

- EE&S 820 Environmental Systems Analysis 3(3,0)** Analysis of a systems view of environmental problems, with particular emphasis on conflicting objectives such as economic and environmental concerns. Example problems span traditional environmental engineering processes, natural resources, proactive environmental management and sustainability. *Preq:* MTHSC 311 or consent of instructor.
- EE&S 832 Air Pollution Meteorology 3(3,0)** Applications of meteorology to air pollution; micro-meteorology; plume rise modeling; atmospheric diffusion; deposition and washout of pollutants; air chemistry; applications of diffusion modeling to air quality planning. *Preq:* Consent of instructor.
- EE&S 833 Air Pollution Control Systems 3(3,0)** Principles and design of air pollution control equipment including mechanical collectors, electrostatic precipitators, baghouse filters, wet scrubbers, adsorbers and incinerators. Offered spring semester only. *Preq:* EE&S 430 or consent of instructor.
- EE&S 834 Particles in the Atmosphere 3(3,0)** Chemical and physical behavior of atmospheric particles and their interaction with other particles, gases and light; generation, measurement methods and control strategies of atmospheric particles. *Preq:* EE&S 630, MTHSC 208, or consent of instructor.
- EE&S 837 Biodegradation and Bioremediation 3(3,0)** Basic principles of biodegradation for major classes of organic contaminants including halogenated aliphatics and aromatics, fuel hydrocarbons, pesticides and nitrated energetic compounds; biotransformations of metals; biodegradation principles applied to the development of bioremediation technologies including intrinsic, in situ and on-site engineered approaches. *Preq:* EE&S 851.
- EE&S 842 Actinide Chemistry 3(3,0)** Chemical and physical aspects of actinide metals and compounds (including properties, structure and bonding, reactions, kinetics, thermodynamics), coordination and solution chemistry, behavior and speciation in the environment, separation and purification, chemistry of the nuclear fuel cycle and waste treatment and related topics; fundamental concepts, history and recent developments. *Preq:* CH 402, MTHSC 208, PHYS 221, or consent of instructor.
- EE&S 843 Environmental Chemistry 3(3,0)** Principles of chemical kinetics and thermodynamics applied to fundamental understanding of aqueous environmental samples including natural waters, wastewaters and treated waters; factors controlling chemical concentrations, acid-base equilibria, solubility equilibria, complex formation, electrochemistry, adsorption phenomena. Offered fall semester only. *Preq:* CH 102 or equivalent.
- EE&S 844 Environmental Chemistry Laboratory I 3(2,3)** Laboratory experience in basic analytical methods used in water quality studies; experimental design, sampling, wet-chemical analytical techniques, data collection and analysis, data interpretation and data quality techniques. Offered fall semester only. *Preq:* Two semesters of general chemistry.
- EE&S 845 Environmental Organic Chemistry 3(3,0)** Application of parameters that describe the equilibrium distribution and exchange rates for environmentally significant organic compounds to the modeling of processes in engineered and natural systems, including environmental parameter estimation techniques, structure-activity relationships and integration of environmental processes to model contaminant distribution and residence time in environmental systems. Offered spring semester only. *Preq:* Two semesters of general chemistry, EE&S 843 or equivalent.
- EE&S 847 Advanced Environmental Chemistry 3(3,0)** Advanced principles and methods in environmental engineering chemistry with applications to both natural and treatment systems; current investigative and study techniques; nature, fluxes and controlling processes of chemical species and radionuclides in environmental systems. *Preq:* EE&S 843 or equivalent.
- EE&S 849 Environmental Chemistry Laboratory II 3(1,6)** Theory and applications of instrumental methods of analysis as applied to measurements for environmental control; spectroscopy and spectrophotometric techniques; electrochemical analyses; chromatographic methods of analysis; light scattering and electrophoretic measurements. Offered fall semester only.
