

GRADUATE COURSES

College of Engineering

Biomedical Engineering (EGRB)

EGRB 506. Artificial Organs. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRB 209 or permission of instructor. This course explores the design, operating principles and practices regarding artificial organs and their use in the human body. Analysis of dialysis systems for kidney replacement, artificial hearts and heart-assist devices, artificial heart valves, cardiac pacemakers, and sensory organ-assist and -replacement devices. Design aspects, legal ramifications, regulatory issues and clinical implantation issues will be addressed.

EGRB 507. Biomedical Electronics and Instrumentation. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Fundamental principles and applications of electronics and instrumentation as related to biomedical sciences.

EGRB 509. Microcomputer Technology in the Biomedical Sciences. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Microcomputer applications to the acquisition and manipulation of data in the biomedical laboratory.

EGRB 511. Fundamentals of Biomechanics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: Calculus and ordinary differential equations (MATH 200-201, MATH 301 or equivalent). Presents basic mechanical properties of materials, describes methods of material testing and introduces techniques for analyzing the solid and fluid mechanics of the body. Considers topics such as stress/strain relationships, particle mechanics, and force balances.

EGRB 513. Cellular Signal Processing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. In this course students will study the process by which an extracellular protein binding event is transduced and interpreted as an incoming signal into a cell. Students will learn the biology of cellular signal transduction, as well as how to apply computational models and experimental techniques to predict and investigate these pathways. The course will follow the course of a protein within a signal transduction cascade, from binding to a receptor, activating intracellular pathways, inducing new transcription and translation, and targeting of the protein to its final location. Students will develop MATLAB-based mathematical models to predict signal transduction dynamics and then study experimental techniques that are used to both disrupt and measure signal transduction.

EGRB 515. Manufacturing of Biomaterials. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to engineering students with junior class standing or above, or with permission of the instructor. This course introduces the concepts/principles underlying different fabrication techniques of biomaterials and correlates the manufacturing techniques to different types of biomaterials and their applications in medicine. The areas of biomedical research and clinical practice that have benefited from each type of manufacturing technique are discussed. Specifically, the course focuses on three major material manufacturing techniques: additive manufacturing, surface treatments and coatings, and scaffold processing.

EGRB 517. Cell Mechanics and Mechanobiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: previous course in biomechanics and a previous cell biology course, or permission of instructor. Graduate-level students will gain a quantitative understanding of cellular mechanics and the way cells detect, modify and respond to the physical properties within the cell environment. Students will gain a thorough understanding of relevant primary literature and mathematical models. Both experimental and theoretical approaches toward cell mechanics and mechanobiology will be addressed. Emphasis will be placed upon cells from the nervous, cardiovascular and pulmonary systems. Cancer cell mechanotransduction will also be addressed.

EGRB 521. Human Factors Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students enrolling in this course should have completed a class in human and/or quantitative physiology (or equivalents), differential equations, statistics and/or have consent of the instructor. Course explores the principles and practices of ergonomics and human factors with respect to effective design and decision-making. Course addresses the physical and cognitive aspects of user-centered design, including factors related to the sensory systems, human memory, movement control and control systems, physical and mental workload, decision-making, mathematical modeling, environmental factors, simulation, usability testing, task analysis, eye tracking, display systems, and controls.

EGRB 523. Rehabilitation Engineering and Prostheses. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRB 203 and EGRB 209, both with a minimum grade of C. Enrollment is restricted to biomedical engineering majors or with permission of instructor. This course explores the principles and practices regarding the development of rehabilitation therapy devices and prostheses. Students will learn how to perform a dynamic analysis of human movement toward the design of rehabilitation therapies, devices and prostheses. The course will further address deficits in neuromuscular control that must be considered when developing engineering solutions for individuals with different therapy and prosthetic needs. The course will also provide a general overview of current technologies and the engineering principles behind these designs.

EGRB 524. Assistive Technology Design. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CMSC 255 or EGRE 245. Smartphones are prevalent in their use as a platform for assistive technology for individuals with disabilities. This course will consider the product development cycle for assistive technology. Students will also learn key aspects of programming Android phones, which are relevant for most assistive technology applications. Students will also have a group design project.

EGRB 525. Modeling and Simulation of Human Movement. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRB 203 and EGRB 209, both with a minimum grade of C. Enrollment is restricted to biomedical engineering majors or with permission of instructor. This course explores the principles and practices regarding musculoskeletal modeling and simulation of human movement. Students will learn the components of musculoskeletal models and how these models are developed and validated. The course will cover computer algorithms that are used to develop simulations of human movement and how simulations can be applied to develop new technologies, devices and understanding. Learning is achieved through a series of lectures, tutorials, reading, webinars and computer simulation exercises.

EGRB 527. Physical Principles of Medical Imaging. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the College of Engineering. A study of the physical principles and basic clinical uses of medical imaging. Analysis of radiation and interaction of radiation, generation and control of X-rays, X-ray diagnostic methods, X-ray computed tomography, magnetic resonance imaging and ultrasonic imaging will be conducted. Basic principle of radionuclide imaging also will be introduced.

EGRB 528. Fundamentals and Applications of Artificial Intelligence in Medical Imaging. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CMSC 225; and CLSE 115, CMSC 210, CMSC 254, EGRB 215 or EGRE 246. This course is designed to provide students with a comprehensive understanding of the intersection between artificial intelligence and medical imaging. Basic understanding of machine learning and image processing is recommended but not mandatory. Students will learn how AI techniques can be applied to various aspects of medical and biological imaging, including image analysis, feature extraction, disease diagnosis and treatment planning. The course will cover both theoretical concepts and hands-on practical applications, preparing students for careers in health care, research and AI development.

EGRB 534. Artificial Intelligence in Rehabilitation Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRB 215. Enrollment is restricted to engineering majors or with permission of instructor. This course offers a comprehensive study and application of the cutting-edge field of applying artificial intelligence to rehabilitation engineering. Students will gain an understanding of the innovative ways AI is revolutionizing the design and delivery of rehabilitation and prediction of patient outcomes. The course covers fundamental concepts in both AI and rehabilitation engineering. Through lectures, hands-on projects and case studies, students gain practical experience in developing AI algorithms in specific applications including: markerless motion capture that utilizes cloud-based data and machine learning, classification of human movement intent, speech classification from neural signals, and machine learning to predict outcomes of brain stimulation. By the end of the course, students are equipped with the knowledge and skills to contribute to the ongoing advancement of AI in rehabilitation engineering and improve patient care in this vital field.

