
- I E 802 Design of Human-Computer Systems 3(3,0)** Issues in designing, implementing, maintaining, and refining the user interface of interactive computer systems including interface design theories, models, principles, and guidelines; interaction styles; input and output devices; system messages; screen design, manuals, on-line help, and tutorials; and iterative design, testing, and evaluation. *Preq:* I E 801 or consent of instructor.
- I E 803 Engineering Optimization and Applications 3(3,0)** Introduction to optimization through the study of problems related to the planning, design, and control of production/manufacturing systems; classical nonlinear optimization and algorithmic procedures, primal and dual problems with postoptimality analysis, Markov chains. *Preq:* Graduate standing and consent of instructor.
- I E 804 Manufacturing Systems Planning and Design 3(3,0)** Concepts and principles associated with the design of manufacturing systems with a focus on modeling and integration methodologies; group technology, process planning, manufacturing modeling, and design for manufacturing. *Preq:* Graduate standing and consent of instructor.
- I E 805 Foundations in Quality Engineering 3(3,0)** Fundamental tools of quality engineering and their application to real situations; advanced statistical process control, design of experiments, Taguchi techniques, and Shainin methodologies. *Preq:* Graduate standing and consent of instructor.
- I E 807 Discrete Systems Simulation 3(3,0)** Constructing computer models to represent existing real-world systems or hypothetical future systems; experimenting with these models to explain system behavior, improve system performance, or design new systems with desirable performances. *Preq:* MTHSC 302 and I E 809 or consent of instructor.
- I E 809 Model Systems Under Risk 3(3,0)** Application of probabilistic methods to engineering problem solving and decision making. Cases are presented illustrating use of Markov chains, queuing processes, and other stochastic models in practice. *Preq:* MTHSC 302 or consent of instructor.
- I E 811 Human Factors in Quality Control 3(3,0)** Aspects of use of the human as a detector of product quality, serving as the basis for a taxonomy of human tasks in inspection; incorporates models of visual search and human decision making within the quality control framework. *Preq:* Graduate standing and consent of instructor.
- I E 812 Work Science and Design 3(3,0)** Design methods for work and work systems; scientific and engineering basis of work and its analysis. *Preq:* Consent of instructor.
- I E 813 Occupational Ergonomics 3(3,0)** Theory and applications of ergonomics at work; human performance, fatigue, stress, work patterns, work environment.
- I E 815 Research Methods in Ergonomics 3(2,2)** Contexts and processes for research in ergonomics with emphasis on engineering problems; scientific and engineering methods; measurement; visual and physical tasks; simulation, laboratory and archival studies. *Preq:* MTHSC 884 or equivalent or consent of instructor.
- I E 860 Dynamic Programming 3(3,0)** Theory and methodology of dynamic programming; Bellman's principle of optimality; Mitten's sufficiency conditions; recursive optimization of serial and nonserial multistage systems; optimization of discrete and continuous systems through decomposition; special aspects of problem formulation. *Preq:* I E 803.
- I E 865 Facility Planning and Design 3(3,0)** Planning and design of industrial facilities emphasizing automated production facilities; quantitative approaches to equipment design and evaluation of performance. *Preq:* I E 803.
- I E 871 Industrial Testing and Quality 3(3,0)** Design and use of component and product tests; automated inspection; test and inspection in integrated systems; cost-based models. *Preq:* I E 661.
- I E 880 Advanced Methods of Operations Research 3(3,0)** Methods and applications of advanced operations research techniques; discrete optimization, integer, and mixed integer programming, Boolean minimization, network optimization, permutization methods on implicit enumeration. *Preq:* I E 803 or consent of instructor.
- I E 881 Metaheuristics 3(3,0)** Survey of selected metaheuristic techniques. Topics may include genetic algorithms and other evolutionary algorithms, tabu search, and simulated annealing. Students implement multiple metaheuristics from problems throughout the semester in a high-level language.
- I E 884 Advanced Engineering Economic Analysis 3(3,0)** Engineering economic analysis for engineering research, development, and construction projects emphasizing detailed treatment of tax effects, methods for determining discount rates, proper use of economic criteria in various decision environments (certainty vs. uncertainty, single vs. multiple project selections, etc.). *Preq:* Consent of instructor.
- I E 886 Operations Research in Production Control 3(3,0)** Latest techniques in scientific inventory management, scheduling, and forecasting; operations research; statistics; computer methods; case studies. *Preq:* I E 803.
- I E 888 Advanced Probabilistic Methods 3(3,0)** Advanced treatment of stochastic optimization, potentially including single and multiple channel queues, Markov programming, and stochastic optimal control. *Preq:* Consent of instructor.
- I E 890 Special Problems in Industrial Engineering 1-3(1-3,0)** Principles and methods of industrial engineering applied to analysis of a current interest problem. May be repeated for a maximum of six credits. To be taken Pass/Fail only. *Preq:* Consent of instructor.
- I E 891 Master's Thesis Research 1-12**
- I E 892 Master's Design Project 3(1,6)** Design project in industrial systems; integration of industrial engineering principles and methodologies; resolution of contemporary systems design problems. Project requires research, development, implementation planning, reporting, and project assessment. *Preq:* Consent of instructor.
- I E 893 Selected Topics in Industrial Engineering 1-3(1-3,0)** Selected topics in industrial engineering emphasizing new developments in systems science, systems analysis, and operations research. May be repeated for credit. *Preq:* Consent of instructor.
- I E 895 Industrial Engineering Research Techniques 1(1,0)** Series of weekly one-hour lectures given by students, faculty, and guests on methods and issues involved in industrial engineering research. To be taken Pass/Fail only.
- I E 971 Advanced Quality Engineering Seminar 3(3,0)** Current topics in the research and development of quality engineering methodologies. *Preq:* I E 871 or consent of instructor.
- I E 991 Doctoral Dissertation Research 1-12**

