ENT 870 Insect Physiology and Molecular Biology 4(3,3) Advanced instruction on the structure and function of insect physiological processes at the molecular, cellular and tissue levels; physiological and molecular mechanisms underlying the various internal systems of insects. Laboratory emphasizes hands-on experimentation and the scientific writing technique to report experimental findings. Prq: BIOL 111, CH 223, ENT 301, 495, or consent of instructor.

ENT 891 Master’s Thesis Research 1-12

ENT 991 Doctoral Dissertation Research 1-12

ENVIRONMENTAL AND NATURAL RESOURCES

E N R (BIOSC) 613 Restoration Ecology 3(3,0) Applies ecological principles to the restoration of disturbed terrestrial, wetland and aquatic ecosystems. Includes the restoration of soils and waterways, flora and fauna and of natural ecological processes such as plant succession and nutrient cycling. Prq: Introductory course in ecology or conservation biology, consent of instructor.

E N R (FOR) 616 Forest Policy and Administration 3(3,0) See FOR 616.

E N R 629 Environmental Law and Policy 3(3,0) Develops an understanding of the three branches of government that affect and dictate use and protection of natural resources. Attention is given to major federal environmental statutes. Includes examination of how policy is developed, implemented and evaluated in the public and private sectors. Prq: Junior standing or consent of instructor.

E N R (FOR) 634 Geographic Information Systems for Landscape Planning 3(3,2) See FOR 634.

E N R 650 Conservation Issues 3(3,0) Interactive study and discussion of issues related to the conservation of natural resources, emphasizing current issues in the conservation of biodiversity, identification of conflicting issues between consumptive and nonconsumptive resource management, and development of viable solutions for conservation of resources. Prq: W F B (BIOSC) 313 or consent of instructor.

ENVIRONMENTAL ENGINEERING AND SCIENCE

EE&S 601 Environmental Engineering 3(3,0) Introduction to the field of environmental engineering. Topics include environmental phenomena, impact of pollutants in the aquatic environment, solid waste management, air pollution control, radiological health and simple water and wastewater treatment systems. Prq: Junior standing in engineering or consent of instructor.

EE&S 602 Water and Waste Water Treatment Systems 3(3,0) Study of fundamental principles, rational design considerations and operational procedures of the unit operations and processes employed in water and waste water treatment. Both physicochemical and biological treatment techniques are discussed. Introduction to the integration of unit operations and processes into water and waste treatment systems. Prq: EE&S 401; and C E 341, CH E 311, M E 308 or equivalent; or consent of instructor.

EE&S 610 Environmental Radiation Protection 3(3,0) Fundamental principles of radiological health and radiation safety. Topics include radiation fundamentals, basic concepts of environmental radiation protection, internal and external dosimetry, environmental dose calculations and radiation protection standards. Offered fall semester only. Prq: Consent of instructor.

EE&S 611 Ionizing Radiation Detection and Measurement 3(2,3) Laboratory exercises in ionizing radiation detection and measurements. Topics include nuclear electronics; counting statistics; radiation interactions; basic gas, scintillation and semiconductor detectors; gamma-ray spectroscopy; health physics survey instrumentation; and thermoluminescent dosimetry. Offered spring semester only. Prq: EE&S 410 or consent of instructor.

EE&S 630 Air Pollution Engineering 3(3,0) Introductory course in air pollution and its control. Topics include air pollutants and effects, sources, dispersion models, engineering controls and air-quality legislation. Prq: Senior standing in engineering or physical sciences.

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

EE&S 680 Environmental Risk Assessment 3(3,0) Quantitative estimation of the human health risk posed by the release of a contaminant to the environment. Topics include methods for analyzing emission rate, environmental transport, exposure and health effects; methods of uncertainty analysis; and the role of risk assessment in environmental regulation and environmental decision making. Prq: EE&S 401 or consent of instructor.

EE&S (B E) 684 Municipal Solid Waste Management 3(3,0) Introduction to the problems, regulations, collection, handling, recycling and disposal of municipal solid wastes in the urban and rural sectors. Emphasis is on integrated waste-management systems with resource recovery, composting, incineration, landfill disposals and their costs. Prq: Senior standing in engineering or science or consent of instructor.

EE&S 685 Hazardous Waste Management 3(3,0) Introduction to problems, regulations, treatment and ultimate disposal of hazardous and toxic materials. Spill cleanup, groundwater transport, land disposal, incineration and treatment technologies are discussed. Offered spring semester only. Prq: EN SP 200 or EE&S 401 or consent of instructor; two semesters of general chemistry.