- EE&S 850 Stream and Estuarine Analysis 3(3,0)** Physical, chemical and biological processes and relationships which exist in streams and estuaries; estuarine environment; free-flowing streams; mechanisms describing transport of conservative and nonconservative materials through estuarine systems; the estuary as a resource and techniques for its management. Offered fall semester only.
- EE&S 851 Biological Principles of Environmental Engineering 3(3,0)** Basic principles of biology and biochemistry as applied to problems of environmental control and wastewater treatment; kinetic and energetic aspects. Offered fall semester only.
- EE&S 852 Subsurface and Wetland Hydraulics 3(3,0)** Hydraulics of subsurface water including hydraulic head and gradient concepts, Darcy's Law, saturated/unsaturated flow, flow in aquifers and aquitards, flow to wells and interactions with surface water in wetlands including discharge and development of seepage faces. Mathematics is at the level of elementary ordinary and partial differential equations. *Preq:* Differential equations, fluid mechanics or EE&S 802 or consent of instructor.
- EE&S 855 Surface and Subsurface Transport 3(3,0)** Quantitative analysis of reactive transport and biodegradation in ground water and surface water; applications of the advection-dispersion equation with reaction terms including classical chemical reactions, radioactive decay and reactions mediated by microbes. *Preq:* C E 340 and MTHSC 208 or equivalent.
- EE&S 856 Pollution of the Aquatic Environment 3(3,0)** Effects of domestic and industrial water pollution on the physical, chemical and biological characteristics of natural waters; associated environmental determinants of human disease, toxicology and epidemiology of chronic disease. Offered fall semester only.
- EE&S 861 Environmental Engineering and Science Seminar 1(1,0)** Current advances and research developments in various areas of environmental engineering and science. Off-campus speakers, students and faculty participate. To be taken Pass/Fail only.
- EE&S 880 Environmental Risk Assessment 3(3,0)** Methodology of quantitative risk assessment including identification and quantification of the source term, calculation of environmental transport and estimation of health effects. Applications involve various classes of contaminants in atmospheric and aquatic environmental pathways. Offered spring semester only. *Preq:* MTHSC 208, graduate standing in engineering or science.
- EE&S 881 Special Problems 1-4** Problems selected to meet interests and experiences of student and instructor.
- EE&S 883 Selected Topics in Environmental Engineering 1-4(1-4,0)** Topics in environmental engineering not covered in other courses. Topics vary to keep pace with current developments. May be taken concurrently with EE&S 884, which (if offered) would be a different topic.
- EE&S 884 Selected Topics in Environmental Engineering 1-4(1-4,0)** Topics in environmental engineering not covered in other courses. Topics vary to keep pace with current developments. May be taken concurrently with EE&S 883, which (if offered) would be a different topic.
- EE&S 891 Master's Thesis Research 1-12**
- EE&S 961 Environmental Engineering and Science Doctoral Student Seminar 1(1,0)** Current advances and research developments in various areas of environmental engineering and science. Doctoral students are required to enroll each semester that the course is offered and present one seminar per year. To be taken Pass/Fail only.
- EE&S 991 Doctoral Dissertation Research 1-12**
- ## ENVIRONMENTAL SCIENCE AND POLICY
- EN SP 672 Environmental Planning and Control 2(2,0)** Application of planning and control to effective environmental quality improvement. Water supply and treatment, wastewater treatment and disposal, solid waste disposal, air pollution abatement, and land use and zoning are considered from the standpoint of control. Not intended for graduate students in engineering. *Preq:* Consent of instructor.
- ## ENVIRONMENTAL TOXICOLOGY
- ENTOX 600 Wildlife Toxicology 3(3,0)** Assessment of impacts of toxic substances on reproduction, health and well-being of wildlife species; acute and chronic effects of agricultural chemicals, pesticides, hazardous waste, industrial waste and oil releases are discussed. *Preq:* BIOCH 305 or organic chemistry, one year of general biology, W F B 350 or consent of instructor.

