Courses of Instruction

BIO E 800 Seminar in Bioengineering Research 1(2,0) Original research in bioengineering; weekly one-hour seminar associated with weekly recitation covering seminar preparation, presentation, professional writing, bioengineering ethics and related topics. To be taken Pass/Fail only.

BIO E 801 Biomaterials 3(3,0) Structure and properties of the main classes of materials used in artificial organs and surgical implants; metals, ceramics, polymers, composites and materials of biological origin; mechanical properties, corrosion and design. Preq: Consent of instructor.

BIO E 802 Compatibility of Biomaterials 3(1,6) Determining compatibility of biomaterials with the physiological environment; optical microscopy, microradiography and ultraviolet fluorescence; normal histology of tissues; basic pathological reactions and tissue reactions to materials.

BIO E 803 Polymeric Biomaterials 3(3,0) Interplay of physicochemical properties of polymeric materials and the design of biomedical devices and their in vitro and in vivo performance; critical manufacturing aspects of selected augmentation and prosthetic devices for soft and hard tissues; analysis of case studies and reports on recent research findings. Preq: Consent of instructor.

BIO E 807 Nanotechnology and Biomaterials 3(3,0) The emerging field of nanotechnology and its relation to solving bioengineering and health-related problems is treated. Also considers the promise of nanotechnology in the creation and utilization of materials and devices at the level of atoms and molecules. New scientific approaches, research tools, clinical tools, and devices are presented.

BIO E 812 Orthopedic Engineering and Pathology 3(3,0) Interdisciplinary study of orthopedic cases (bone growth, bone remodeling, osteoarthritis, implant fixation and joint replacements); biomechanical, biomaterials and clinical diagnosis of failed implants (total joints, fracture fixation and spinal instrumentation); basic concepts of orthopedic pathology for engineers. Preq: BIO E 801, 802, 820, and 882, or consent of instructor.

BIO E 820 Structural Biomechanics 3(3,0) Mechanical functions of the human body treated as an engineering structure and the devices used to assist and supplement these functions; movement of the musculoskeletal system; locomotion; gait; prehension; lifting; function of artificial limbs; orthopedic prostheses and braces; effect of vibration and impact on the body; mathematical and other models of the body. Preq: Consent of instructor.

BIO E 823 Vascular Engineering and Pathology 2(2,0) Medical and bioengineering aspects of artificial vascular and cardiovascular devices; physiology and pathological aspects of patients with need for such devices; diagnostic techniques and surgical management of diseases and pathology; design aspects of current devices and selection; state-of-the-art in experiments and human clinical trials. Preq: BIO E 801, 802, and 846, or consent of instructor.

BIO E 824 Cellular and Molecular Analysis in Tissue Engineering 4(3,3) Describes the molecular basis for cell regulation by extracellular stimuli including growth factors, matrix and force. Also describes theoretical and laboratory instruction in research methods used to analyze cellular signaling and functional response in the design and evaluation of tissue engineering constructs. Preq: BIO E 849 or consent of instructor.

BIO E 846 Biomedical Basis for Engineered Replacement 3(3,0) Form and function of human organs, major systems and examples of engineering repair and replacement methods are presented in light of pathological or traumatic organ malfunction. Core course for all Bioengineering graduate students, taken preferably during their first fall semester.

BIO E 847 Transport Processes in Bioengineering 4(4,0) Mathematical modeling of blood flow through capillaries and solute transfer from capillaries to tissues by diffusion and convection, pharmacokinetic analysis of drug adsorption, transport and elimination routes in body, and analysis of the design and performance of extracorporeal devices for organ replacement, including hemodialysis, blood oxygenation and immobilized enzyme reactors. Preq: MTHSC 208 or equivalent.

BIO E 848 Cellular Interactions with Biomaterials 4(2,2) Cell biological concepts and issues relevant to cell-biomaterial interactions; methods for studying cell structure and function including basic cell culture techniques and in vivo biocompatibility assays; biomaterial physical properties which influence cellular interactions; interactions between implant materials and host tissues at the cellular and molecular level; overview of tissue engineering.

BIO E 849 Tissue Engineering 3(3,0) Principles and practices of biological organ and tissue development; cellular/matrix interaction and translation of information from two-dimensional surfaces to three-dimensional scaffolds; selection and processing of biomaterials to form tissue scaffolds; analysis of tissue engineered devices, standards and regulations. Preq: BIO E 801, 846.

BIO E 850 Selected Topics in Biomedical Engineering 1(0,4,12,0) Advanced topics in bioengineering intended to develop in-depth areas of particular student interest. Credit may be earned for more than one semester. Preq: Consent of instructor.

BIO E 870 Biostatistics and Biostatistics Applications 1(0,5) Concepts and techniques of instrumentation in bioengineering emphasizing effects of instrumentation on the biological system under investigation; transducers and couplers; data conversion; conditioning and transmission; experimental problems in acute and chronic procedures with static and dynamic subjects.

BIO E 871 Biomedical Imaging in Biophotonics 3(3,0) Study of biophotonics, an interdisciplinary subject of applying photonic to diagnose and manipulate biological samples from individual cells to the entire human body. Introduces fundamental and frontier topics in the optical imaging aspect of biophotonics for graduate students to gain the ability to solve biophotonic-related biomedical problems. Preq: E C E 320, MTHSC 208, PHYS 221 (or their equivalents); or consent of instructor.

BIO E 882 Biomaterials Implantology 4(2,6) All phases of experimental surgery including selection of animal models, preparation of animals for surgery, general and special surgical techniques, and basic and applied instrumentation. Preq: BIOSC 459 or equivalent.

BIO E 890 Internship 1-5 Observation and assignment in a medical college, dental college, hospital, veterinary clinic, dental clinic, health service, or industrial department. Preq: Consent of department chair.

BIO E 891 Master’s Thesis Research 1-12 BIO E 892 Nonthesis Independent Study in Bioengineering 1-6 Independent study in bioengineering for work necessary to complete requirements for the Master of Science degree in Bioengineering, nontenured option. May be repeated for additional credit. To be taken Pass/Fail only.

BIO E 991 Doctoral Dissertation Research 1-12

BIOLOGICAL SCIENCES

BIOSC (ENT) 600 Insect Morphology 4(3,3) See ENT 600.

BIOSC 601 Plant Physiology 3(3,0) Relations and processes that pertain to maintenance, growth and reproduction of plants, including absorption of matter and energy, water relations of the plant, utilization of reserve products and liberation of energy. Preq: BIOL 104/106 or 111 or BIOSC 205 and CH 102. Coreq: BIOSC 602.

BIOSC 602 Plant Physiology Laboratory 10(3) Laboratory exercises and experiments designed to indicate the relations and processes that pertain to maintenance, growth and reproduction of plants, including absorption of matter and energy, water relations of the plant, utilization of reserve products and liberation of energy. Coreq: BIOSC 601.

BIOSC (GEN) 605 Molecular Genetics of Eukaryotes 3(3,0) See GEN 605.

BIOSC 606 Introductory Plant Taxonomy 3(3,0) Introduction to the basic principles and concepts of plant systematics with emphasis on the plants of South Carolina. Preq: BIOL 104/106 or 111 or BIOSC 205. Coreq: BIOSC 607.

BIOSC 607 Plant Taxonomy Laboratory 10(3) Introduction to the basic techniques of plant taxonomy with laboratory and field emphasis on the flora of South Carolina. Coreq: BIOSC 606.

BIOSC 608 Comparative Vertebrate Morphology 3(3,0) Phylogeny and diversity of vertebrates and study of their comparative morphology, leading to an understanding of the relationships and functioning of living organisms. Preq: BIOL 104 or 111. Coreq: BIOSC 609.

BIOSC 609 Comparative Vertebrate Morphology Laboratory 2(0,5) Comparative anatomy of representative vertebrates; methods used in preparing specimens for study and display. Coreq: BIOSC 608.

BIOSC 610 Limnology 3(3,0) Detailed introduction to the physical, chemical and biological interrelationships that characterize inland water environments. A fundamental approach to the interactions of components of the environment is developed at a theoretical level. Preq: Junior standing in a life science or consent of instructor.
BIOSC 611 Limnological Analyses 2(1,2) Examines a broad range of topics covered with both standing and running fresh waters. About one-third of the laboratory exercises address the major physical components of lakes and streams. The remainder provides rationale and methods for quantitative analyses of biota, as well as some integrated analyses of whole ecosystems. Prereq or Coreq: BIOSC 610 or 643.

BIOSC (E N R) 613 Restoration Ecology 3(3,0) See E N R 613.

BIOSC (AVS, MICRO) 614 Basic Immunology 4(3,3) See MICRO 614.

BIOSC (ENT) 615 Insect Taxonomy 3(1,6) See ENT 615.

BIOSC (GEN) 616 Recombinant DNA 3(3,0) See GEN 616.

BIOSC 617 Marine Biology 3(3,0) Survey of organisms that live in the sea and their adaptations to the marine environment. Emphasizes characteristics of marine habitats, organisms and the ecosystems. Prereq: BIOL 104/106, 111, or consent of instructor.

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

BIOSC 620 Neurobiology 3(3,0) Broad background in neurobiology. Topics include neuroanatomical structure-function; conduction in the neuron; neurite growth and development; neuromuscular junction; chemistry, physiology and pharmacology of specific neurotransmitters and receptors; visual process; axoplasmic transport; hypothalamic-pituitary regulation; theories of behavior; theories of learning and memory. Prereq: BIOL 104/106, 111, or consent of instructor.