## INTEGRATED PEST MANAGEMENT

- I P M 601 Principles of Integrated Pest Management 3(3,0)** Origins, theory, and practice of integrated pest management. Relationships among crop production and protection practices are explored. Economics of various control strategies are considered. Integrated pest management field projects are studied. Conventional and integrated pest management approaches are compared. Multidisciplinary plant problem analysis is introduced. *Preq:* CSENV 407, ENT 301, PL PA 310, or consent of instructor.

**I P M 700 Internship in Plant Health 1-5** Professional employment under competent supervision in an approved agency or organization dealing with the vocational or occupational aspects of plant health. During the internship, students submit weekly reports covering the experience. A terminal report is also required. To be taken Pass/Fail only. *Preq:* Second semester graduate standing, I P M 601, consent of instructor.

**I P M 800 Special Problems in Plant Health 1-3(0,3-9)** Directed individual study of a special problem in plant health. Emphasis is on organizing, conducting, and reporting on independent investigation. *Preq:* Consent of instructor.

## LANDSCAPE ARCHITECTURE

**LARCH 605 Urban Genesis and Form 3(3,0)** Exploration of urban forms and developments within their historic context through off-campus, on-site lectures and exposure to historic cities and sites. Students visit historic and contemporary cities and analyze those places through readings and direct observations. Offered Maymester only. *Preq:* LARCH 252 or consent of instructor.

**LARCH 623 Environmental Issues in Landscape Architecture 3(3,0)** Overview of environmental and ecological issues and their relationship to landscape architecture practice and design. *Preq:* LARCH 452 or consent of instructor.

**LARCH 633 Historic Preservation in Landscape Architecture 3(3,0)** Study of historic landscape preservation in a number of contexts including gardens, vernacular landscapes, parks, cemeteries, and battlefields. *Preq:* LARCH 452 or consent of instructor.

**LARCH 643 Community Issues in Landscape Architecture 3(3,0)** In-depth study of issues relevant to community design. Overview of physical design and related social issues. *Preq:* LARCH 452 or consent of instructor.

**LARCH 653 Key Issues in Landscape Architecture 3(3,0)** Overview of research in landscape architecture and study of relevant research methods. Students write proposals for their own projects positioned within the larger context of research in the profession. *Preq:* Fifth-year Landscape Architecture student or graduate student, or consent of instructor.

**LARCH 801 Landscape Architecture Orientation I 6(3,9)** Focused study of design, design theory, and design communication. Assigned readings, lectures, and discussions link those topics to graduate-level explorations of design intervention in the cultural and natural landscape. *Preq:* Students in First Professional MLA program or consent of instructor.

**LARCH 802 Landscape Architecture Orientation II 6(3,9)** Second-semester course of focused study in design, design theory, and design communication. Assigned readings, lectures, and discussions link those explorations to graduate-level study in nature, culture, and design. Explorations begun in LARCH 801 are taken to greater depth and complexity. *Preq:* Students in First Professional MLA program or consent of instructor.

**LARCH 813 Advanced Regional Design 6(3,9)** Advanced study and analysis of natural and cultural landscapes at the regional scale with an emphasis on South Carolina. Includes an exploration of landscape ecology as an informant to design and application geographic information systems. Each student also engages in independent research. *Preq:* Students in Second Professional MLA or MArch program or consent of instructor.