ENTOX 621 Chemical Sources and Fate in Environmental Systems 3(3,0) Chemical cycles in the environment are discussed on global and microcosm scales. The dependence of fate processes on physical and chemical properties and environmental conditions is examined. Breakdown, movement and transport of selected toxicants are addressed to illustrate the mechanisms that govern chemical fate. *Preq:* Organic and analytical chemistry or consent of instructor.

ENTOX (ENT) 630 Toxicology 3(3,0) Basic principles of toxicology including quantitation of toxicity, toxicokinetics, biochemical action of poisons and environmental toxicology are studied. Acute and chronic effects of various classes of poisons are discussed (e.g., pesticides, drugs, metals and industrial pollutants) in relation to typical routes of exposure and regulatory testing methods. Offered fall semester of odd-numbered years only. *Preq:* Organic chemistry, one year of general biology, or consent of instructor.

ENTOX 637 Ecotoxicology 3(3,0) Study of the effects of stressors on the ecosystem. Explores the integrative relationships that comprise the field of ecotoxicology in a hierarchical format that focuses on the various levels of ecological organization. *Preq:* ENTOX 430 or consent of instructor.

ENTOX (CSENV, GEOL) 685 Environmental Soil Chemistry 3(3,0) See CSENV 685.

ENTOX 801 Advanced Wildlife Toxicology 3(1,6) Interactions between chemical contaminants and wildlife species focusing on effects at the organismal, species, trophic, community and ecosystem level. Field and laboratory techniques that professional wildlife toxicologists use are emphasized. *Preq:* ENTOX 400, 430.

ENTOX (BIOSC) 811 Immunotoxicology 3(3,0) Study of how environmental contaminants, drugs and natural biotoxins affect the immune system of man and animals; cellular and molecular mechanisms of action by immunotoxic agents. *Preq:* AVS 825, ENTOX 630, consent of instructor.

ENTOX 822 Analytical Toxicology Laboratory 3(1,6) Laboratory instrumentation, procedures and experimental methods used for identification and quantitation of toxic substances and their transformation products in environmental and biological samples; application of these procedures in the isolation, detection and quantitation of toxicants in authentic samples. *Preq:* Organic and analytical chemistry or consent of instructor; instrumental analysis recommended.

ENTOX (BIOSC) 830 Mechanistic Toxicology 3(3,0) Detailed biochemical toxicology: control, regulation and activity of metabolic enzymes; molecular and cellular mechanisms of toxic action; proposed mechanisms for initiation and development of cancer; mode of action and kinetics of cholinesterase inhibitors; structure/activity relationships of ion channel blockers; biochemical and molecular biomarkers. *Preq:* ENTOX (ENT) 430.

ENTOX (BIOSC) 831 Biomarkers in Toxicology 3(1,6) Methodology used in biomarker identification and evaluation of the effects of toxic substances on living systems using biomarkers in sentinel organisms and surrogate biomarkers. *Preq:* Organic chemistry and biochemistry with laboratory; ENTOX 400 or (ENT) 430; or consent of instructor.

ENTOX 841 Procedures and Techniques in Ecological Risk Assessment 2(1,3) Evaluation and application of the procedures and techniques used in ecological risk assessments, including laboratory and field methods, to determine, measure and evaluate the risks to aquatic, terrestrial and avian species; impacts to biota within, and resulting from, chemical waste disposal facilities and hazardous waste sites. *Preq:* CH 223, 224, 313; EX ST 804 or 805; ENTOX (ENT) 630; or consent of instructor.

ENTOX 852 Ecological Models 3(2,3) Systems analysis applied to ecology; construction of models which predict ecological consequences of stresses to the environment; frequency response analysis, energy models, information flow, and transfer functions for population interactions. *Preq:* Course in ecology and in computer programming or consent of instructor.

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 602 Introduction to Statistical Computing 3(3,0) Introduction to statistical computing packages. Topics include data importation, basic descriptive statistic computation, basic graphic preparation, and statistical analysis methods and procedures. *Preq:* EX ST 301.