BIOSC (PL PA) 625 Introductory Mycology 3(0,0) Introduction to the biology of all the major groups of fungi and some related organisms, with considerations of the taxonomy, morphology, development, physiology and ecology of representative forms. Prereq: BIOL 104/106 or 111 or BIOSC 205. Coreq: BIOSC (PL PA) 626.

BIOSC (PL PA) 626 Mycology Practicum 2(1,3) Application of the principles of mycological techniques, including isolation, culture, identification and microscopic study of fungi. Includes examples from all major groups of fungi. Coreq: BIOSC (PL PA) 625.

BIOSC 628 Quantitative Biology 4(3,3) Applies quantitative methods to a wide range of biological problems. Main focus is on building modeling skills using population, physiological, genetic and evolutionary problems. Also includes a review of statistical principles and introduces basic bioinformatics techniques. Prereq: BIOL 104, 111, or equivalent; MTHSC 108 or equivalent.

BIOSC 632 Animal Histology 3(3,0) Structural and functional study of the basic tissues of animals and tissue makeup of organs. Emphasis is on light microscopy level with selected tissue studied at the electron microscope level. Prereq: BIOSC 303 or consent of instructor. Coreq: BIOSC 633.

BIOSC 633 Animal Histology Laboratory 2(1,2) Microscopic examination of basic animal tissue types and the tissue makeup of organs which comprise systems. Coreq: BIOSC 632.

BIOSC (ENT) 636 Insect Behavior 3(2,3) See ENT 636.

BIOSC 640 Developmental Animal Biology 3(3,0) Events and mechanisms responsible for the development of multicellular animals. Gametogenesis, fertilization, embryonic development, cellular differentiation, morphogenesis, larval forms and metamorphosis, asexual reproduction, regeneration, malignancy and aging are analyzed in terms of fundamental concepts and control processes. Prereq: BIOSC 301 or consent of instructor. Coreq: BIOSC 650.

BIOSC 641 Ecology 3(3,0) Study of basic ecological principles underlying the relationships between organisms and their biotic and abiotic environments. Includes physiological, population and community ecology, with applications of each to human ecological concerns. Prereq: BIOL 104/106, 111, BIOSC 205, or consent of instructor.

BIOSC 642 Biogeography 3(3,0) Study of patterns of distribution of plants and animals in space and time. Prereq: BIOSC 302 or 303 and 304 or consent of instructor.

BIOSC 643 Freshwater Ecology 3(3,0) Study of basic ecological principles and concepts as they apply to freshwater environments: rivers and streams, wetlands, lakes and ponds and reservoirs. Prereq: junior standing in a life science or consent of instructor.

BIOSC 644 Freshwater Ecology Laboratory 2(1,2) Laboratory-based course providing a synthesis of ecological principles and concepts as they apply to freshwater ecosystems. Activities are hypothesis driven and relate to each other to form an overall synthesis of the field. Hands-on experiences allow engagement in creative inquiry. Prereq or Coreq: BIOSC 643 or consent of instructor.

BIOSC 645 Ecology Laboratory 2(1,2) Modern and classical approaches to the study of ecological problems discussed in BIOSC 441. Students are introduced to field, laboratory and computer-based analyses of plant and animal populations and communities. Prereq or Coreq: BIOSC 645.

BIOSC 646 Plant Ecology 3(3,0) Ecology of plants in relation to their biotic and abiotic environments. Individual organisms, populations and communities are considered with an emphasis on seed plants in terrestrial environments. Prereq: BIOL 104/106, 111, or BIOSC 205, or consent of instructor.

BIOSC 647 Plant Ecology Laboratory 2(1,2) Experimental and observational approach to addressing principles discussed in BIOSC 646. Students are introduced to field and laboratory methods involving individual organisms, populations and communities. Prereq or Coreq: BIOSC 646 or consent of instructor.

BIOSC 650 Developmental Biology Laboratory 2(1,2) Examines a broad range of topics concerned with the development of multicellular animals such as gametogenesis, fertilization, embryonic development, cell differentiation, morphogenesis, larval metamorphosis, and regeneration. Laboratory exercises provide the rationale and methods for the descriptive and experimental analysis of development in representative invertebrates and vertebrates. Prereq or Coreq: BIOSC 640 or equivalent.

BIOSC 652 Plant Anatomy and Morphology 3(3,0) Study of the anatomy, reproduction and phylogenetic relationships of vascular plants. Prereq: BIOL 104/106, 111, BIOSC 205, or consent of instructor.

BIOSC 653 Plant Anatomy and Morphology Laboratory 2(1,2) Laboratory focusing on the anatomy, reproduction and phylogenetic relationships of vascular plants. Coreq: BIOSC 652.

BIOSC 654 Plant Virology 4(3,3) Study of plant viruses; their morphology, biochemistry, purification and transmission; symptoms resulting from virus infection; virus vector relationships. Serological and nucleic acid hybridization procedures. Diagnosis of viral diseases and the identification of causal agents. Replication of plant viruses, the interaction between viral host and plant genome. Control of plant viral diseases. Prereq: BIOCH 301, MICRO 305, or consent of instructor.

BIOSC (ENT) 655 Medical and Veterinary Entomology 3(2,3) See ENT 655.

BIOSC (MICRO) 656 Medical and Veterinary Parasitology 3(3,0) Introduction to parasitism in the animal kingdom; emphasizes basic and applied principles related to economically and medically important diseases. Classical and experimental approaches to the study of parasitism are examined in reference to protozoa, helminths and arthropods. Prereq: BIOL 104/106 or 111. Coreq: BIOSC 657.

BIOSC (MICRO) 657 Medical and Veterinary Parasitology Laboratory 2(1,2) Laboratory to reinforce material presented in BIOSC 656. Introduces students to both live and preserved human/animal parasites. Also introduces techniques used in collection, preservation and examination of animal parasites. Coreq: BIOSC 656.

BIOSC 658 Cell Physiology 3(3,0) Study of the chemical and physical principles of cell function emphasizing bioenergetics and membrane phenomena. Prereq: BIOCH 301 or 305 or consent of instructor.

BIOSC 659 Systems Physiology 3(3,0) Physiological systems of vertebrates and their homeostatic controls. Function of the major physiological systems is described in terms of anatomical structure and chemical and physical principles. Prereq: One year each of biology, chemistry and physics or consent of instructor.

BIOSC 660 Systems Physiology Laboratory 2(1,2) Modern and classical experimental methods are used to demonstrate fundamental physiological principles discussed in BIOSC 659. Students are introduced to computer-aided data acquisition and computer simulations of physiological function. Prereq or Coreq: BIOSC 659.

BIOSC 661 Cell Biology 3(3,0) In-depth analysis of how and where intracellular and extracellular molecules control general and specific cellular functions such as gene expression, secretion, motility, signaling, cell-cycle control and differentiation. Taught and graded at a level where students are expected to infer from and integrate cellular events. Prereq: BIOCH 301 or consent of instructor.

BIOSC 662 Cell Biology Laboratory 2(1,2) Accompanies BIOSC 661; focuses on molecular and microscopic analysis of eukaryotic cells. Coreq: BIOSC 661.
Courses of Instruction

BIOSC 664 Mammalogy 4(3,3) Origin, evolution, distribution, structure and function of mammals with laboratory emphasis on mammals of the Southeast. Field trips and live trapping of mammals are required. Preq: BIOSC 303 or consent of instructor.

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

BIOSC 666 Evolution of Human Behavior 3(3,0) Familiarizes students with the evolutionary basis of human behavior. Examines topics such as altruism, cooperation, mating systems, parental investment and social systems using diverse examples, from hunter-gatherer to technological societies. Preq: ANTH 201, BIOSC 335, 470, or PSYCH 201; or consent of instructor.

BIOSC 668 Herpetology 3(2,3) Systematics, life history, distribution, ecology and current literature of amphibians and reptiles. Laboratory study of morphology and identification of world families and U.S. genera, as well as all southeastern species. Field trips are required. Preq: BIOSC 303 or consent of instructor.

BIOSC (ENT, W F B) 669 Aquatic Insects 3(1,6) See ENT 669.

BIOSC 670 Behavioral Ecology 3(3,0) Historical and modern developments in animal behavior emphasizing the evolutionary and ecological determinants of behavior. A synthesis of ethology and comparative psychology. Preq: BIOSC 302 or 303 or consent of instructor.

BIOSC 671 Behavioral Ecology Laboratory 2(1,2) Laboratory exercises that explore the behavior of animals. Emphasizes behavioral observation and analysis and presentation of findings in a report format. Includes a semester-long independent research project. Preq or Coreq: BIOSC 670 or consent of instructor.

BIOSC 672 Ornithology 4(3,3) Biology of birds: their origin and diversification, adaptations, phylogeny, classification, structure and function, behavior, ecology and biogeography. Field identification is emphasized and field trips are required. Preq: BIOSC 303 or consent of instructor.

BIOSC 673 History of Modern Biology 3(3,0) Examines the intellectual and social factors defining the study of life from the scientific revolution of the 1600s to the modern biological sciences. Investigates the historical origins of biological disciplines and explores the differing cultures, methodologies and philosophical commitments of these communities. Preq: Introductory course in biology or consent of instructor.

BIOSC 675 Comparative Physiology 3(3,0) Physiological systems of invertebrates and vertebrates with emphasis on environmental adaptation. Physiological principles as they relate to metabolism, thermoregulation, osmoregulation, respiration, and neural and integrative physiology. Preq: One year each of biology, chemistry and physics or consent of instructor.