EGRB 591. Special Topics in Biomedical Engineering. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. Enrollment is restricted to students with senior or graduate standing in the School of Engineering or by permission of the instructor. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of research training. See the Schedule of Classes for special topics to be offered each semester.

EGRB 601. Numerical Methods and Modeling in Biomedical Engineering. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Prerequisite: MATH 301 or equivalent. Enrollment is restricted to graduate students. The goal of this course is to develop an enhanced proficiency in the use of computational methods and modeling, to solve realistic numerical problems in advanced biomedical engineering courses and research, as well careers. The course will discuss and students will develop advanced technical skills in the context of numerical data analysis and modeling applications in biology and medicine. An important component of this course is developing problem-solving skills and an understanding of the strengths and weaknesses of different numerical approaches applied in biomedical engineering applications.

EGRB 602. Biomedical Engineering Systems Physiology. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Prerequisite: EGRB 601. Enrollment restricted to graduate students. Biomedical engineering requires a foundational understanding of organ systems in the body as well as an advanced understanding of how to apply engineering principles and mathematical models to those systems. In this course, students will learn the basic physiology of major organ systems while also identifying and implementing mathematical modeling approaches to simulate and better understand these organ systems. Students will also learn how to apply engineering concepts, such as fluid dynamics, thermodynamics, structural mechanics and mass transport to better understand organ system physiology.

EGRB 603. Biomedical Signal Processing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: Calculus and differential equations (MATH 301 or equivalent), including Laplace and Fourier Transforms. Explores theory and application of discrete-time signal processing techniques in biomedical data processing. Includes discrete-time signals and systems, the Discrete/Fast Fourier Transforms (DFT/FFT), digital filter design and implementation, and an introduction into processing of discrete-time random signals.

EGRB 604. Biomechanics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 201, MATH 301 or permission of instructor. Presents fundamental principles and conservation laws governing solid and fluid mechanics which are then applied to the mechanics of living systems. This enables an understanding of normal biomechanical function as compared with variations present in dysfunctional states. The objectives of this course are to introduce the student to the general mechanical function of a variety of biological materials and structures, linkage to structure-function relationships, and how these can be studied and represented mathematically.

EGRB 605. Grant Writing in Biomedical Engineering. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to graduate students. Students will learn about the typical components in a scientific grant, the review process for grants and approaches for developing such grants. Students will also acquire tools to improve their scientific writing skills by approaching scientific writing from the reader's perspective. Students will develop and write a complete grant proposal during the course that will be reviewed by department faculty in an interactive mock grant review panel.

EGRB 610. Microprocessor Interfacing for Biomedical Instrumentation. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: EGRB 509 or permission of instructor. Principles and applications of microprocessor interfacing for biomedical instrumentation. Topics include microprocessor architecture, assembly language, programming and debugging techniques, EPROM programming and bus structure and interfacing.

EGRB 611. Cardiovascular Dynamics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisite: PHIS 501 or PHIS 502. Analyzes and models the cardiovascular system in health and disease through studies on the properties of heart and vascular tissue, the mechanics of blood flow and the application of engineering methods to the diagnosis and treatment of cardiovascular pathologies.

EGRB 612. Structural Biomechanics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRB 511. Treats mechanical functions of the human body as an engineering structure used to assist and supplement these functions. Includes movement of the musculoskeletal system, joint reaction forces, stresses and strains developed within bones, function and design of orthopedic prostheses and braces, effect of vibration and impact on the body, mathematical and other models of the body.

EGRB 613. Biomaterials. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Undergraduate material science or permission of the instructor. Primary and secondary factors determining the performance of materials used for implants in the human body. Topics will include metallurgy of stainless steel, cobalt-chromium alloys, titanium alloys, biocompatibility of implant materials, mechanical and physical properties of biomaterials, corrosion of biomaterials and medical polymers.

EGRB 614. Tissue Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. In this course, students will learn and apply fundamental and novel concepts of biology, physiology, chemistry, physics, material science, biomaterials and engineering principles to design novel strategies for stem cell engineering and therapy and tissue engineering. Emphasis will be placed on designs and methods to solve current complex biomedical problems.

EGRB 615. Medical Imaging. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Calculus and college physics. Covers the physical principles and techniques of medical imaging modalities such as ultrasound, X-ray and nuclear magnetic resonance. Includes generation and detection of images, consideration of system design and qualitative image analysis.

EGRB 616. Cell Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will cover the cell and its engineering principles with an emphasis on current research techniques. Topics covered include the organization and structure of the cell, cell signaling, and application of cell biology to biomedical research. Advanced methods are taught enabling students to interpret and present findings from primary literature.

EGRB 618. Regenerative Engineering and Medicine. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: undergraduate or graduate level physiology or permission of instructor. Study of the design, development and clinical application of regenerative medicine strategies. Analysis of molecular and cellular engineering, biomaterials and tissue engineering, stem cell biology, and immunology as they pertain to pre-translational and clinically used regenerative medicine therapies, as well as the regulatory and ethical considerations of their implementation.

EGRB 619. Computational and Experimental Models of Cellular Signal Transduction. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Corequisite: EGRB 616 or permission of instructor. In this course students will study the process by which an extracellular protein binding event is transduced and interpreted as an incoming signal into a cell. Students will learn the biology of cellular signal transduction, as well as how to apply computational models and experimental techniques to predict and investigate these pathways. The course will follow the course of a protein within a signal transduction cascade, from binding to a receptor, activating intracellular pathways, inducing new transcription and translation, and targeting of the protein to its final location. Students will develop MATLAB-based mathematical models to predict signal transduction dynamics and then study experimental techniques that are used to both disrupt and measure signal transduction.

EGRB 635. Modeling for Biomedical Engineers. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Permission of instructor. Applies mathematical modeling techniques to biomedical systems. Covers linear and nonlinear systems, deterministic and random systems, large systems, ecosystems, numerical techniques, graph theoretical approaches and simulation packages. Utilizes examples of biochemical, physiological and pharmacokinetic systems throughout.

EGRB 670. Advanced Molecular Modeling Theory and Practice. 3 Hours.

Semester course; lecture and laboratory hours. 3 credits. Prerequisite: MEDC 641, EGRB 641 or permission of the instructor. Examines the principles and applications of computational chemistry and molecular graphics to current problems in drug design. Lectures focus on the application of specific computational methods and techniques to solve problems in drug/molecular design. Workshop sessions provide hands-on experience using state-of-the-art hardware and software for molecular modeling.

EGRB 690. Biomedical Engineering Research Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Presentation and discussion of research reports and topics of current interest to the program seminar or special group seminar.

EGRB 691. Special Topics in Biomedical Engineering. 1-4 Hours.