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.

EX ST 815 Environmental and Ecological Statistics 3(3,0) Overview of statistical techniques in Environmental Science and Ecology. Probability distributions and sampling; population estimation using capture/recapture, line transect and line intercept methods; spatial point pattern analysis; modelling environmental and ecological data; environmental monitoring. *Preq:* EX ST 801 and 803 or consent of instructor.

EX ST 816 Spatial Statistics 3(3,0) Introduction to spatial data analysis emphasizing concepts and interpretation, spatial point processes, clustering, spatial autocorrelation, semivariograms, kriging, spatial regression and analysis of variance. *Preq:* EX ST 801 and 803 or consent of instructor.

EX ST 817 Multivariate Statistics in Agriculture, Forestry and Natural Resources 3(3,0) Application of multivariate techniques for linear models (MANOVA, Hotellings T²), covariance structure (principal components, factor analysis), classification (discriminant and cluster analyses) and structural equation modeling drawing examples from life sciences, natural resources, tourism and related programs. *Preq:* EX ST 801 and 803 or consent of instructor.

EX ST 819 Biostatistics 3(3,0) Statistical analyses applicable to disease/mortality occurrence. Introduction to epidemiology study designs and appropriate statistical analyses. Statistical methodology applicable to life-tables and survival curves and clinical trials. *Preq:* EX ST 801.

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:* 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 610 Food Product Development 4(3,3) A strategic and systems approach to integrated product development practices for developing new food products within a team setting. Focuses on the Stage-Gate process for moving from product idea to launch and application of sensory analysis techniques.

FD SC 630 Dairy Processing and Sanitation 3(2,3) Processing, manufacture and distribution of fluid, frozen, cultured and other dairy products. Emphasizes sanitation in a commercial food processing plant environment, chemical and microbiological aspects, processing procedures, equipment operation, ingredient applications, formulation and functional properties. *Preq:* BIOL 104/106, CH 102.

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 608 Wood and Paper Products 3(3,0) Study of wood structures and identification; physical and mechanical properties of wood products; standard testing procedures; manufacture of lumber, plywood, oriented strand board; drying, preservation, grading and use of wood products. Also discusses common grades of paper and paperboard; fiber sources; pulping and paper-making equipment and processes; chemical recovery process; and environmental issues. *Preq:* Junior standing or consent of instructor.

FOR 610 Harvesting Processes 4(3,3) Study of forest harvesting processes with detailed analysis of production, cost, environmental impacts, safety, transportation and business considerations. *Preq:* Senior standing or consent of instructor.

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 (EN R) 616 Forest Policy and Administration 3(3,0) 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 forest 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 (E N R) 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) Classical and computational genetics topics, including Mendelian vs. non-Mendelian inheritance, genetic variation, evolutionary, conservation, coalescent theory, molecular evolution, quantitative trait locus, and association mapping in the framework of population and quantitative genetics. *Preq:* EX ST 301, GEN 302, or consent of instructor.

- GEN 611 Fundamentals of Genetics I Laboratory 2(0,4)** Crosses are performed using eukaryotic organisms with appropriate markers, and molecular markers are amplified, sequenced and analyzed. Collected data are used to test hypotheses regarding possible modes of inheritance and for patterns of molecular evolution. Population and molecular evolutionary genetics concepts are also examined. *Preq:* GEN 410 or concurrent enrollment, or consent of instructor.
- 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)** Molecular genetics, including replication, transcription and translation, gene expression, recombinant DNA technology, developmental, human, cancer and behavioral genetics. *Preq:* BIOCH 301 or concurrent enrollment, GEN 302, or consent of instructor.
- GEN (BIOCH) 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 Molecular Evolution and 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 socioeconomic 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 litho-stratigraphy 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 659 Biogeochemistry 3(3,0)** Examines how biology directs mass and energy transfer between the lithosphere, biosphere, hydrosphere and atmosphere. The scale of examination ranges from molecular to global. Topics include element cycling, mineral-microbe/plant interface, biomining, and biogeochemical applications to bioremediation, ecology, environmental toxicology and biotechnology. *Preq:* CH 102 or GEOL 318 or consent of instructor.
- GEOL (CSENV, ENTOX) 685 Environmental Soil Chemistry 3(3,0)** See CSENV 685.
- 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. *Preq:* G C 165, 310, 350; concurrent enrollment in G C 606; 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 die cutting for label, folding cartons and corrugated; and glass, plastic and metal container printing. *Preq:* G C 165, 310, 350; concurrent enrollment in G C 605; or consent of instructor.