BIOSC 676 Comparative Physiology Laboratory 2(1,2) Modern classical experimental methods demonstrate fundamental physiological principles discussed in BIOSC 475. Students are introduced to computer-based data acquisition and manipulation as well as computer simulations of physiological function. Preq or Coreq: BIOSC 675.

BIOSC 677 Ichthyology 3(2,3) Systematics, life history, distribution, ecology and current literature of fish. Laboratory study of morphology and identification of U.S. genera and all Southeastern species. Field trips are required. Preq: BIOSC 303 or consent of instructor.

BIOSC (AVS) 680 Vertebrate Endocrinology 3(3,0) Introduction to the basic principles of neuroendocrine integration and homeostatic maintenance in vertebrates. Comparative morphology and physiology of various endocrine tissues and hormone chemistry and modes of action are considered. Preq: BIOSC 303, organic chemistry or consent of instructor.

BIOSC 681 Web Design for the Life Sciences and Agriculture 3(2,2) Discusses basic principles and theories of Web design and site construction, including usability and accessibility considerations. Web and graphics design software are used to develop sites suitable for life science and agricultural organizations. Service-learning is used with student projects. Preq: AG ED 200, CP SC 120, or consent of instructor.

BIOSC 684 Human and Comparative Vertebrate Embryology 3(3,0) Study of human and comparative vertebrate embryology with an introduction to related clinical correlations. Students develop an understanding of normal and abnormal human and comparative vertebrate embryonic development. Preq: BIOL 111 or consent of instructor.

BIOSC 687 Electron and Optical Microscopy Theory 3(2,2) Offers a theoretical and practical introduction to light and electron microscopy. Topics include: Koehler illumination, polarization, interference, phase contrast, DIC, epifluorescence, laser scanning light microscopy, SEM, TEM, EDS, ultramicrotomy, tomography and digital imaging. Preq: Consent of instructor.

BIOSC 700 SC Life: Topics for Teachers 3(2,2) Topics relating to the SC Life curriculum. Lectures, laboratories and extensive field studies focus on the natural history and biodiversity of South Carolina. Restricted to elementary and secondary school teachers. May be repeated for credit, but only if different topics are covered. Preq: Consent of instructor.

BIOSC 710 SC Life: DNA Technology for Teachers 3(2,2) Lectures and laboratories focus on application of DNA technology in society. Restricted to elementary, middle and secondary school teachers. May be repeated for credit, but only if different topics are covered. Preq: Consent of instructor.

BIOSC 711 SC Life: Forensic Science Topics for Teachers 3(2,2) Topics relating to the SC Life curriculum. Studies the history, development and modern applications of forensic science to answer questions of interest to the legal system. Lectures, laboratories and field trips focus on employing techniques of forensic science. Restricted to elementary and secondary school teachers. May be repeated for credit, but only if different topics are covered. Preq: Consent of instructor.

BIOSC 712 SC Life: Technology Topics for Teachers 3(2,2) Lectures and laboratories focus on ways to help teachers integrate technology into the classroom. Restricted to elementary, middle, and secondary school teachers. May be repeated for credit, but only if different topics are covered. Preq: Consent of instructor.

BIOSC 730 SC Life: Forensic Science Topics for Teachers 3(2,2) Application of a broad spectrum of forensic science to answer questions of interest to the legal system. Lectures, laboratories and field trips focus on different subdivisions of forensic science. Restricted to elementary and secondary school teachers. May be repeated for credit, but only if different topics are covered. Preq: Consent of instructor.

BIOSC 731 SC Life: DNA Technology for Teachers 3(2,2) Lectures and laboratories focus on application of DNA technology in society. Restricted to elementary, middle and secondary school teachers. May be repeated for credit, but only if different topics are covered. Preq: Consent of instructor.

BIOSC 802 Conservation Genetics 3(3,0) Introduction to theoretical population genetics and empirical studies of evolutionary genetics. Emphasizes exploring conservation genetics issues from an applied perspective by doing exercises using real data sets and population genetics analyses programs as well as discussions of empirical studies of species of conservation concern. Preq: BIOSC 335, GEN 300 or 302, or consent of instructor.

BIOSC 803 Population Dynamics 4(2,6) Fundamental mechanisms basic to regulation of natural animal populations. Laboratory research project in population dynamics complements theory.

BIOSC 810 Behavioral Ecology 3(3,0) Behavior of animals and the ecological context in which various behaviors are shown; empirical and theoretical aspects of behavioral ecology at individual, population and community levels. Preq: BIOSC 441 and 470 or consent of instructor.

BIOSC (ENTOX) 811 Immunotoxicology 3(3,0) See ENTOX 811.

BIOSC 812 Seminar 1(1,0) Review and presentation of current literature in biological sciences. May be repeated for a maximum of four credits. To be taken Pass/Fail only. Preq: Consent of instructor.

BIOSC 813 Graduate Teaching Assistant Colloquium 1(1,0) Designed for graduate teaching assistants (GTAs) during their first year of laboratory instruction. Covers a variety of topics designed to prepare GTAs for departmental instructional duties, as well as information concerning safety and professional ethics in the laboratory classroom. To be taken Pass/Fail only. Preq: Graduate teaching assistant in Biological Sciences.

BIOSC 816 Advanced Ecosystem Analysis 4(3,3) Description and analysis of ecological systems; biogeochemical, physicochemical and ecological principles emphasizing fundamental unity of ecosystems and their abiotic environment. Laboratory focuses on application of theory to actual field and laboratory research problems. Preq: BIOSC 641, MTHSC 210, 605, or consent of instructor.

BIOSC 820 Community Ecology 3(3,0) Examines species interactions in plant and animal communities and uses experimental, observational and theoretical approaches to study competition, predation, facilitation, habitat selection and succession. Emphasizes how species diversity is maintained and the consequences of diversity at local and regional scales. Preq: BIOSC 441 or equivalent.

BIOSC 825 Comparative and Veterinary Immunology 3(3,0) Survey of the evolutionary relationships, the physiology and the cellular/molecular biology of the immune systems of animals; demonstrations that focus on those animals having high economic input, biomedical importance, or a key ecological position; current research with a historical perspective. Preq: AVS 825, MICRO 614, or consent of instructor.

BIOSC (ENTOX) 830 Mechanistic Toxicology 3(3,0) See ENTOX 830.

BIOSC (ENTOX) 831 Biomarkers in Toxicology 3(1,6) See ENTOX 831.

BIOSC (ENTOX) 854 Aquatic Toxicology 3(3,0) See ENTOX 854.

BIOSC 863 Special Problems 1-4 Research not related to thesis. Preq: Consent of instructor.
BIOSC 687 Electron and Light Microscopy Practicum
Continuation of BIOSC 687, offering independent study of electron microscopes. Proficient students become systematics and other topics of interest to graduate continuity and those interested in pursuing the Field Research option. May be repeated for credit, but only if different topics are covered. BIOSC 891 Master’s Thesis Research 1-9
BIOSC 897 Ph.D. Dissertation Research 1-9
BIOSC 910 Master’s Thesis Research 1-12
BIOSC 911 Ph.D. Dissertation Research 1-12

BIOMOLECULAR ENGINEERING

BIOCHEM 627 Membranes for Biotechnology and Biomedical Science 3(3,0)
Special topics in membrane science and technology. Covers the fundamentals of membranes, principles of membrane separation technologies, and applications in biotechnology and biomedical science. Topics may include liquid-liquid extraction, reverse osmosis, ultrafiltration, dialysis, and ion exchange. Emphasizes the design and application of membrane-based systems for various biotechnological processes.

BIOHE 621 Holistic Modeling of Small Watersheds 3(3,0)
Design, practices for small watershed monitoring and management. Topics may include hydrology, soil erosion, vegetation, and riparian ecosystems. Emphasizes the integration of physical, chemical, and biological processes in small watershed systems. Prerequisite: BIOTE 300; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.

BIOTE 621 Biomedicine 3(3,0)
Course provides an overview of the principles and techniques used in biomedical research. Topics may include molecular biology, genetics, cell biology, biochemistry, and immunology. Emphasizes the use of biological materials and techniques for the study of human diseases and the development of new therapies. Prerequisite: BIOT 300, 301, 302, 303, 304, 305; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.

BIOTE 622 Biotechnology and Bioengineering 3(3,0)
Course provides an overview of the principles and techniques used in biotechnology and bioengineering. Topics may include genetic engineering, recombinant DNA technology, and bioprocessing. Emphasizes the use of biological materials and techniques for the production of industrial products. Prerequisite: BIOT 300, 301, 302, 303, 304, 305; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.

BIOTE 623 Bioprocess Engineering Design 3(3,2)
Course provides an overview of the principles and techniques used in bioprocess engineering. Topics may include fermentation, enzyme technology, and biocatalysis. Emphasizes the use of biological materials and techniques for the production of industrial products. Prerequisite: BIOT 300, 301, 302, 303, 304, 305; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.

BIOTE 624 Properties of Molecules and Materials 3(3,0)
Course provides an overview of the principles and techniques used in the study of the properties of molecules and materials. Topics may include spectroscopy, thermodynamics, and transport properties. Emphasizes the use of experimental and computational methods for the study of molecular and materials systems. Prerequisite: BIOT 300, 301, 302, 303, 304, 305; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.