Semester course; 1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advance study, or specialized laboratory procedures not available in other courses or as part of the research training.

EGRB 697. Directed Research in Biomedical Engineering. 1-15 Hours.

Semester course; 1-15 credits. Research leading to the M.S. degree or elective research projects for other students.

Chemical and Life Science Engineering (CLSE)**CLSE 101. Introduction to Engineering. 3 Hours.**

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Prerequisites: course open to first-year students majoring in chemical and life science engineering. Introduction to chemical and life science engineering. Topics covered include ethics and social responsibility; engineering design process; engineering solutions; estimations and approximations; dimensions, units and conversions; mathematics and computer solutions; life-long learning; introduction to the interface between engineering, biology and medicine.

CLSE 102. Methods in CLSE. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: CLSE 101. An introduction to problem formulation and solution methods for chemical and life science engineering. Typical chemical and life science engineering scenarios will be presented. Emphasis will be placed on identifying and formulating problems based on presented scenarios.

CLSE 115. Introduction to Programming for Chemical and Life Science Engineering. 4 Hours.

Semester course; 3 lecture and 3 laboratory hours. 4 credits. Prerequisite: MATH 200. Introduction to the concepts and practice of structured programming. Topics include problem-solving, top-down design of algorithms, objects, basic syntax, control structures, functions and arrays.

CLSE 201. Chemical Engineering Fundamentals I: Material Balances. 4 Hours.

Semester course; 3 lecture and 1 recitation hours. 4 credits. Prerequisites: CLSE 115, CHEM 101 and CHEM 102, and MATH 200 and MATH 201, or equivalents, all with minimum grades of C. The first of two introductory chemical and life science engineering courses. Covers material balances on steady-state chemical processes.

CLSE 202. Chemical Engineering Fundamentals II: Energy Balances and Engineering Thermodynamics. 4 Hours.

Semester course; 3 lecture and 1 recitation hours. 4 credits. Prerequisites: CLSE 201 with a minimum grade of C, CHEM 101-102 and MATH 200-201 or equivalents. The second of two introductory chemical and life science engineering courses. Covers energy balances on steady-state chemical processes, computer-aided balance calculations, balances on transient processes and introduction to thermodynamics.

CLSE 301. Transport Phenomena I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLSE 202 with a minimum grade of C; PHYS 208 and MATH 301. Basic concepts of transport phenomena as applied to chemical and life science engineering. Topics include transport of mass momentum and energy in single and multidimensions.

CLSE 302. Transport Phenomena II. 4 Hours.

Semester course; 3 lecture and 1 recitation hours. 4 credits. Prerequisites: CLSE 301 and CLSE 305. Concepts of transport phenomena as applied to chemical and life science engineering. Topics include advanced multicomponent, multiphase systems, integral analysis, and an integrated view of momentum, heat and mass transport in unit operations.

CLSE 305. Thermodynamics of Phase Equilibria and Chemical Reactions. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLSE 202 with a minimum grade of C and MATH 307. Thermodynamic properties of fluids and mixtures, partial molar quantities, phase equilibria, activity coefficients and correlations, equations-of-state, chemical reaction equilibria for liquid, vapor and multiphase reactions, and the use of equations-of-state and activity/fugacity correlations to obtain the thermodynamic functions required for the calculation of chemical reaction equilibrium constants. Computing using Excel VBA is a required component of this course.

CLSE 306. Industrial Applications of Inorganic Chemistry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CHEM 302 and CHEZ 302. Chemical engineering students: EGRC 201 and EGRC 205. A study and analysis of the most important industrial applications of inorganic chemistry, with emphasis on structure/properties correlation, materials and energy balance, availability and logistics of starting materials, economic impact and environmental effects. Crosslisted as: CHEM 306.

CLSE 312. Chemical Reaction Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLSE 301 and 305. Introduces the student to the analysis of reactors via coupling of empirical reaction rates and thermodynamic constraints with reactor material and energy balances. The behavior of the ideal reactor types (batch, CSTR and PFR) is emphasized with attention given to departure from these ideals by real systems.

CLSE 320. Instrumentation Laboratory. 3 Hours.

Semester course; 1 lecture and 6 laboratory hours. 3 credits. Prerequisites: CLSE 301 and CLSE 305. This laboratory introduces students to a variety of measurement instruments used in modern chemical engineering laboratories and process plants. Detailed laboratory reports are required for each of the experiments undertaken by the students.

CLSE 325. Bioengineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLSE 201 and BIOL 151 or BIOL 152. An introductory and survey level course required for all chemical engineering students. This course introduces concepts and principles of chemical engineering to problems and issues in the life sciences, biotechnology and medicine. Students apply heat and mass transfer concepts, separations and controls to topics that include clinical diagnostics, bioanalytical instrumentation, biosensors and biochips, bioprocess engineering including fermentation, biochemical pathway engineering, protein folding and aggregation, bioreactors and tissue engineering.

CLSE 402. Senior Design Studio I (Laboratory/Project Time). 2 Hours.

Semester course; 6 laboratory hours. 2 credits. Prerequisites: senior standing in chemical and life science engineering and participation in a senior design (capstone) project; CLSE 301, 302, 305 and 312. A minimum of six laboratory hours per week dedicated to the execution phase of the senior design (capstone) project, which should meet appropriate engineering standards and multiple realistic constraints. Tasks include team meetings, brainstorming, sponsor advising, designing, fabrications, assembling, reviewing, studying, researching, testing and validating projects.

CLSE 403. Senior Design Studio II (Laboratory/Project Time). 2 Hours.

Semester course; 6 laboratory hours. 2 credits. Prerequisites: senior standing in chemical and life science engineering and participation in a senior design (capstone) project; CLSE 402. A minimum of six laboratory hours per week dedicated to the execution phase of the senior design (capstone) project, which should meet appropriate engineering standards and multiple realistic constraints. Tasks include team meetings, brainstorming, sponsor advising, designing, fabrications, assembling, reviewing, studying, researching, testing and validating projects.

CLSE 405. Process Synthesis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLSE 302, 305 and 312. A senior technical elective. Students synthesize flowsheets for existing and newly proposed chemical and biochemical products. Quantitative tools learned in earlier courses are used to examine the technical and economic feasibility of the flowsheets. Written bi-weekly status reports are required from each student and each student completes a process synthesis and analysis as a semester project.

CLSE 409. Process Control in Chemical and Life Science Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLSE 301 and 305. Covers process control as applied to chemical and life science engineering with many practical examples. Topics include time and frequency domain analysis, multivariable processes and applications to chemical and biochemical production and processing.