EE&S 686 Pollution Prevention and Industrial Ecology 3(3,0) Topics include pollution prevention technology, the role of pollution prevention within a corporation, source reduction and recycling, pollution prevention assessments, treatment to reduce disposal, life-cycle assessment, design for environment, industrial ecology. Emphasis is on case studies. Prq: Senior standing in College of Engineering and Science.

EE&S 690 Special Projects 1-3(1-3,0) Studies or laboratory investigations on special topics in the environmental engineering and science field. Arranged on a project basis with a maximum of individual student effort and a minimum of staff guidance. May be repeated for a maximum of three credits. Prq: Consent of instructor.

EE&S 701 Special Problems 1-6(1-6,0) Environmental engineering problems selected to meet the interests and experience of students and instructor. Formal report is required. Restricted to MEng students. To be taken Pass/Fail only.
Courses of Instruction

EE&S 802 Environmental Engineering Principles 3(3,0) Fundamental principles required for simulation and modeling of environmental engineering phenomena; mass transfer, reactor kinetics, simulation techniques and applications to various natural and engineered systems. Offered fall semester only.

EE&S 803 Physicochemical Operations in Water and Wastewater Treatment Systems 3(3,0) Principles of physicochemical operations used in water and wastewater treatment including sedimentation, filtration, mixing, gas transfer, adsorption, ion exchange, coagulation, precipitation, disinfection and oxidation. Offered spring semester only. Prq: EE&S 802, 843.

EE&S 804 Biochemical Operations in Wastewater Treatment Systems 3(3,0) Principles of biochemical operations used in wastewater treatment; modeling of ideal biochemical reactors and design criteria for aerated lagoons, activated sludge, trickling filters, rotating biological contactors, nitrification, denitrification and digestion. Offered spring semester only. Prq: EE&S 802, 851.

EE&S 805 Laboratory in Water and Wastewater Treatment Operations 3(0,6) Laboratory exercises in selected water and wastewater treatment operations including sedimentation, filtration, adsorption, coagulation, softening, aeration, activated sludge, aerobic digestion and anaerobic digestion. Offered spring semester only. Coreq: EE&S 803 or 804.

EE&S 806 Process and Facility Design for Environmental Control Systems 24(2-4) Integration of unit operations into complex systems for treatment of industrial/domestic water and wastewater, contaminated groundwater or air; landfill leachate and toxic liquid wastes. Student teams design an integrated system for either water/wastewater or a hazardous/toxic waste. Offered fall semester only. Prq: EE&S 803, 804.

EE&S (GEOL) 808 Groundwater Modeling 3(3,0) See GEOL 808.

EE&S (GEOL) 809 Subsurface Remediation Modeling 3(3,0) See GEOL 809.

EE&S (GEOL) 810 Analytical Methods for Hydrogeology 3(3,0) See GEOL 810.

EE&S 812 Environmental Nuclear Engineering 3(3,0) Environmental aspects of nuclear technology emphasizing nuclear reactors and the nuclear fuel cycle; environmental transport of radioactive materials; radioactive effluents from nuclear power plants; nuclear power plant safety; environmental aspects of fuel cycle activities; waste management. Offered fall semester only. Prq: EE&S 610, consent of instructor.

EE&S 813 Environmental Radiation Protection Laboratory 3(1,6) Continuation of EE&S 611; advanced experiments in radiation detection, radiation protection, health physics and environmental monitoring. Offered fall semester only. Prq: EE&S 611 and consent of instructor.

EE&S (CH E) 814 Applied Numerical Methods in Process Simulation 3(3,0) See CH E 814.

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. Prq: 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. Prq: 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. Prq: EE&S 830 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. Prq: 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 nitrate energetic compounds; biotransformations of metals; biodegradation principles applied to the development of bioremediation technologies including intrinsic, in situ and on-site engineered approaches. Prq: EE&S 851.

EE&S (CH) 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. Prq: CH 402, MTHSC 208, PHYS 221, or consent of instructor.

EE&S 843 Environmental Chemistry 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/un saturated 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. Prq: 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. Prq: CHE 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.
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. Prq: 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. Prq: 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. Prq: Organic and analytical chemistry or 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. Prq: AVS 825, ENTOX 630, consent of instructor.

ENTOX 825 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. Prq: ENTOX (ENT) 430.

ENTOX 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. Prq: Organic chemistry and biochemistry with laboratory; ENTOX 400 or (ENT) 430; or consent of instructor.
EX ST 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. Prereq: 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. Prereq: 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 graphs. Prereq: 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. Prereq: 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. Prereq: 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. Prereq: 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. Prereq: 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. Prereq: EX ST 801.

EX ST 811 Special Problems in Experimental Statistics 1-3(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 I 3-3(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; modeling environmental and ecological data; environmental monitoring. Prereq: 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. Prereq: 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. Prereq: EX ST 801 and 803 or consent of instructor.