BIOTE 625 Biomedical Engineering 3(3,0)
Course provides an overview of the principles and techniques used in biomedical engineering. Topics may include the design and analysis of medical devices, the development of new medical technologies, and the use of computational methods for the study of biological systems. Emphasizes the use of engineering principles and methods for the study of biological and medical systems. Prerequisite: BIOT 300, 301, 302, 303, 304, 305; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.

BIOTE 626 Biosensors and Bioelectronic Devices 3(3,0)
Course provides an overview of the principles and techniques used in biosensors and bioelectronic devices. Topics may include the design and analysis of sensor systems, the development of new sensor technologies, and the use of computational methods for the study of biological and medical systems. Emphasizes the use of engineering principles and methods for the study of biological and medical systems. Prerequisite: BIOT 300, 301, 302, 303, 304, 305; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.

BIOTE 627 Membranes for Biotechnology and Biomedical Science 3(3,0)
Course provides an overview of the principles and techniques used in membrane science and technology. Covers the fundamentals of membranes, principles of membrane separation technologies, and applications in biotechnology and biomedical science. Topics may include liquid-liquid extraction, reverse osmosis, ultrafiltration, dialysis, and ion exchange. Emphasizes the design and application of membrane-based systems for various biotechnological processes.

BIOTE 628 Bioprocess Engineering Design 3(3,2)
Course provides an overview of the principles and techniques used in bioprocess engineering. Topics may include fermentation, enzyme technology, and biocatalysis. Emphasizes the use of biological materials and techniques for the production of industrial products. Prerequisite: BIOT 300, 301, 302, 303, 304, 305; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.

BIOTE 629 Bioengineering Principles for Biological Engineering 3(3,2)
Course provides an overview of the principles and techniques used in bioengineering. Topics may include genetic engineering, recombinant DNA technology, and bioprocessing. Emphasizes the use of biological materials and techniques for the production of industrial products. Prerequisite: BIOT 300, 301, 302, 303, 304, 305; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.

BIOTE 631 Biomedical Engineering 3(3,0)
Course provides an overview of the principles and techniques used in biomedical engineering. Topics may include the design and analysis of medical devices, the development of new medical technologies, and the use of computational methods for the study of biological systems. Emphasizes the use of engineering principles and methods for the study of biological and medical systems. Prerequisite: BIOT 300, 301, 302, 303, 304, 305; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.

BIOTE 632 Bioengineering Principles for Biological Engineering 3(3,2)
Course provides an overview of the principles and techniques used in bioengineering. Topics may include genetic engineering, recombinant DNA technology, and bioprocessing. Emphasizes the use of biological materials and techniques for the production of industrial products. Prerequisite: BIOT 300, 301, 302, 303, 304, 305; (for Chemical Engineering majors) CH E 330, 350, 375; (for Biosystems Engineering majors) BIOTE 300, 311, 312, 315, 322, 325, 326.
Courses of Instruction

BS 822 Organic Plant Metabolism 3(3,0) Discusses the regulation of plant metabolism, focusing on plant physiology and the role of enzymes. May be repeated for a maximum of six credits.

BS 823 Inorganic Plant Metabolism 3(3,0) Explores the role of inorganic compounds in plant metabolism, including nutrient uptake and transport. May be repeated for a maximum of six credits.

BS 831 Plant Growth and Development 3(3,0) Studies the mechanisms of plant growth and development, including cell division, growth hormones, and environmental factors. May be repeated for a maximum of six credits.

BS 832 Plant Pathology 3(3,0) Introduces the principles of plant pathology, including disease causation and control. May be repeated for a maximum of six credits.

BS 833 Plant Breeding and Genetics 3(3,0) Focuses on the principles of plant breeding and genetics, including genetic variation and selection. May be repeated for a maximum of six credits.

BS 834 Plant Physiology 3(3,0) Studies the physiological processes of plants, including photosynthesis, respiration, and transpiration. May be repeated for a maximum of six credits.

BS 835 Industrial Biotechnology Techniques 4(3,3) Covers the principles of industrial biotechnology, including biocatalysis, fermentation, and bioinformatics. May be repeated for a maximum of six credits.

BS 836 Advanced Bioprocess Engineering 3(3,0) Focuses on the design and operation of bioprocesses, including fermentation and biocatalysis. May be repeated for a maximum of six credits.

BS 837 Bioreactor Design and Operation 3(3,0) Studies the design and operation of bioreactors, including reactor scale-up and process optimization. May be repeated for a maximum of six credits.

BS 838 Advanced Bioproduction 3(3,0) Focuses on the principles and practices of bioproduction, including process development and scale-up. May be repeated for a maximum of six credits.

BS 839 Advanced Bioprocess Control 3(3,0) Studies the control and optimization of bioprocesses, including process monitoring and control. May be repeated for a maximum of six credits.

BS 840 Advanced Bioprocess Economics 3(3,0) Focuses on the economic aspects of bioprocesses, including cost analysis and process economics. May be repeated for a maximum of six credits.

BS 841 Advanced Bioprocess Biotechnology 3(3,0) Studies the role of biotechnology in bioprocessing, including genetic engineering and biocatalysis. May be repeated for a maximum of six credits.

BS 842 Advanced Bioprocess Management 3(3,0) Focuses on the management aspects of bioprocessing, including quality assurance and safety. May be repeated for a maximum of six credits.

BS 843 Advanced Bioprocess Safety 3(3,0) Studies the safety considerations in bioprocessing, including risk assessment and management. May be repeated for a maximum of six credits.

BS 844 Advanced Bioprocess Quality Assurance 3(3,0) Focuses on the quality assurance aspects of bioprocessing, including validation and verification. May be repeated for a maximum of six credits.

BS 845 Advanced Bioprocess Regulatory 3(3,0) Studies the regulatory aspects of bioprocessing, including compliance and regulatory issues. May be repeated for a maximum of six credits.

BS 846 Advanced Bioprocess Safety and Security 3(3,0) Focuses on the safety and security considerations in bioprocessing, including threat assessment and mitigation. May be repeated for a maximum of six credits.

BS 847 Advanced Bioprocess Environmental Impact 3(3,0) Studies the environmental impact of bioprocessing, including sustainability and environmental regulations. May be repeated for a maximum of six credits.

BS 848 Advanced Bioprocess Economic 3(3,0) Focuses on the economic aspects of bioprocessing, including cost-benefit analysis and profitability. May be repeated for a maximum of six credits.

BS 849 Advanced Bioprocess Ethical 3(3,0) Studies the ethical considerations in bioprocessing, including ethical issues and stakeholders. May be repeated for a maximum of six credits.

BS 850 Advanced Bioprocess Social 3(3,0) Focuses on the social aspects of bioprocessing, including stakeholder involvement and community impact. May be repeated for a maximum of six credits.

BS 851 Advanced Bioprocess Environmental 3(3,0) Studies the environmental aspects of bioprocessing, including sustainability and environmental regulations. May be repeated for a maximum of six credits.

BS 852 Advancement of Bioproduction 3(3,0) Focuses on the advancement of bioproduction, including process development and scale-up. May be repeated for a maximum of six credits.

BS 853 Advanced Bioproduction 3(3,0) Studies the principles and practices of bioproduction, including process development and scale-up. May be repeated for a maximum of six credits.

BS 854 Advanced Bioproduction Management 3(3,0) Focuses on the management aspects of bioproduction, including quality assurance and safety. May be repeated for a maximum of six credits.

BS 855 Advanced Bioproduction Safety 3(3,0) Studies the safety considerations in bioproduction, including risk assessment and management. May be repeated for a maximum of six credits.

BS 856 Advanced Bioproduction Quality Assurance 3(3,0) Focuses on the quality assurance aspects of bioproduction, including validation and verification. May be repeated for a maximum of six credits.

BS 857 Advanced Bioproduction Regulatory 3(3,0) Studies the regulatory aspects of bioproduction, including compliance and regulatory issues. May be repeated for a maximum of six credits.

BS 858 Advanced Bioproduction Environmental Impact 3(3,0) Studies the environmental impact of bioproduction, including sustainability and environmental regulations. May be repeated for a maximum of six credits.

BS 859 Advanced Bioproduction Economic 3(3,0) Focuses on the economic aspects of bioproduction, including cost-benefit analysis and profitability. May be repeated for a maximum of six credits.

BS 860 Advanced Bioproduction Ethical 3(3,0) Studies the ethical considerations in bioproduction, including ethical issues and stakeholders. May be repeated for a maximum of six credits.

BS 861 Advanced Bioproduction Social 3(3,0) Focuses on the social aspects of bioproduction, including stakeholder involvement and community impact. May be repeated for a maximum of six credits.

BS 862 Advanced Bioproduction Environmental 3(3,0) Studies the environmental aspects of bioproduction, including sustainability and environmental regulations. May be repeated for a maximum of six credits.

BS 863 Advanced Bioproduction Advanced 3(3,0) Focuses on the advanced aspects of bioproduction, including process development and scale-up. May be repeated for a maximum of six credits.
Courses of Instruction

MBA 826 Business Marketing 3(3,0)
Strategic marketing as it applies to industrial, organizational and institutional markets; consumer marketing versus business-to-business marketing; current business marketing literature and practices. Prereq: Principles of marketing or equivalent or consent of instructor.

MBA 828 Services Marketing 3(3,0)
Nature of services marketing and the special requirements that distinguish successful services marketing from goods marketing. Topics include promoting and making the service tangible, designing optimal service operations, the ideal service worker, pricing of services and critical points of services delivery. Prereq: Principles of marketing or equivalent or consent of instructor.