CLSE 428. Introduction to Polymer Science and Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLSE 302, 305 and 312, and CHEM 302, or equivalents. A senior technical elective. The course offers an introduction to the chemistry, physical properties and processing of polymers. Topics include step and chain polymerization, structure/property relationships, mechanical properties of plastics and elastomers, solution properties, methods for polymer characterization, and processing techniques.

CLSE 440. Unit Operations Laboratory. 3 Hours.

Semester course; 1 lecture and 6 laboratory hours. 3 credits. Prerequisites: CLSE 302, CLSE 305 and CLSE 312. Students carry out experiments with chemical and biochemical reactors, energy exchangers, fluid flow networks and other unit operations. Detailed laboratory reports are required for each of the experiments undertaken.

CLSE 450. Undergraduate Research in Chemical and Life Science Engineering. 1-6 Hours.

Semester course; variable hours. Up to 6 credits. Undergraduate research under the supervision of a faculty member. Specific topics vary depending on the interests of the student and the adviser. Registration requires approval of the student's academic adviser and research adviser.

CLSE 460. Undergraduate Honors Research in Life Sciences Engineering. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Corequisites: BIOL 218, CLSE 302. An undergraduate honors research course for academically talented juniors and seniors requiring advanced work and an honors thesis on a topic relevant to life sciences engineering. Topics and credit hours will be chosen in consultation with a sponsoring faculty member.

CLSE 461. Stem Cell Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 218, CLSE 302. The production and behavior of adult and embryonic stem cells are studied and potential applications for the treatment of disease are surveyed. Stem cell engineering techniques including parthenogenesis, nuclear transfer stem cells and embryonic carcinoma cells are introduced. The use of stem and germ cells for cloning is covered, and ethical considerations involving the use of embryonic human stem cells are discussed.

CLSE 543. Advanced Reaction Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides the fundamental background needed to effectively design reactors at the macroscale exemplified by batch, pilot and plant operations or at the micro- and nano-scale exemplified by the current trend to miniaturize unit operations. A quantitative analysis is developed to explain why "real" reactor performance departs from ideal batch, CSTR and plug flow reactor performance.

CLSE 544. Applied Transport Phenomena. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides the basis for analyzing mass, energy and momentum transport issues in environmental, chemical, biological and industrial processes. Molecular mechanisms of momentum transport, energy transport and mass diffusion are utilized to develop an engineering analysis of a given process. This molecular approach is complemented with macroscopic mass, momentum and mechanical energy balances.

CLSE 545. Water Essentials. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MATH 121 and CHEM 121. This course examines the most important applications of water – and outlines many water chemistry details – for critical industrial processes including steam generation, heat exchanger and steam condenser cooling, high-purity water production, and wastewater treatment. Also included is information regarding impurities produced by fossil fuel combustion. The course provides practical information for engineers, chemists and other technical specialists preparing to enter industries such as refining, biofuels, power, pharmaceuticals, food and beverage, electronics, environmental sustainability, and many others.

CLSE 549. Process Biotechnology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Designed to provide a rational basis addressing engineering challenges in the emerging biotechnology area. The course material is broad in scope covering biochemical synthesis, bioreactor design and bioprocess monitoring and control. It also deals with important issues associated with separation and purification techniques used with biomaterials.

CLSE 560. Protein Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with senior or graduate standing in the School of Engineering or School of Pharmacy, or by permission of instructor. This course focuses on the structure-function characterization of proteins and the quantification of protein-protein interactions for the design of novel protein and peptide therapeutics. Additional topics include biochemistry of proteins for engineers, large scale, batch production and manufacturing techniques for biologics.

CLSE 561. Stem Cell Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 218 and CLSE 302. The production and behavior of adult and embryonic stem cells are studied and potential applications for the treatment of disease are surveyed. The importance of the extracellular matrix in cell differentiation and proliferation is established. Stem cell engineering techniques including parthenogenesis, nuclear transfer stem cells and embryonic carcinoma cells are introduced. The use of stem and germ cells for cloning, stem cells and tissue rejection, and ethical considerations in the use of embryonic human stem cells are discussed.

CLSE 562. Advanced Systems Biology Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 218, CLSE 115, and CLSE 302. The system-level properties of biology will be surveyed to understand how DNA leads to cellular behavior through complex molecular interactions. Theoretical and experimental concepts associated with high-throughput data (genomics, transcriptomics, metabolomics, fluxomics, proteomics), cellular regulation and computational modeling will be introduced. Bioinformatic analysis, integration of data and current challenges are discussed.

CLSE 563. Metabolic Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 218, CLSE 115, and CLSE 302. The principles and methods used in metabolic engineering of microbes will be covered. Theoretical and experimental concepts associated with metabolite production, strain design, strain construction and strain characterization will be introduced. Design principles, metabolic engineering challenges, metabolic engineering applications and ethical considerations of genomic alterations are discussed.

CLSE 570. Molecular Physiology and Microanatomy for Chemical and Life Science Engineering. 4 Hours.

Semester course; 3 lecture and 2 laboratory hours. 4 credits. Prerequisites: BIOL 218 and CLSE 302. Understanding physiology from the molecular perspective of cellular biochemical mass action kinetics, molecular diffusion and transport, biomolecular separation processes, and dynamic biochemical control theory is key to the engineering and design strategies for medical intervention in disease and human health. This course explores these biomolecular dynamic events in human physiology with an emphasis on the application of the fundamental biochemical transport phenomena, kinetics and separation processes, and dynamic control theory. Laboratory component emphasizes living, single-cell manipulation and analysis methods, such as patch clamp devices, and the microanatomy of internal organs.

CLSE 572. AI/ML in Chemical and Life Science Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CLSE 115 or equivalent. Enrollment is restricted to students with senior or graduate standing in the College of Engineering or Department of Chemistry, or with permission of instructor. Students should have an introductory course in computer programming and the ability to code in Python at an intermediate level. Digital technology has penetrated nearly every commercial sector of the global economy with tremendous implications. In this course, the fundamental basis and applications of basic tools of AI/ML in the areas of chemical and materials engineering are developed, including molecular structure-property prediction and product development, text-to-procedure extraction, and automation-assisted chemical process development. Student learning and course performance will be assessed with a combination of exams as individual and group-based project work.

CLSE 575. Nanotechnology in Life Science and Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with senior or graduate standing in the School of Engineering or Department of Chemistry, or with permission of instructor. Nanobiotechnology is the application of nano- and micro-fabrication methods to build tools for exploring the world of biological systems. This course will introduce the principles and practice of microfabrication techniques and perspectives in the field of nanobiotechnology. Lectures will cover interdisciplinary topics such as biomolecules at interfaces, biosensors, micro- and nano-fabrication strategies, self-assembly, nanoparticles, micro- and nano-devices and microfluidics.