**LARCH 823 Advanced Community Design Studio 6(3,9)** Studio focused on the study of communities. Students engage in a series of design explorations culminating in a mixed-use parcel on a large tract. Includes intensive study of growth and change in the contemporary landscape. New development in southeastern U.S. serves as a laboratory. *Preq:* LARCH 653 or consent of instructor.

**LARCH 830 Graduate Seminar I 3(3,0)** Seminar including reading, writing, and discussion on environmental and social/cultural issues in landscape architecture. Course is grounded in an exploration of the history of landscape architectural theory. *Preq:* LARCH 802 or consent of instructor.

**LARCH 840 Graduate Seminar II 3(3,0)** Graduate seminar in one of the areas of departmental focus: growth and change, health and design, or restoration. *Preq:* LARCH 830 or consent of instructor.

**LARCH 843 Interdisciplinary Design and Research 6(3,9)** Students participate in an interdisciplinary project linked to one of the focus areas in the department: health and design, restoration (environmental or cultural/historical), growth and change. Each student identifies a personal research project related to the larger team project. *Preq:* LARCH 653 or consent of instructor.

**LARCH 850 Graduate Colloquium 3(3,0)** Series of lectures and presentations by graduating students, faculty members, and guest designers and scholars. Students offer reviews and critiques of the various presentations. *Preq:* LARCH 840 or consent of instructor.

**LARCH 853 Advanced Interdisciplinary Design and Research 6(3,9)** Continuation of LARCH 843 with an advanced interdisciplinary project linked to one of the focus areas in the department: health and design, restoration (environmental or cultural/historical), and growth and change. Each student identifies a personal research project related to the larger team project. *Preq:* LARCH 843 or consent of instructor.

**LARCH 890 Directed Studies 1-6(1-6,0)** Special topics and independent research in landscape architecture with faculty guidance. May be repeated for a maximum of six credits. *Preq:* Consent of advisor.

**LARCH 891 Thesis Project 6(1,15)** Complex and sophisticated independent project in landscape architectural research and/or advanced design. *Preq:* LARCH 843 or consent of instructor.

## LANGUAGE

**LANG 600 Phonetics 3(3,0)** Study of basic phonetic concepts used in the study of sounds and language.

**LANG (PO SC) 685 Global Affairs and Governments 3(3,0)** See PO SC 685.

## LAW

**LAW 605 Construction Law 3(3,0)** Provides a practical knowledge of legal principles applied to the construction process and legal problems likely to be encountered by the practicing construction professional. Topics include construction contracting, liability, claims and warranties, documentation, and responsibility and authority of contracting parties. *Preq:* LAW 322 or consent of instructor.

**LAW 620 International Business Law 3(3,0)** Intensive examination of the historical background of modern public and private international law; selected issues of public international law—human rights, law of war, United Nation's system, and international litigation; selected issues of private international law—international sales, international trade, and formation and operation of multinational businesses. *Preq:* LAW 322 or consent of instructor.

**LAW 801 Law for Professional Accountants 3(3,0)** Preparation for professional exams and responsibilities in managerial positions. Topics include professional and legal responsibilities of accountants, business organizations, commercial law, government regulation of business and property. Case studies, problems, and student papers are utilized. *Preq:* LAW 322 or equivalent.

**LAW 848 Law for Real Estate Professionals 3(3,0)** Provides the real estate professional with the fundamentals of law as it applies in the real estate arena. Explores the various legal forms of ownership, the form and process of real estate transactions, and governmental regulation of land use. *Preq:* Graduate standing or consent of instructor.

## M B A

See courses listed under Business Administration.

## MANAGEMENT

**MGT 803 Operations Management 3(3,0)** Introduction to a broad range of operations management topics. Serves as a foundation for understanding the importance, relevance, and significance of analytical models and tools to be introduced in subsequent courses in the MS in Management program. Topics include operations strategy, process and facility design, planning and control, quality management, and continuous improvement. Offered fall semester only.

**MGT 804 Operations Strategy 3(3,0)** In-depth study, through case studies and readings, of the role operations systems capabilities play in providing sources of competitive advantage. Topics include industry analysis, technological forecasting, formulation of organization and operations strategies, and development of operations system capabilities. *Preq:* MGT 803 or consent of instructor. Offered fall semester only.

**MGT 806 Industrial Management Internship 0** Faculty-approved internship to give MS in Management students on-the-job learning in support of classroom education. Internships must be at least six, full-time, consecutive weeks with the same internship provider. May be repeated. *Preq:* Consent of graduate coordinator.