MBA 829 Marketing Foundations 2(2,0)
Principles and concepts involved in planning, pricing, promoting and distributing goods and services. Prereq: Consent of MBA director.

MBA (FIN) 832 International Financial Management 3(3,0)
Factors that influence the financial management of multinational corporations. Topics include international parity conditions, currency exposure management, capital budgeting of international projects and political risks. Prereq: MBA 807 or 857 or consent of instructor.

MBA 833 Real Estate Investments 3(3,0)
Study of real estate investment analysis and decision making featuring the use of the discounted cash flow model and other tools to evaluate investment alternatives from the perspective of an equity real estate investor. Emphasizes market analysis, ownership alternatives and financing considerations. Prereq: MBA 836.

MBA 835 Investment Management 3(3,0)

MBA 836 Real Estate Principles 3(3,0)
Advanced survey course to acquaint students with the theories, practices and principles of real estate. Topics include urban economics, real estate law, brokerage, real estate valuation, financial institutions, tax issues, investment analysis, and development. Prereq: MBA 807 or 819 or consent of instructor.

MBA 837 Legal Environment of Business 2(2,0)
Legal and case analysis of court systems and dispute resolution, contracts, business torts, EEOC, Age Discrimination in Employment Act, Americans with Disabilities Act, Employment-at-Will compared to union participation; international legal considerations as these topics relate to business concerns. May not be used for credit toward a graduate degree. Prereq: Consent of MBA director.

MBA 839 Business Negotiations and Legal Dispute Resolution 3(3,0)
Negotiation and dispute resolution in the business environment. Negotiation techniques and practices, negotiation team building, international negotiation issues, as well as alternative dispute resolutions as applied to legal issues within the business environment. Prereq: MBA 837, 838 or consent of instructor.

MBA 841 Real Estate Finance 3(3,0)
The application of financial analysis and theory to real estate, mortgage credit analysis and current financing techniques for residential and commercial properties is emphasized. Topics include financial institutions, mortgage financing techniques, financial decisions and construction financing. Prereq: MBA (FIN) 836.

MBA 842 Real Estate Valuation 3(3,0)
Study of real estate appraisal with primary emphasis on two student projects: a house appraisal and a commercial property appraisal. Topics include highest and best use analysis, the three approaches to value, advanced capitalization techniques, discounted cash flow analysis and the standards of professional practice. Prereq: MBA (FIN) 836.

MBA 845 Technology and Innovation Management 3(3,0)
Interdisciplinary examination of problems and issues in integrating technology and innovation into processes and products; evaluating tangible and intangible aspects of new technology adoption; management research and development; and functional integration of marketing and operations.

MBA 846 Use of Derivatives in Financial Engineering 3(3,0)
The valuation and use of basic derivative securities such as futures and options; the financial engineering of securities combinations such as swaps, spreads and straddles; applications of derivatives and financial engineering in managing financial risks. Prereq: MBA 807 or consent of instructor.

MBA 850 Business Communications 1(1,0)
Techniques, skills, problems and approaches for effective business communications; strengths and weaknesses of various communications forms with concentration on informative and persuasive written material. Includes practical experience in written work and presentations, video and verbal feedback, teamwork, problem solving and situational presentations. Prereq: Consent of MBA director.

MBA 851 Managerial Accounting 3(3,0)
Analysis, interpretation and use of accounting information for planning and control in business and nonbusiness organizations. Includes profit planning, budgeting and standards; product and segment costing and evaluation; and case studies and computer-based assignments. Offered spring semester only. Prereq: MBA 819 or consent of instructor.

MBA 852 Managerial Decision Making 3(3,0)
Survey of decision modeling techniques useful in managerial decision making, including linear programming, project management, queuing models, transportation problems and Monte Carlo simulation. Prereq: Consent of MBA director.

MBA 853 Advanced Marketing Strategy 3(3,0)
Advanced marketing theory and critical thinking skills applied to support strategic decision making. Data analysis and advanced marketing models are employed with emphasis on building analytic and assessment skills. Offered spring semester only. Prereq: MBA 858 or MKT 865 or consent of instructor.

MBA 854 Information Systems 3(3,0)
The critical role of information systems in contemporary business organizations; key information systems and technologies; their impacts both within and across organizational settings.

MBA 862 Managerial Economics 3(3,0)
Use of economic analysis in managerial decision making. Topics include the theory of cost, production, industrial organization, coordination and control of the firm, from theoretical concepts to actual decision making. Offered fall semester only. Prereq: Consent of MBA director.

MBA 863 Advanced Managerial Economics 3(3,0)
Advanced economic analysis for managerial decision making. Topics include advanced price theory, theory of firm, internal organization of the firm, the economics of strategic behavior in the market and the empirical estimation of demand and cost functions. Prereq: MBA 862 or consent of instructor.

MBA 870 Strategic Management 3(3,0)
Investigation of the ongoing process of positioning a firm for competitive advantage in its changing business environment focusing on the role of general managers in formulating and implementing strategies for single and multibusiness firms. Business cases, class discussions and group projects are used to integrate content from previous business courses. Offered spring semester and summer session only. Prereq: MBA 807, 809, 838, 854, 856, 861, 862; or consent of instructor.

MBA 871 Programming and System Development 3(3,0)
Programming concepts and structures in developing information systems applications. Specific techniques and tools covered are updated to incorporate the newest technologies. Prereq: Consent of instructor.

MBA 872 Entrepreneurial Finance 3(3,0)
Topics include business valuation, financial forecasting, financing strategies and business harvesting. Includes case studies and computer modeling. Prereq: ECON 855 or MBA 807.

MBA (MGT) 873 Managing Continuous Improvement 3(3,0)
How to initiate and lead change toward a total quality environment; basic tools of quality management; use of teams to achieve change; quality function deployment; ISO 9000; supplier development; and use of survey methods to track progress of change. Prereq: MGT 803 or consent of instructor.

MBA 875 Enterprise Development 3(3,0)
Studies the entrepreneurial process from conception to birth of new venture emphasizing discovery, searching for opportunities and gathering resources to convert opportunities to businesses. Students learn how to evaluate entrepreneurs and their plans by working in teams to write a business plan for a new venture.

MBA 876 Electronic Marketing 3(3,0)
Application of the concepts and theories of marketing to e-commerce, challenges facing marketing in business-to-business and business-to-consumer contexts, strategic application of marketing mix variables in e-business environment. Prereq: Consent of instructor.
M B A 880 MBA Seminar I 1-3(1,3) Discussion of topics in professional development for MBA stu-
dents through workshops and other activities. May be
repeated for a maximum of four credits. To be
taken Pass/Fail only. Prq: Consent of instructor.

M B A 881 Seminar on Ethics and Leadership 1(1,0)
Exposes MBA students to various ethical, leader-
ship and personal development venues through
a combination of speakers, networking activities,
workshops, competitions, personal development
exercises and other related activities. To be taken
Pass/Fail only. May be repeated for a maximum of
two credits. Prq: Consent of instructor.

M B A 888 Internship in Business Administration
1-3 Preplanned, preapproved, faculty-supervised
internship designed to give students on-the-job
learning in support of classroom education. In-
ternships must be no less than ten full-time, con-
ssecutive weeks with the same internship provider.
May be repeated for a maximum of three credits.
Prq: Thirty semester hours of graduate credit and
consent of MBA director.

M B A 899 Selected Topics in Business Administra-
tion 3(3,0) Current topics in business administra-
tion as they relate to the manager. Topics may come
from a single functional area or may integrate two
or more functional areas (accounting, economics,
finance, management, or marketing). May be re-
peated for a maximum of nine credits.

CAREER AND TECHNOLOGY
EDUCATION

CTE 610 Selected Topics 1-3(1,3) Subject areas
organized according to program needs. Content
is planned cooperatively by the University and
the school system or agency requesting the course.
May be repeated for a maximum of 18 credits, but
only if different topics are covered. Prq: Consent
of instructor.

CTE 613 Contemporary Technological Problems
3(3,0) Provides students with an understanding of
the problems and contributions of technology.
Examples of these relationships are taken from his-
torical accounts and from analyses of contemporary
technological intervention both in industrialized
and nonindustrialized countries.

CTE 615 History and Philosophy of Career and
Technology Education 3(3,0) Study of career and
technology education programs with the intent of
developing a sound individual philosophy. General
topics include history, local, state and federal leg-
islation; types of career and technology programs;
professional organizations and career guidance.

CTE 620 Manufacturing II: Computer-Integrated
Manufacturing 3(2,3) Study of computer-integrated
manufacturing and its related concepts, including
robotics, computer numeric control, electronic
pneumatic and sensor systems, programmable logic
controllers, and ancillary devices. Prq: CTE 220
or consent of instructor.

CTE 630 Construction Technology II: Practices and
Systems 3(2,3) Study of industrial practices and
systems affecting man, materials and equipment as-
associated with construction industries. Activities are
directed toward developing a working knowledge of
construction technology and a framework for
incorporating this instruction into programs in the

CTE 640 Power Technology II: Transmission and
Control Systems 3(2,3) Continuation of CTE 240.
Instruction in transmitting and controlling power
for utilization in such areas as manufacturing,
communications, construction and transportation.
Introduces concepts of automation and robotics to
enable classroom teachers and industry personnel
to gain necessary insights into this important area
of technology. Prq: CTE 240.

CTE 660 Developing Training Programs for Indus-
try 3(3,0) Identification, selection and organization
of subject matter for industrial training programs.
Emphasizes analysis techniques, session dem-
stration planning, written instructional materials
development, trainee evaluation, and planning
instructional schedules. Prq: Senior standing in
Career and Technology Education or consent
of instructor.