CLSE 580. Sustainable Chemical Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CLSE 202 or permission of instructor. The course offers a survey of sustainability, green chemistry and green engineering considerations in chemical processing. Topics include quantitative analysis of green chemistry metrics, process intensification, renewable resources and waste valorization. Science communication and science policy will be discussed.

CLSE 585. Interfacial Phenomena. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The course offers an introduction to interfacial phenomena and colloid physical chemistry. Students will develop the ability to apply basic concepts from interface and colloid chemistry and physics to describe engineering applications. The course will also introduce modern experimental techniques and current literature in colloidal and interfacial phenomena.

CLSE 601. Engineering Project Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course covers the fundamental tools and techniques of managing engineering projects and processes. It is based on the "Project Management Body of Knowledge" guide with a focus on creating value for stakeholders. Students will learn the eight project performance domains and gain relevant skills to develop project objectives, define milestones and deliverables, create project plans and manage project resources, including some coverage of project management software. Through course projects students will hone their communication, teamwork and decision-making skills. They will also learn how to manage project risks and resolve conflicts that may arise during projects.

CLSE 602. Engineering Contracts and Effective Negotiations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Engineers are often required to provide input toward the development of contracts and other legal documents as part of overall business operations. This course provides fundamental tools that will aid student understanding of operations at the interface of technology and legal considerations. The course will also include additional content in the review of negotiation methods related to contract development and advancement of business objectives.

CLSE 645. Biosensors and Bioelectronic Devices. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course develops the methodologies used in the design, fabrication and application of biosensors and bioelectronic devices to monitoring problems in the environmental, medical and chemicals industries. Fundamentals of measurement science will be applied to optical, electrochemical, mass and thermal means of signal transduction. Fundamentals of surface science will be used to interpret bio-immobilization, biofouling and non-specific interactions of enzymes, antibodies and DNA at surfaces.

CLSE 650. Quantitative Analysis in Chemical and Life Science Engineering. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: MATH 301. An understanding of the quantitative descriptions of chemical and biological processes is required for engineering analysis, including prediction and design. Analytical approaches are necessary to simplify and provide limits of complex behavior. These approaches include perturbation theory and scaling, density functional formulations, control theory, and stability theory. This course represents the applied mathematical foundations on equilibrium and nonequilibrium analysis of chemical and biological systems.

CLSE 654. Equilibrium Analysis in Chemical and Biological Systems. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: CLSE 305. Provides a molecular-based, thermodynamic framework for the quantitative equilibrium analysis of a broad range of biological and chemical processes. Contemporary equations of state, liquid solution models and elementary statistical mechanics are used to predict the behavior of molecules. Important issues addressed include the estimation of solvation and partitioning of molecules between phases or media, the calculation of free energy changes associated with cellular events and prediction of order/disorder phenomena.

CLSE 655. Nonequilibrium Analysis in Chemical and Life Science Engineering. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: CLSE 301, CLSE 302 and MATH 301. An understanding of the spatial and temporal dynamics of biological systems is key to many cellular events including cell signaling processes, second messenger systems, positive and negative feedback control, transcription, translation, and many more. This course introduces nonequilibrium (dynamic) analysis as applied to biological and chemical systems.

CLSE 656. Advanced Chemical Reaction Engineering. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: MATH 301 and CLSE 312. This course builds upon fundamental principles of chemical reaction engineering including integration of mass balances, reactor design equations and chemical rate laws. Emphasis is given to development of mathematical models and computational simulation of chemical reaction systems with multiple reactions. Additional topics include analysis of systems with unknown reaction parameters and mechanisms and bioprocess/biochemical approaches to chemical production.

CLSE 660. Biomolecular and Computational Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CLSE 650. Dynamic analysis of interacting cellular events, including cell signal pathways, clock reactions, etc., often requires large-scale computational approaches. Furthermore, these techniques are necessarily time dependent requiring unique methodologies, such as multi-time scale methods. This course introduces the subject of real-time biomolecular simulations.

CLSE 675. Polymers in Medicine. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is based on the need for integration of engineering and materials science of polymers with applications in life science engineering. Basic principles of polymer science including structural concepts at the molecular-, nano-, micro- and macro-scales are emphasized so that the student can understand structure/function correlation. The course treats polymer synthesis, molecular weight, morphology and surface science at an introductory level, but quantitative correlations are emphasized. Surface science is emphasized, as medical applications are often dependent on the interaction of a solid polymer with an in vivo environment (tissue, blood, membrane). The polymers chosen for emphasis include polyethylene (hip, knee replacement), poly(vinylchloride) (blood bags, catheters), polyurethanes (artificial heart, wound care) and silicones (implants, catheters). The use of polymers in drug delivery applications is explored, including osmotic-pressure-driven drug delivery. Concepts surrounding polymeric surface modifiers are developed, including applications such as enhanced biodegradability and biocidal function.

CLSE 690. Research Seminar in Chemical and Life Science Engineering. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated up to eight times. Presentations and discussions of current problems and developments in life science engineering by faculty and visiting lecturers.

CLSE 691. Special Topics in Chemical and Life Science Engineering. 1-4 Hours.

Semester course; 1-4 lecture hours (delivered online, face-to-face or hybrid). 1-4 credits. Enrollment is restricted to students who have completed at least one graduate-level engineering course and with permission of the instructor. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other course offerings or as part of research training.

CLSE 692. Independent Study in Chemical and Life Science Engineering. 1-5 Hours.

Semester course; 1-3 lecture and/or 0-4 laboratory hours. 1-5 credits. Prerequisites: graduate standing or permission of instructor. The student must submit a prospectus to the graduate committee for approval and identify a faculty member willing to supervise the course. Investigation of specialized engineering problems through literature search, mathematical analysis, computer simulation and/or experimentation. Written and oral reports, final report and examination required.

CLSE 697. Directed Research in Chemical and Life Science Engineering. 1-15 Hours.

Semester course; 1-15 research hours. 1-15 credits. Enrollment is restricted to graduate students or by permission of instructor. Research directed toward completion of the requirements for the M.S. or Ph.D. in engineering with concentration in chemical and life science engineering under the direction of an engineering faculty member and advisory committee. Graded S/U/F.

Computer and Information Systems Security (CISS)**CISS 609. Advanced Computational Intelligence. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students with an undergraduate course in artificial intelligence, or equivalent background with permission of instructor. Exploration of issues related to application of computational intelligence techniques to system security, particularly in the detection of anomalous system behavior. Of particular interest are issues associated with the automated detection of anomalies caused by authorized users through intended malicious behavior or through accidental misuse, and issues associated with automated user authentication.