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 impact 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. Prereq: 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. Prereq: 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) Comprehensive 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. Prereq: 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 concept and contours of a right to health and of emerging trends in health and human rights. Prereq: FCS 820 or consent of instructor.

FCS (P ADM) 827 Public Personnel Administration 3(3,0) See P ADM 827.

FCS (P ADM) 829 Public Financial Management 3(3,0) See P ADM 829.

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, ideologies 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. Prereq: 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 and child-age assistance. Prereq: 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. Prereq: FCS 830 or consent of instructor.
Courses of Instruction

FCS 835 Institutions in Community Life 3(3,0)
Interdisciplinary review of core community institutions and their impact on families and communities. Focuses on four institutions: education, religion, health and government. Each institution is examined both individually and in a systems perspective for its relationship with other institutions and with families and communities.

FCS 836 Area Studies 3(3,0) Expands students' knowledge of the nature of family and community life in various regions of the world (e.g., Eastern Europe; Middle East; Latin America; the Caribbean). Topics include political, social and economic trends; social and political transformation; cross cultural issues; globalization; human rights; and civil society. May be repeated for a maximum of six credits.

FCS 840 Topics in Societal and International Research 1-3(1-3,0) Covers selected topics in research design and data analysis with attention to community-based and field research, and research in international settings. Prq: Consent of instructor.

FCS (P ADM) 862 Administrative Leadership 3(3,0) See P ADM 862.

FCS (P ADM) 878 Selected Topics in Public Administration 3(3,0) See P ADM 878.

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 16 Students synthesize, integrate and apply knowledge and skills learned through courses to family and community issues, working with faculty and community leaders to gain professional experience. To be taken Pass/Fail only. May be repeated for a maximum of six credits. Prq: Consent of instructor.

FCS 896 Independent Study 1-6(1-6,0) Individual readings or research on a topic 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. Prq: 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 financing decisions. Topics include capital budgeting, capital structure and bankruptcy, valuation, corporate governance, executive compensation, mergers and acquisitions, and restructuring. Prq: FIN 312 with a C or better.

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. Prq: FIN 305 with a C or better.

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. Prq: FIN 307 with a C or better.

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. Prq: FIN 307 with a C or better.

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. Prq: FIN 307 with a C or better.

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. Prq: 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. Prq: BIOC 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. Prq: BIOC 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. Prq: Physics and organic chemistry or biochemistry.

FD SC 606 Food Preservation and Processing Laboratory 10(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. Prq: 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 systematic 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 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. Prq: BIOC 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. Prq: 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. Prq: 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. Prq: 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.
Courses of Instruction

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 619 Forest Wildlife Management 3(2,3) Principles, practices and problems of wildlife management with emphasis on upland forest game species. Habitat manipulation through use of appropriate silvicultural practices in association with other techniques is evaluated. Preq: FOR 460 or consent of instructor.
FOR (E N R) 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 110(2,3) 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 accordance 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.
Courses of Instruction

FOR (PRTM) 816 Remote Sensing and GIS in Natural Resources 3(2,3) Practical application of computer mapping, spatial analysis and natural resource inventory using remote sensing and geographical information systems. Offered spring semester of odd-numbered years only. Preq: FOR (ENR) 434 or consent of instructor.

FOR 845 Biodiversity in Managed Forests 3(2,3)
Theory and practice of maintaining biodiversity are fundamental to successful management of forests. Conservation of biodiversity is viewed from the macro (landscape) and micro (stand) levels. Socioeconomic and policy as well as ecological perspectives are considered in design of appropriate management practices. Preq: FOR 415, 460, or consent of instructor.

FOR 891 Master's Thesis Research 1-12
FOR 893 Selected Topics in Forest Resources 1-4(0-4,0-12) Specialized topics not covered in other courses which explore current areas of research and management in forest and natural resources in a format of lecture, lab, or both. May be repeated for a maximum of eight credits, but only if different topics are covered. Preq: Graduate standing or consent of instructor.

FOR 991 Doctoral Dissertation Research 1-12

FORESTRY AND NATURAL RESOURCES

F N R 666 Stream Ecology 3(2,3) Covers the ecology of flowing water systems. Topics include geomorphology, physical and chemical factors of streams, biology of stream-dwelling organisms, trophic relationships, competition, colonization, drift, community structure, disturbance and human impacts. Preq: Junior standing or consent of department chair.

F N R 730 Master Naturalist for Teachers 3(2,4)
Teachers learn about the natural history and natural resources of South Carolina, including geology, biology, ecology and human impacts. Additionally, this online course with associated field trips may be used to help teachers as part of obtaining certification through the South Carolina Master Naturalist program.