CTE 665 Conducting and Evaluating Training
Programs 3(3,0) Basic concepts of supervision,
administration and management of training
programs. Emphasis is on determining training
requirements, planning, directing and evaluating
training programs. Prq: CTE160, 460 or consent
of instructor.

CTE 668 Public Relations 3(3,0) Emphasizes tech-
niques and methods of effective public and indus-
trial relations which contribute to understanding
and cooperation of labor, business, professional
educational and industrial groups.

CTE 670 Course Organization and Evaluation
3(3,0) Problems, techniques and procedures in the
preparation, selection and organization of subject
matter for instructional purposes. Methods, tech-
niques and preparation of materials used in the
evaluation of student achievement in industrial
education subjects.

CTE 671 Teaching Career and Technology Educa-
tion 3(3,0) Emphasizes methods for teaching and
training in career and technology education.
Emphasis is given to class organization, prepara-
tion of lesson outlines and audio-visual aids.
Prq: ED F 355.

CTE 673 Assessment in Career and Technology
Education 3(3,0) Study of competency testing in
career and technology education which includes
educational objectives and measurement; con-
struction and use of oral, objective, short answer,
matching, essay and performance tests; and
treatment of test data for grade assignments and
statistical analysis.

CTE (AG ED, ED F) 680 Educational Applications
of Microcomputers 3(2,2) See ED F 680.

CTE (AG ED, ED F) 682 Advanced Educational
Applications of Microcomputers 3(2,2) See ED
F 682.

CTE 683 Architectural Drafting for Career and
Technology Education 3(1,6) Study of the major
aspects of architectural drawing such as plot, floor
and foundation plans; wall sections; and elevations.
Prq: CTE 180.

CTE 684 Communications Technology II: Sys-
tems 3(2,2) Continuation of CTE 280. Includes
theory and operation of communications systems:
telegraph, telephone, radio, television, satellites,
sound/video recorders, lasers and computers.
Instruction on strategies for interpreting this area
of technology to trainees and students is emphasized.
Prq: CTE 280.

CTE 686 Instructional Media Development 3(1,4)
Basic instructional media development tech-
niques. Students develop material using author-
ing software such as HyperCard, transparencies
using Persuasion and/or PowerPoint, and fully
storyboarded, scripted and edited digital as well as
analog video.

CTE 692 Advanced Projects 1-6 Students gain depth
in content by completing projects under the super-
vision of an instructor in career and technology edu-
cation. Written project approval is required before
registering. May be repeated twice for a maximum
of six credits. Prq: Consent of instructor.

CTE (ED) 700 Supervising the Student Teacher in
the Public School 2-3(2,3) See ED 700.

CTE 705 Seminar in Industrial Education 1(1,0)
Students and faculty discuss and study new
and professional advances. May be
repeated for a maximum of three credits. To be
taken Pass/Fail only.

CTE 820 Recent Process Developments 3(3,0)
Study of recent technological innovations, inven-
tions, processes and products and their impact
on our industrial, labor, educational and social
institutions.

CTE (HR D) 845 Needs Assessment for Education
and Industry 3(3,0) See H R D 845.

CTE (HR D) 846 Applied Public Relations 3(3,0)
See H R D 846.

CTE (HR D) 847 Instructional Systems Design
3(3,0) See H R D 847.

CTE 851 Current Topics in Communication Tech-
ology I 1-3(1,3) Recent technological processes in
the communication industry such as CAD, desktop
publishing and interactive video for teachers and
industrial personnel.

CTE 852 Current Topics in Manufacturing Tech-
nology 1-3(1,3) Contemporaneous manufacturing
practices for public school teachers and industry
personnel.

CTE 853 Current Topics in Construction Technol-
ogy I 1-3(1,3) Update for teachers in industrial
technology education programs at the secondary
level, instructors in construction-related programs
at the postsecondary level and industrial trainers
in the private sector; contemporary technological
processes in construction industries.

CTE 854 Current Topics in Power Technology
1-3(1,3) Contemporaneous applications of power
and energy for public school teachers and industry
personnel.

CTE (HR D) 860 Instructional Materials Develop-
ment 3(3,0) See H R D 860.

CTE 865 American Industries 3(3,0) Concepts and
principles of American industry and technology.
Industrial plant visits supplement study of industrial
organization, economics, management, production
and products.
C E 804 Chemical Engineering Thermodynamics 3(3,0) Classical and statistical thermodynamics applied to problems in chemical engineering emphasizing modern methods of predicting thermophysical properties of gases and liquids. Students' and instructor's interests influence course content but usually include fundamentals of applied statistical mechanics, molecular theory of dense fluids, descriptions of intermolecular forces, gas-liquid and liquid-liquid critical phenomena, theories of interfacial phenomena and adsorption, statistical mechanics of polymeric systems, statistical mechanics of polydispersed systems, computer simulation of fluids by Monte Carlo, molecular dynamics and stochastic dynamics methods. Preq: CH E 804 or equivalent.

CH E 815 Selected Topics in Chemical Engineering 3(3,0) Topics not covered in other courses emphasizing current literature and results of current research. Topics vary from year to year to keep pace with developments. May be repeated for credit.

CH E 890 Special Projects 1-6 Comprehensive analytical and/or experimental treatment of phenomena of current interest in chemical engineering emphasizing modern technological problems. May be repeated for a maximum of six credits. To be taken Pass/Fail only. Preq: Consent of instructor and department chair.

CH E 891 Master's Thesis Research 1-12

CH E 895 Chemical Engineering Graduate Seminar 1(1,0) Series of weekly, one-hour seminars given by students, faculty and guests on topics of current interest. Credits earned in this course do not apply to or alter the required minimum of six research hours for the MS degree or the required 30 research credit hours for the PhD degree. To be taken Pass/Fail only.
Courses of Instruction

CH E 945 Selected Topics in Chemical Engineering 3(3,0) More comprehensive study of topics first covered in CH E 845.

CH E 991 Doctoral Dissertation Research 1-12

CHEMISTRY

CH 602 Inorganic Chemistry 3(3,0) Basic principles of inorganic chemistry are discussed with special emphasis on atomic structure, chemical bonding, solid state, coordination chemistry, organometallic chemistry, and acid-base theories. The chemistry of certain selected elements is treated. Offered fall semester only. Prq: CH 331, 332.

CH 604 Bioinorganic Chemistry 3(3,0) Covers fundamentals of bioinorganic chemistry with review of necessary inorganic and biochemical concepts. Topics include metal uptake, transport and storage in biological systems; functions of metals in proteins; metal ion interactions with nucleic acids; physical methods used in bioinorganic chemistry; heavy element toxicity, radiopharmaceuticals and other metallotherapeutics. Prq: BIOCH 301 or CH 205.

CH 611 Instrumental Analysis 3(3,0) Principles of operation and application of modern chemical instrumentation in the field of analytical chemistry. Topics include basic electronics, statistics, optical, mass, magnetic resonance, electron and x-ray spectroscopies, radiochemistry, and separation science. Prq: CH 331, 332.

CH 614 Bioanalytical Chemistry 3(3,0) Survey of selected areas of importance in bioanalytical chemistry. Includes fundamental principles, advanced topics and applications of analytical measurements of biomolecules, bioassays, immunossays, separations, mass spectrometry, method validation, macromolecular crystallography, microscopy and imaging. Prq: CH 313, 411, or consent of instructor.

CH 621 Advanced Organic Chemistry 3(3,0) Survey of modern organic chemistry with an emphasis on synthesis and mechanisms. Prq: CH 224, 322, or equivalent.

CH 625 Medicinal Chemistry 3(3,0) Survey of the pharmaceutical drug discovery process. Covers discovery of candidate compounds; bioassay methods; associated regulatory and commercial issues. Case studies are selected from the current literature. Prq: CH 224 or equivalent or consent of instructor.

CH 627 Organic Spectroscopy 3(2,3) Survey of modern spectroscopic techniques used in the determination of molecular structure. Emphasis is on the interpretation of spectra: nuclear magnetic resonance, ultraviolet, infrared, mass spectroscopy, optical rotatory dispersion and circular dichroism. Prq: One year each of organic chemistry and physical chemistry.

CH 635 Atomic and Molecular Structure 3(3,0) Introduction to quantum theory and its application to atomic and molecular systems. Topics include harmonic oscillator, hydrogen atom, atomic and molecular orbital methods, vector model of the atom, atomic spectroscopy and molecular spectroscopy. Offered spring semester only. Prq: CH 332 or consent of instructor.

CH 651 Frontiers in Polymer Chemistry 3(3,0) Survey of selected areas of current research in polymer science with particular emphasis on polymer synthesis. Although a text is required for review and reference, course is primarily literature based and focused on areas of high impact to multidisciplinary technology. Prq: CH 223, 224, PFC 415 or consent of instructor.

CH 671 Teaching Chemistry 3(3,0) Topics in chemistry addressed in the context of constructivist methodologies. Also considers laboratory work and management, laboratory safety and the use of technology in the chemistry classroom. Prq: 300-level chemistry course or high school teaching experience or consent of instructor.

CH 704 Selected Topics for Chemistry Teachers 1-6(1,1,1-6) Directed individual study in designing experiments and teaching materials or an in-depth study of one or more advanced topics. For graduate students in Elementary and Secondary Education. May be repeated, but only if different topics are covered. Offered spring semester of odd-numbered years only.