CISS 616. Data Warehousing. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: INFO 610. Covers important concepts and techniques in the design and implementation of a data warehouse. Topics include the data warehouse architecture, the logical and physical design issues in the data warehousing development process, technical factors (i.e., hardware, client/server technology, data warehousing and DBMS technologies) and implementation considerations (i.e., data extraction, clean-up and transformation tools). Introduces online analytical processing and data mining. Crosslisted as: INFO 616.

CISS 618. Database and Application Security. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Theory and practice of database and software security focusing in particular on some common database software security risks and on the identification of potential threats and vulnerabilities. Crosslisted as: CMSC 618.

CISS 624. Applied Cryptography. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides a comprehensive survey of modern cryptography. Included are techniques of enciphering and deciphering messages using cryptographic algorithms, block ciphers and block cipher modes, hash functions and message authentication codes, public key cryptography and digital signatures, and steganography. Crosslisted as: CMSC 620.

CISS 634. Ethical, Social and Legal Issues in Computer and Information Systems Security. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Analyzing socio-political and ethical issues surrounding computer and information systems security. Topics include privacy laws, identity theft, information collection and retention policies, and enforcement.

CISS 646. Computer and Information Systems Access Control. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Detailed discussion of access control, including administration, identification and authentication techniques, methodologies and implementations, methods of attack, monitoring, and penetration testing.

CISS 654. Business Continuity and Disaster Recovery Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Fundamentals of business continuity and disaster recovery planning. Includes risk assessment, physical facility protection, data recovery planning, strategies for network backup, desktop recovery, emergency decision making, and maintenance and testing of the plan and its components.

CISS 693. Practice of Computer and Information Systems Security. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students will undertake practical research projects. Written reports of the investigations are required. This course is intended to be taken at the end of the program.

CISS 697. Guided Study. 1-3 Hours.

Semester course; variable hours. 1-3 credits. Intended for graduate students in the Computer and Information Systems Security program wishing to do research on problems in computer and information systems security. Approval of proposed work is required by the director of graduate programs of the Department of Information Systems or of the Department of Computer Science no later than the 10th week of the prior semester. Each student will work with an appropriate faculty member on an approved research proposal. The student will submit a written report on the research conducted as the final product for the course. This course is intended to be taken near the end of the student's degree program.

Computer Science (CMSC)**CMSC 501. Advanced Algorithms. 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: CMSC 401 or equivalent. Enrollment is restricted to students with graduate standing or those accepted into the accelerated B.S. to M.S. program in computer science. Advanced graph algorithms, advanced data structures, applied numerical algorithms, optimization methods, approximation methods for hard graph and string problems and computational geometry algorithms.

CMSC 502. Parallel Algorithms. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: CMSC 312 and CMSC 401. Enrollment is restricted to students with graduate standing or those accepted into the accelerated B.S. to M.S. program in computer science. Software and hardware mechanisms for providing mutual exclusion in uniprocessor and multiprocessor environments. Architectural issues including pipeline design, superscalar computers, multiprocessors, memory systems, peripherals, interfacing techniques, networks, performance and software issues. Design and uses of parallel algorithms to solve concurrency problems in a distributed environment including message passing and remote procedure calls. Students will work in teams (as well as on individual projects) to design and implement parallel algorithms.

CMSC 506. Computer Networks and Communications. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CMSC 312. Theoretical and applied analysis of basic data communication systems; design of networks in the framework of the OSI reference model; Local and Wide Area Networks; performance analysis of networks; error control and security. Students will work in teams to design and implement a small computer network. Crosslisted as: EGRE 526.

CMSC 508. Database Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CMSC 303 with a minimum grade of C. Design and implementation of relational database systems. Emphasis is placed on entity-relationship diagrams, relational algebra, normal forms and normalization. Introduction to SQL. Discussion of physical level issues. Students will be required to complete a design project and give an oral presentation of the project. Not applicable toward the M.S. in Computer Science or the Ph.D. in Engineering, computer science concentration.

CMSC 510. Regularization Methods for Machine Learning. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in computer science or related discipline such as bioinformatics or acceptance into the accelerated B.S. to M.S. program in computer science. The course will assume undergraduate-level background in algorithms, linear algebra, calculus, statistics and probability. Upon successful completion of this course, the student will be able to understand recent advances in machine learning and apply machine-learning tools that go beyond learning from data, as well as have the ability to incorporate additional knowledge about the learning problem. Topics covered will include optimization-based view of supervised machine learning; classical regularization approaches including weight decay and Lasso; regularization terms incorporating additional knowledge about structures in the feature space, including group lasso and graph-based regularization terms; semi-supervised learning using graphs linking unlabeled and labeled samples.

CMSC 512. Advanced Social Network Analysis and Security. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Pre- or corequisites: CMSC 412 and CMSC 501. Enrollment is restricted to students with graduate standing in computer science or a related discipline such as bioinformatics or acceptance into the accelerated B.S. to M.S. program in computer science. The purpose of the course is to teach algorithms for analyzing social networks and complex systems. The focus will be on understanding the inner workings of algorithms using in-network analysis and security threats in online social network sites. Topic covered will include modeling social and technological networks, methods for analyzing structure and dynamical processes on the network, and security and privacy issues in online social networks such as inference attacks, network anonymization, sybil attacks and defense, social bots.

CMSC 516. Advanced Natural Language Processing. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in computer science or a related discipline, or those accepted into the accelerated B.S. to M.S. program in computer science. Upon successful completion of this course, the student will be able to understand recent advances in natural language processing and apply NLP algorithms and techniques for processing unstructured text. Word-level, syntactic and semantic processing will be considered. Specific topics include rule-based and statistical methods for creating computer programs that analyze, generate and understand human language. Regular expressions and automata, context-free grammars, probabilistic classifiers and machine learning. Applications to real-world problems such as spell-checking, Web search, automatic question answering, authorship identification and developing conversational interfaces.

CMSC 525. Introduction to Software Analysis, Testing and Verification. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: CMSC 304 and CMSC 401. Enrollment is restricted to students with graduate standing or those accepted into the accelerated B.S. to M.S. program in computer science. An introduction to concepts and techniques used in the analysis of software for certain properties. Using analytic results to derive test data and verify the correct implementation of programs. Flow graphs, fault/failure model, theoretical and practical limitations. Control flow, data flow and error flow analyses. Testing strategies including random, structural, mutation and error flow. Software metrics.