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 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 600 Introduction to Leadership Theories and Concepts 3(2,1) Interdisciplinary course introduces students to the nature of leadership. Students gain a broad understanding of the history and origins of leadership, theoretical approaches to leadership and the essence of contemporary leadership. Students are encouraged to test their ability to apply these concepts to life experiences. *Preq:* Junior standing or consent of instructor.

HEHD 610 Leadership Behavior and Civic Engagement 3(2,1) Students couple concepts of social justice and civic engagement with theoretical foundations from HEHD 400 to complete a comprehensive theory-to-practice project. Introduces students to a comprehensive leadership skill set to become active change agents for the common good. *Preq:* HEHD 400.

HEHD 620 Leadership Application and Experience 3(2,3) Immerses students in a practical leadership experience utilizing knowledge and skills gained in HEHD 400 and 410. Students identify an issue or problem and practice leadership by developing and implementing a community project. Challenges students to commit themselves to long-term engagement as agents of change. *Preq:* HEHD 410.

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 to MS in Youth Development Leadership Program.

HEHD 809 Management of Staff and Volunteers 3(3,0) Examines approaches and strategies for successful management and development of staff and volunteers in youth-serving organizations, including effective organizational systems and working with boards and advisory committees. Covers business and organizational principles and practices for success as well as challenges of recruiting, supervising and retaining staff and volunteers. *Preq:* Youth Development Leadership major or consent of instructor.

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 Archival Research and Oral History in Historic Preservation 3(3,0) Introduction to historic buildings and landscapes research. Emphasizes researching the physical and social history of buildings and places. Charleston and its environs provide case study projects for archival research.

H P 612 Materials and Methods of Historic Construction 3(3,0) Survey of traditional materials and methods of construction in America from the 18th through the early 20th 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 806 Society and Culture of Early Charleston 3(3,0) Examines the society and culture of early Charleston (c. 1670–1861) through a localized analysis of important topics in American social/cultural history. Topical study is applied to an investigation of extant Charleston buildings and urban fabric. *Preq:* H P 610 or consent of instructor.

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 819 Investigation, Documentation and Conservation 3(3,0) Through study and application of the Historic American Buildings Survey, the standard method for creating baseline documents, students gain experience in the best investigation and documentation techniques. The method is applied to various structures located in Charleston's historic district. Students also gain a base understanding of conservation practices and techniques.

H P 823 Historic Interiors 3(3,0) Students gain familiarity with American interiors and decorative arts from early European settlement through the late 19th century. They consider periodization and documentation of the structure, finishes, decorations and the material culture of those structures with emphasis on the interpretation of primary documents: inventories, pattern books, accounts, paintings and prints.

HP 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 859 Professional Project in Historic Preservation 3(3,0) Professional project is a thesis alternative that provides students with a more flexible presentation of their research to reflect essential preservation knowledge and skills. Students work directly with their committees to complete projects requiring a flexible presentation such as documentation drawings and other methods germane to historic preservation. *Preq:* Consent of advisor.

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

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 650 Studies in Ancient History 3(3,0) Selected topics in ancient history ranging from pre-Biblical times to the fall of the Roman Empire. May be repeated once for credit with departmental consent.

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 20th 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 18th 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) Pre-planned 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.