CH 800 Professional Development Issues in Chemistry 1(1,0) Covers development of professional behavior for graduate students in chemistry, including communication skills, teaching techniques, research ethics, career management, "grantsmanship," and intellectual property issues in science. Prq: Graduate standing in Chemistry.

CH 805 Theoretical Inorganic Chemistry 3(3,0) Application of group theory to structure and properties of inorganic molecules. Offered spring semester of even-numbered years only. Prq: CH 435 and 804 or consent of instructor.

CH 807 Chemistry of the Transition Elements 3(3,0) Structure, spectroscopy and reactivity of transition metals and their compounds. Offered fall semester of odd-numbered years only. Prq: CH 804 or consent of instructor.

CH 808 Chemistry of the Nonmetallic Elements 3(3,0) Principles and implementation of a bonding model for descriptive inorganic chemistry of boron, carbon, silicon, nitrogen, phosphorus, oxygen and sulfur. Offered spring semester of odd-numbered years only. Prq: CH 804 or consent of instructor.

CH 809 Chemical Applications of X-Ray Crystallography 3(2,2) Physical description of the crystalline state, symmetry in crystals, X-ray diffraction, modern methods of structure determination, and chemical interpretation of structural results. Offered spring semester of odd-numbered years only. Prq: CH 331 and 332 or consent of instructor.

CH 811 Analytical Chemistry 3(3,0) Graduate-level review of modern analytical chemistry; literature, sampling, quality control/assurance, chemometrics and the use of modern analytical methods; team taught by the analytical faculty. Offered fall semester only.

CH 812 Chemical Spectroscopic Methods 3(2,3) Emission and absorption spectroscopy, chemical microscopy, X-ray diffraction, and fluorescence techniques in analytical chemistry; theory and operation of instruments.

CH 831 Electrochemical Science 3(3,0) Theory and experimental study of electrochemical thermodynamics, electrified interfaces, interfacial charge transfer, electrolyte solutions, electrode processes, and membrane electrochemistry; amperometric, voltammetric, electrolytic and potentiometric methods; practical applications of electrochemistry in analysis, materials synthesis and energy technology. Prq: Graduate standing in Chemistry or Chemical Engineering or consent of instructor.

CH 816 Separation Science 3(3,0) Fundamental thermodynamic and kinetic concepts of separation and practical aspects of current separation techniques used in analytical chemistry. Offered spring semester of odd-numbered years only.

CH 818 Surface and Thin Film Analysis 3(2,2) Fundamental principles underlying the most commonly employed techniques for surface and thin films analysis. Representative techniques include atomic force microscopy, scanning electron microscopy, secondary ion mass spectrometry, Auger electron spectroscopy and Rutherford backscattering. Laboratory exercises give insights into analytical methods.

CH 821 Organic Chemistry I 3(3,0) Theoretical concepts of organic chemistry, stereochemistry and mechanisms of organic reactions. Offered fall semester only. Prq: CH 421 or satisfactory performance on the organic chemistry placement examination.

CH 822 Organic Chemistry II 3(3,0) Continuation of CH 821; mechanisms of organic reactions including photochemistry and Woodward-Hoffman rules; modern synthetic organic chemistry. Offered spring semester only. Prq: CH 821 or consent of instructor.

CH 830 Fundamentals of Physical Chemistry 3(3,0) Principles of classical thermodynamics, chemical kinetics and quantum chemistry. Offered fall semester only. Prq: CH 331 or equivalent.

CH 831 Chemical Thermodynamics 3(3,0) Classical thermodynamics emphasizing theory and significance of energetics and systems of variable composition. Offered fall semester of odd-numbered years only. Prq: CH 331 or equivalent.

CH 834 Statistical Thermodynamics 3(3,0) Study of statistical thermodynamics including ensemble method, ideal gases, internal degrees of freedom, solid state, imperfect gases, distribution function method in fluids, and time-dependent fluctuations. Prq: CH 831.

CH 835 Chemical Kinetics 3(3,0) Rate processes and reaction mechanisms; order of reaction; theory of rate processes; relation of reaction rates to mechanism; homogeneous and heterogeneous catalysis; experimental methods; chain reactions; diffusion; effects of solvent, temperature and pressure on reaction rates and mechanisms. Lectures are supplemented by assigned problems, paper and oral examination of topic of special interest to the student. Offered spring semester of odd-numbered years only.

CH 837 Quantum Chemistry 3(3,0) Mathematical and conceptual formulation of quantum theory of electronic structure of atoms and molecules; eigenvalue solution of one-dimensional Schrodinger equation and application of this method to chemical problems. Offered fall semester of odd-numbered years only.
Courses of Instruction

CH 838 Computational Chemistry 3(3,0) Theoretical methods and software used in computational chemistry; quantum chemical methods including molecular orbital methods and density functional theory; classical simulation techniques including potential energy functions, molecular mechanics, molecular dynamics and Monte Carlo. Advanced topics vary with interests of students. Preq: CH 331 and 332 or equivalent.

CH 840 Techniques of Experimental Chemistry 3(1,6) Theory and practice in major experimental techniques used in chemical research; chromatography; NMR, IR, visible, UV, and ORDR spectroscopy; mass spectrometry; ESR; Mössbauer spectroscopy and tracer analysis.

CH 841 Chemical Applications of NMR Spectroscopy 3(2,2) Basic concepts of NMR spectroscopy with application to organic, inorganic, physical and analytical chemistry; design of spectroscopic experiments and interpretation of spectra; modern techniques including multipulse, multinuclear and two-dimensional methods. Offered fall semester only. Preq: CH 331 and 332 or consent of instructor.

CH 851 Graduate Student Seminar 1-2(1-2) Students and faculty review current topics in chemistry. May be taken more than one semester.

CH 852 Departmental Seminar 1-2(1-2) Off-campus speakers are invited to present aspects of their research to the chemistry faculty and graduate students every week during the academic year. Some of these talks may form the basis for cumulative examination questions. Attendance is mandatory. May be taken more than one semester. Preq: Approved bachelor's degree.

CH 860 Chemical Biology 3(3,0) Covers fundamentals of chemical biology by examining the structure, function, bonding and reactivity of nucleic acids, proteins, carbohydrates and lipids. Topics are covered from the perspective of organic, inorganic, analytic and physical chemistry. Credit will be given for only one of CH 860, BIOCH 631. Preq: Undergraduate coursework in organic, inorganic, physical and analytic chemistry; or consent of instructor.

CH 891 Master's Thesis Research 1-12

CH 900 Selected Topics in Inorganic Chemistry 1-4(1-4) Special problems in molecular spectroscopy, molecular orbital treatments, applications of group theory to chemical structure, irreversible thermodynamics and special topics in statistical mechanics. Topics vary with interests of students. May be repeated for credit, but only if different topics are covered.

CH 901 Doctoral Dissertation Research 1-12

CITY AND REGIONAL PLANNING

C R P 601 Introduction to City and Regional Planning 3(0,0) Introduces students from other disciplines to City and Regional Planning. Spatial and nonspatial areas of discipline are explored through a wide ranging lecture/seminar program. Preq: Consent of instructor.

C R P 602 Human Settlement 3(0,0) Overview of forces and trends affecting community growth and change—historical, ecological, economic, demographic, design and development—pertaining to human settlement patterns and their interrelationship in the urbanization process, especially at the national, regional, townscape and neighborhood scale. Taught from various perspectives. Includes a foundation core course for Master’s in Real Estate Development, City and Regional Planning, and Landscape Architecture. Preq: Consent of instructor.

C R P 603 Seminar on Planning Communication 3(0,0) In-depth analysis of methods to communicate planning and policy decisions effectively. Familiarizes students with the various communication skills needed by planners, policymakers and other professionals to become successful practitioners. Preq: Consent of instructor.

C R P 612 Urban Transportation Planning 3(0,0) Serves as a vehicle for synthesis and application of skills developed in other courses and includes participation in one or more real-world planning projects in addition to seminars and readings devoted to development of professional practice skills. Preq: Consent of instructor.

C R P 609 Current Issues in Planning 1(1,0) Students are exposed to current practice issues in various fields of the planning profession through a series of guest speakers representing various areas of planning practice. The course is team-taught to address diverse subject matter. Preq: Consent of instructor.

C R P 613 Fundamentals of Transportation Planning 3(3,0) Identifies issues and questions transportation planners face, characterizes policy shaping transportation, instructs on methods to solve transportation planning problems and portrays the political and organizational environment in which transportation planners operate. Students integrate concepts and considerations via a systems approach with sensitivity to the transportation planning environment. Preq: Consent of instructor.

C R P 614 Geographic Information Systems for Landscape Planning 3(1,6) Develops competence in geographic information systems technology and its application to various spatial analysis problems in landscape planning. Introduces basic principles of GIS and their use in spatial analysis and information management. Topics include database development and management, spatial analysis techniques, cartography, critical review of GIS applications and hands-on projects.

C R P 801 Planning Process and Legal Foundations 3(3,0) Introduction to the city and regional planning profession and related processes with the legal foundation for comprehensive planning and tools of implementation. Preq: Consent of instructor.

C R P 802 Site Planning and Infrastructure 3(2,3) Working knowledge of natural systems and infrastructure systems as they affect site planning and development. Preq: Consent of instructor.