CMSC 526. Theory of Programming Languages. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CMSC 304. Enrollment is restricted to students with graduate standing or who have been accepted into the five-year accelerated B.S. and M.S. program in computer science. An introduction to the formal semantics of programming languages, logic programming and functional programming. Topics include denotational semantics, attribute grammars, Backus Formal Functional Programming, fixed point semantics, model-theoretic semantics and PROLOG.

CMSC 531. 3D Computer Vision for Robot Navigation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students in computer science or related discipline or to students accepted into the five-year accelerated program in computer science. The course focuses on recent advancements in 3D robotic vision. It covers basic concepts and computational models of 3D sensing, robotic mapping, visual odometry, simultaneous localization and mapping, as well as 3D point data processing for robotic navigation. Students will acquire in-depth knowledge in robotic vision by completing a course project.

CMSC 591. Topics in Computer Science. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. May be repeated for credit. Enrollment requires permission of the instructor. The course is open to students with graduate standing or those accepted into the accelerated B.S. to M.S. program in computer science. A study of selected topic(s) in computer science at the graduate level. See the Schedule of Classes for specific topics to be offered each semester.

CMSC 601. Convex Optimization. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CMSC 501 or permission of instructor. Enrollment restricted to students with graduate standing in computer science or related discipline. A background in undergraduate-level linear algebra is assumed. Convex sets and functions. Convex optimization problems: Linear, quadratic, semi-definite and cone programs. Duality theory. Approximation algorithms for NP-complete integer optimization problems via semi-definite relaxations and rounding schemes. Algorithms for optimization, such as gradient descent, proximal descent, alternating directions method of multipliers, interior point methods.

CMSC 602. Operating Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CMSC 502. A study of operating systems including those in multiprocessor and distributed environments. I/O programming, resource management (including processor and memory management), security and system performance evaluation.

CMSC 603. High Performance Distributed Systems. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in computer science or related discipline or those accepted into the accelerated B.S. to M.S. program in computer science. The course will assume undergraduate-level background in algorithms, data structures and parallel programming. Upon successful completion of this course, the student will be able to understand the concepts underlying distributed systems; analyze problems to identify performance bottlenecks, parallelization opportunities and concurrency issues in a distributed environment; create distributed and scalable implementations using multiple hosts/GPUs; design and implement algorithms using Hadoop, Spark and CUDA.

CMSC 605. Advanced Computer Architecture. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 426 or with permission of instructor. This course will focus on the design and analysis of high performance computer architectures. Topics investigated include pipeline design, superscalar computers, multiprocessors, memory systems, peripherals, interfacing techniques, networks, performance and software issues. Crosslisted as: EGRE 635.

CMSC 608. Advanced Database. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CMSC 508. Topics discussed include: handling of missing information; the relationship between relational calculus, relational algebra and SQL; logic databases; distributed databases; outer joins; and transaction processing. Emphasis is placed on theoretical issues involved in these topics. In addition students will work in teams to develop a working database application.

CMSC 610. Algorithmic Foundations of Bioinformatics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Graduate student standing or acceptance into five-year accelerated program in computer science or related discipline such as bioinformatics. The purpose of the course is to teach algorithms for analyzing biological and medical data. The focus will be on understanding the inner workings of algorithms used in bioinformatics tools. Topic covered will include algorithms for assembling and searching biological sequences, finding patterns associated with disease, and exploring biological networks.

CMSC 611. Computer Multimedia. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Study of computer multimedia techniques relating to images, sound, video and text. Emphasis on compression techniques and standard storage formats. This course is programming-intensive.

CMSC 612. Game Theory and Security. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: CMSC 401. Enrollment is restricted to students with graduate standing in computer science or those accepted into the accelerated B.S. to M.S. program in computer science. The course will provide an introduction to game theory and mechanism design concepts. Lectures cover topics such as introduction of games, equilibrium concepts, computation of game-theoretic solution concepts, mechanism, and issues in game theory and mechanism design.

CMSC 615. Cryptocurrency and Blockchain Techniques. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in computer science or a related discipline. The course will assume undergraduate-level background in algorithms, data structures and programming. Upon successful completion of this course, the student will be able to understand the major concepts about cryptocurrency and blockchain techniques; be familiar with major blockchain applications as well as real-world issues; understand the underlying consensus mechanisms in the Bitcoin system and other alternative cryptocurrency systems; analyze the security of Nakamoto consensus; understand, write and execute smart contracts using an Ethereum-like platform.

CMSC 618. Database and Application Security. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Theory and practice of database and software security focusing in particular on some common database software security risks and on the identification of potential threats and vulnerabilities. Crosslisted as: CISS 618.

CMSC 619. The Design and Specifications of User Interfaces. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Graduate standing and permission of instructor. Requires knowledge of first order predicate calculus and context-free languages. Focuses on human-computer interface design principles and methodology and formal specifications of user interfaces.

CMSC 620. Applied Cryptography. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides a comprehensive survey of modern cryptography. Included are techniques of enciphering and deciphering messages using cryptographic algorithms, block ciphers and block cipher modes, hash functions and message authentication codes, public key cryptography and digital signatures, and steganography. Crosslisted as: CISS 624.

CMSC 621. Theory of Computation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate student standing and permission of instructor. Discussion of the complexity and computability of problems and programs. Topics will include unsolvability, universal programs and abstract complexity.

CMSC 622. Network and System Security. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Studies the principles of network security and system security. Included are topics relating to application layer security, TCP layer security, network layer security and link layer security and the use of access control, intrusion detection, intrusion prevention and other related tools.

CMSC 623. Cloud Computing. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides an introduction to cloud computing architecture and cloud computing security. The course covers the basic concepts of cloud computing, including memory virtualization, device virtualization and related security problems in cloud computing.

CMSC 624. Software Quality Assurance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: a course in software engineering and graduate standing in computer science, or permission of instructor. A study of issues that affect the quality of software and of methodology to assure that software products are of the desired quality. This also includes issues in assessing product quality as well as the process by which the software is produced. Topics include various methodologies, standards, metrics and tools.

CMSC 625. Advanced Software Analysis, Testing and Verification. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CMSC 525. Studies the concepts and techniques used in the analysis of software and the derivation of test data. Focuses on software metrics and reliability; construction of tools to aid software analysis and testing. Requires students to review seminal and current papers from the literature, and lead their discussion in class.

CMSC 628. Mobile Networks: Applications, Modeling and Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in computer science or a related discipline. The course will assume undergraduate-level background in algorithms, data structures, programming and networks. Upon successful completion of this course, the student will be able to understand the major concepts about mobile networks such as device-to-device communication technologies, mobility models and coverage; be familiar with various mobile network types (e.g., mobile social networks, delay tolerant networks, overlay networks, vehicular networks and cellular networks) and devices (e.g., smartphones, femtocells, WiFi), learn how to model mobile networks with stochastic processes and real datasets; be able to use different networking simulators; and understand various routing algorithms and analyze their behavior.