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 (BIOGSC) 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: GEN 410 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 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 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, transcription and horizontal gene transfer. Preq: GEN 420 and 440, or consent of instructor.

GEN (BIOCH, 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; polyplody; 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 3(3,0) 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 mutations 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 nyctotic 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. Prereg: 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. Prereg: 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. Prereg: 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. Prereg: GEOG 101 or 103 or consent of instructor.

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

GEOG 640 Geography of Historic Preservation 3(3,0) Aspects of historic preservation with emphasis on sites and structures in their geographical, historical and socioeconomical contexts. Examples are drawn from American architectural styles and settlement forms. Prereg: 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. Prereg: 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. Prereg: 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. Prereg: GEOL 101, 102.

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

GEOL 651 Selected Topics in Hydrogeology 1-4(1-3,0) 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. Prereg: GEOL 300 or 408 or consent of instructor.

GEOL 659 Biogeochernistry 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, biomineralization, and biogeochemical applications to bioremediation, ecology, environmental toxicology and biotechnology. Prereg: 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 1-60(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 imurities 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. Prereg: 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, selfpotentials and borehole geophysics. Emphasis is based on principles and physical understanding of the geophysical methods with applications in mind. Prereg: 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. Prereg: 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 stratigraph. Prereg: 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. Prereg: 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. Prereg: 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. Prereg: 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. Prereg: 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. Prereg: Consent of instructor.
GER 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. Prq: GEO 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. Prq: 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. Prq: GEO 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. Prq: GEO 408 and (EE&S) 808 or consent of instructor.

GEOL 850 Selected Topics in Environmental Geology 1-4(1-3,0) 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. Prq: Consent of instructor.

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

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

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. Prq: 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. Prq: 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. Prq: Second year or graduate standing in current major.

GRAPHIC COMMUNICATIONS

G C 606 Package and Specialty Printing 4(2,6)
In depth study of the 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 barcode production are covered. New developments and trends are discussed. Laboratory in techniques includes printing and converting. Prq: G C 310 or 340; 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. Prq: G C 606 or consent of instructor.

G C 640 Commercial Printing 4(2,6) Advances skills learned in previous graphic communications courses and applies the knowledge to large format processes. 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. Prq: 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. Prq: 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. Prq: 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. Prq: 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. Prq: 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. Prq: Consent of instructor.

G C 801 Process Control in Color Reproduction 3(2,3) Techniques and rationale for processes 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. Prq: 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 color science principles, measurement and integration relative to the printing, publishing and packaging industry; color systems development, application and integration. Prq: 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. Prq: 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. Prq: 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. Prq: 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. Prq: 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. Prq: G C 894, 897, acceptance of a written proposal, approval of advisor.
HEALTH

HLTH 600 Selected Topics in Health 1-6(0-3-18)
Topics selected to meet special and individualized interest of students in health. May be repeated for a maximum of nine credits, but only if at least two different topics are covered. Prereq: 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. Prereq: Two-semester sequence in science or consent of instructor.

HLTH 610 Maternal and Child Health 3(3,0)
Foci 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. Prereq: 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 experience. 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. Prereq: 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. Prereq: 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. Prereq: 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. Prereq: 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 healthcare demand and supply analysis, consumer behavior, production and costs, perfect competition vs. healthcare competition, price discrimination and regulation. Prereq: 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. Prereq: HLTH 807 or M B A (FIN) 807, M B A 803, 806, 808, MGT (M B A) 809 or equivalent.

HEALTH ADMINISTRATION

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

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

M 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 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 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 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. Prereq: 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. Prereq: 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. Prereq: 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/oragnizations. 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.

HEALTHCARE GENETICS

HCG 901 Advances in Human Genetics 3(3,0) Overview of the disciplines and content areas related to advances in human genetics/genomics. Topics include aspects of biochemical, molecular, population genetics and cyogenetics as they relate to genomic health care Bioinformatics is addressed, incorporating the use of genetic databases for research and clinical settings.

HCG 903 Interdisciplinary Research 1(1,0) Examination of interdisciplinary research in the life sciences as a means of integrating information, data, techniques, tools, perspectives, concepts and/or theories from two or more disciplines or bodies of specialized knowledge to advance knowledge development or solve problems. Preq: Consent of instructor.

HCG 905 Genomics, Ethics and Health Policy 3(3,0) Designed for health-care professionals. Analyzes relationships among political climate, policy design and government action as related to ethical, legal and social issues surrounding availability of genetic information. Examines an ethical perspective and outcomes on health policies relating to genomic issues as well as contemplated actions based on new medical techniques. Preq: Consent of instructor.

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 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 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 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) 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.