C R P 803 Quantitative Analysis 4(2,0) Basic tools of quantitative analysis and planning methods in the context of analytical, procedural and institutional needs of the planner. Students learn data collection, analysis and interpretation of different planning problems. Emphasis is placed on understanding the logic of statistical analysis, methods of planning analysis and policy formulation. Preq: Consent of instructor.

C R P 804 Land Use Analysis and Assessment 4(2,0) Introduction to basic methods of land use planning including land suitability analysis, land market forecasts and formulating alternative land use plans. Development impact assessment and project appraisal methods are introduced to evaluate land use plans. Preq: C R P 803.

C R P 805 Planning Theory and History 3(3,0) Development of the planning practice and theories of planning process: historical evolution of planning practice in the U.S., social issues in planning, theories of planning and critiques of those theories and ethical issues in planning practice. Preq: Consent of instructor.

C R P 806 Urban Systems and Growth Management 3(3,0) Overview of basic principles of resource allocation including public finance and project appraisal techniques. Introduces infrastructure planning and capital improvement plans followed by basic concepts of growth management and an overview of growth management laws and tools. Course is team-taught to address diverse subject matter. Preq: Consent of instructor.

C R P 807 Professional Studio 4(2-3,6-9) Serves as a vehicle for synthesis and application of skills developed in other courses and includes participation in one or more real-world planning projects in addition to seminars and readings devoted to development of professional practice skills. Preq: Consent of instructor.

C R P 813 Fundamentals of Transportation Planning 3(3,0) Identifies issues and questions transportation planners face, characterizes policy shaping transportation, instructs on methods to solve transportation planning problems and portrays the political and organizational environment in which transportation planners operate. Students integrate concepts and considerations via a systems approach with sensitivity to the transportation planning environment. Preq: Consent of instructor.

C R P 814 Public Transit 3(3,0) Familiarizes students with core concepts and practices in public transit. Course modules examine modes and design, planning issues and organizational environments inherent to public transit, and technical operations. Course concludes with an examination of comprehensive transit systems. Preq: Consent of instructor.

C R P 815 Transportation Innovation 3(3,0) Through lectures, seminar discussions and collaborative learning activities, course interaction develops students’ transportation knowledge, research and ideas. Students are encouraged to use information already obtained to create visionary thinking and interaction skills needed to become transportation leaders. Preq: C R P 813.
C R P 820 Negotiation and Development Dispute Resolution 3(3,0) Skill-building course in conflict resolution and consensus building through bargaining and negotiation, primarily in the design professions. Students play active roles in discovering, applying, reflecting on and critiquing the theories, styles and techniques of conflict resolution and consensus building that work in different types of disputes. Pr: Consent of instructor.

C R P 822 Urban Design 3(3,0) Analysis of the evolution of the physical patterns of cities through research in the historical development of urban form in Europe and America within the context of prevailing social, economic and political influences; approaches to the analysis of contemporary cities through the study of modern planning theorists. Pr: Consent of instructor.

C R P 830 Introduction to GIS 1(1,0) Introduces participants to ArcGIS as a tool for real estate development analysis and provides the foundation for becoming a successful GIS user. Students are introduced to fundamental GIS concepts. Topics include displaying, downloading, analyzing and printing public domain geographical data sets. Pr: Consent of instructor.

C R P 832 Problems in Site Planning 3(1,6) Advanced site planning and design concept studies developed through site projects; concentration on industrial, residential and recreational facilities. Emphasis is on us-specific site analysis and generation of development alternatives. Pr: Consent of instructor.

C R P 834 Spatial Modeling Using GIS 3(2,3) Use of geographic information systems (GIS) in spatial analysis, information management and synthesis of spatial patterns and processes. Emphasizes developing an operational understanding of the modeling techniques and data used in different applications such as land use allocation, corridor location, site location and market analysis, environmental assessment and cost-benefit analysis. Pr: C R P 634 or consent of instructor.

C R P 835 GIS and Remote Sensing Applications for Trend Analysis 3(2,3) Principles of remote sensing and land information systems in trend analysis. Addresses aspects of change detection for monitoring natural resources and urban growth. Designed for those interested in planning, natural resources management and environmental analysis. Lectures and hands-on laboratory work emphasize the use of imagery for database generation and analysis. Pr: C R P 634, 804, or 834; or consent of instructor.

C R P 840 Seminar in Coastal Planning 3(3,0) Issues relating to development and conservation of coastal environments, focusing on inherent tradeoffs between growth and environmental quality. Discusses ecology and carrying capacity of coastal areas and appropriate management approaches to balance coastal resource demand. Pr: Consent of instructor.

C R P 841 Seminar in Environmental Planning 3(3,0) Current and emerging environmental issues and appropriate planning options, including population dynamics and limits to growth, entropy law, waste management and global climate change; students pursue individual research on an environmental issue of particular concern and report findings. Pr: Consent of instructor.

C R P (PRTM) 844 Outdoor Recreation Resource Management and Planning 3(3,0) Issues relating to planning and development of natural areas for recreational purposes. Emphasis is on the policy-making process at the federal, state, regional and local levels. Pr: Consent of instructor.

C R P (PO ST) 845 Water Policy and Law 3(3,0) Surveys the history, science, economics, politics, legal framework and current debates regarding the allocation of freshwater resources in the U.S., with emphasis on relevant Southeastern issues. Scientists, engineers, planners, landscape architects, policy makers and economists will benefit from understanding water allocation and associated conflicts.

C R P 858 Research Design 3(3,0) Provides opportunity for students in their final year of study in the planning program to develop a proposal for the terminal project or thesis, students are responsible for completing the research, writing and editing necessary for an acceptable proposal. Pr: Consent of faculty.

C R P 859 Planning Terminal Project 3(3,0) Students select, with approval of advisor, and conduct research on individual planning problems of suitable scope. Oral, written and, where appropriate, visual presentations of solutions are required. Students must enroll during fall semester. Pr: C R P 658.

C R P 870 Seminar in Sustainable Development 3(3,0) Pr: Consent of instructor.

C R P 871 Growth Management and Legal Issues 3(3,0) Baseline and court cases relating to the comprehensive plan, implementing tools and other aspects of the planning process in the growth management context. Pr: C R P 672, consent of instructor or department chair.

C R P 872 Housing Issues in the United States 3(3,0) Regulation, stimulation, salvage and replacement of housing through public policy administrative procedures. Specific housing programs are analyzed in detail. Pr: Consent of instructor.

C R P 873 Economic Development Planning 3(3,0) Economic development planning process, focusing on applied programmatic techniques, especially at the state, local and neighborhood levels. Emphasizes theoretical models, economic development process, private/public partnerships, economic development tools, political context, and economic development planning administration and organization. Pr: Consent of instructor.

C R P 883 Techniques for Analyzing Development Impacts 3(3,0) Models and techniques for analyzing development impacts in urban areas and regions; economic, fiscal, social and environmental impact methods. Operational knowledge of these techniques is developed. Pr: Consent of instructor.

C R P 889 Selected Topics in Planning 3(3,0) Topics emphasizing current literature and results of current research. May be repeated for credit. Pr: Consent of instructor.

C R P 890 Directed Studies in City and Regional Planning 1-6(0,3-18) Students pursue individual professional interests under guidance of City and Regional Planning graduate faculty. May be repeated for credit.

C R P 891 Planning Thesis 6(0,18) Students working individually, program a planning problem of appropriate scope and conduct research. Oral, written and where appropriate, visual presentations of theses are required. To be taken Pass/Fail only. Pr: Consent of faculty.

C R P 893 City and Regional Planning Internship 3(0,9) Ten weeks of supervised professional employment with an approved planning entity. To be taken Pass/Fail only. Pr: Two semesters of City and Regional Planning or equivalent.

C R P 894 Planning Internship Seminar 3(3,0) Seminar-based analysis of student internships, enabling students to compare experiences and gain greater understanding of professional practice by reflecting on planning issues. To be taken Pass/Fail only. Pr: C R P 893.

CIVIL ENGINEERING

C E 601 Indeterminate and Matrix Structural Analysis 3(3,0) Analysis of indeterminate structures using moment distribution, energy methods such as virtual work and Castigliano’s Theorem, and the matrix formulation of the direct stiffness method. Pr: C E 301 or consent of instructor.

C E 604 Masonry Structural Design 3(3,0) Introduction to design of structural elements for masonry buildings. lintels, walls, shear walls, columns, pilasters and retaining walls are included. Reinforced and unreinforced elements of concrete or clay masonry are designed by allowable stress and strength design methods. Introduction to construction techniques, materials and terminology used in masonry. Pr: C E 402 or consent of instructor.

C E 607 Wood Design 3(3,0) Introduction to wood design and engineering; properties of wood and wood-based materials; design of beams, columns, walls, roofs, panel systems and connections. Pr: C E 402 or 406, or consent of instructor.

C E 608 Structural Loads and Systems 3(3,0) In-depth discussion of minimum design loads and load combinations. Includes overview of various steel and concrete systems. Discusses practical selection and design issues and design of proprietary building materials and components such as steel joists, diaphragms, engineered wood products, etc. Pr: C E 206, 301.

C E 610 Traffic Engineering Operations 3(3,0) Basic characteristics of motor-vehicle traffic, highway capacity, applications of traffic control devices, traffic design of parking facilities, engineering studies, traffic safety, traffic laws and ordinances, public relations. Pr: C E 311 or consent of instructor.

C E 611 Roadway Geometric Design 3(2,3) Geometric design of roadways, at-grade intersections, and interchanges in accordance with conditions imposed by driver ability, vehicle performance, safety and economics. Pr: C E 311 or consent of instructor.