CMSC 630. Image Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in engineering or science or by permission of the instructor. Introduces theoretical and practical aspects of computer vision for image processing and understanding. It provides a comprehensive walkthrough from basics of image preparation to using computational intelligence tools for knowledge discovery from images. The course will cover basics of image processing and computer vision, including image sampling and quantization, color, pixel-based operations, image filtering, morphological image processing, and image transforms; information extraction including segmentation and feature extraction; pattern recognition for computer vision: classification, novelty and object detection, image understanding, learning from video streams, and tensor-based methods. Examples will include medical image analysis, object recognition in ground and aerial photographs and hyperspectral imaging.

CMSC 635. Knowledge Discovery and Data Mining. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: CMSC 401 or corequisite: CMSC 501. Enrollment is restricted to students with graduate standing in computer science or a related discipline such as bioinformatics, or those accepted into the accelerated B.S. to M.S. program in computer science. Covers knowledge discovery and data mining concepts, tools and methods; provides hands-on experience based on a project involving analysis of large real-life data. Topics include the knowledge discovery process, data storage and representation, preprocessing algorithms for missing data imputation, feature selection and discretization; unsupervised learning algorithms for clustering and association mining; supervised learning algorithms including decision trees, Bayesian models and introduction to support vector machines and neural networks; ensemble learning; protocols and measures for validation of predictive models; and data security and privacy issues.

CMSC 636. Artificial Neural Networks and Deep Learning. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in computer science. The course will assume undergraduate-level background in programming, algorithms, linear algebra, calculus, statistics and probability. Topics ranging from fundamental learning rules, functional, cascade correlational, recurrent and gradient descent networks, to neocognitron, softmax, deep convolutional networks, autoencoders and pretrained deep learning (restricted Boltzmann machines). Students will be required to work in teams on a class paper.

CMSC 654. Memory and Malware Forensics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: CMSC 312. Enrollment is restricted to students with graduate standing in computer science or a related discipline, or those accepted into the accelerated B.S. to M.S. program in computer science. Students should have significant programming experience. This course provides foundation for memory and malware forensics, using the Volatility memory forensics framework, an open source toolkit written in Python. It is focused on investigation of the contents of volatile computer memory (RAM), to reveal hidden malware processes, network connections, clipboard contents, evidence of malware and other malicious evidence. The course will teach skills for analyzing internals of operating systems, such as Mac, Windows and Linux, by concentrating on data structures used by these operating systems.

CMSC 678. Statistical Learning and Fuzzy Logic Algorithms. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: MATH/STAT 309 or MATH 310. The course considers two central problems in modern science and engineering: i) the problem of statistical learning from examples (empirical data) and ii) the problem of embedding existing human knowledge into workable mathematics. Topics include: examples of multivariate functional mapping, basics of classic classification and regression, support vector machines as a learning paradigm based on structural risk minimization, fuzzy logic algorithms, basics of multi-class classification over high dimensional spaces, curve and surface fittings, multivariate function approximation and nonlinear optimization; fuzzy logic systems; crisp and fuzzy sets, linguistic variables, fuzzy set theory; if-then rules, fuzzy interference, fuzzification and defuzzification, neuro-fuzzy paradigms.

CMSC 691. Special Topics in Computer Science. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. Prerequisites: at least one graduate-level computer science course pertaining to the topic area and permission of instructor. An advanced study of selected topic(s) in computer science at the graduate level. See the Schedule of Classes for specific topics to be offered each semester.

CMSC 692. Independent Study. 1-3 Hours.

Semester course; 1-3 variable hours (to be arranged). 1-3 credits. Enrollment restricted to students with graduate standing and consent of instructor. Independent study done under the supervision of a faculty member. The student must identify a faculty member willing to supervise the research and submit a proposal for approval by the computer science graduate committee no later than the 10th week of the prior semester. A written report and an oral presentation are required upon completion of the research project. Graded as Pass/Fail.

CMSC 697. Directed Research. 1-15 Hours.

Semester course; 1-15 research hours (to be arranged). 1-15 credits. May be repeated for credit. A total of three credits may be used to fulfill the M.S. in Computer Science thesis requirement. Independent research culminating in the writing of the required thesis or dissertation. The student must identify a faculty member willing to supervise the research and submit a proposal to the computer science graduate committee no later than the 10th week of the prior semester. This proposal must be approved before the student can register for the course. Graded as S/U/F.

CMSC 701. Research Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Ph.D. standing or permission of instructor. Covers the principles of conducting a research project, reporting the findings in the form of a journal paper and promoting the research through public presentations. Students learn to write grant proposals and practice reviewing research papers and grant proposals. The main emphasis of the course is writing a paper and a grant proposal in a format compliant with NSF, NIH or DoD guidelines.

CMSC 702. Computer Science Seminar. 1 Hour.

Semester course; 1 seminar hour. 1 credit. May be repeated for credit. Enrollment restricted to students in the doctoral program in computer science. Students will attend a weekly research seminar in which the topic and speaker will change each week in order to cover a broad range of subjects at the forefront of computer science research. Students will have to present and to write a report on at least one seminar presented by other speakers. The objective is to expose students to research topics and scholars in the field of computer science as well as to provide them experience in delivering and critiquing seminar talks. Graded as satisfactory/unsatisfactory.

Electrical and Computer Engineering (EGRE)**EGRE 510. Introduction to Internet of Things. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRE 306, EGRE 337 and EGRE 364; or equivalents; or permission of instructor. Students should have prior experience working with MATLAB and Simulink as well as familiarity with high-level programming and mathematical maturity (differential equations, matrix operations, some calculus, probability). This course introduces and covers a broad range of fundamental concepts in Internet of Things including a systems approach to realizing IoT, sensing methods and materials, sensor design, communications, wireless networking technologies, edge and cloud computing, and hardware constraints. Students will have the opportunity to work on small projects individually or in teams to design and implement small-scale IoT systems and components.

EGRE 512. Intelligent Autonomous Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRE 207, EGRE 335 and EGRE 347. Intelligent autonomous systems represent a rapidly advancing field at the intersection of electrical and computer engineering, robotics and artificial intelligence. This course offers a comprehensive exploration of the theory, technologies and practical applications of these systems, equipping senior and graduate students with the skills and knowledge needed to tackle the complex and exciting challenges of the intelligent autonomous systems field. They will possess the skills to analyze, design and optimize autonomous systems, making informed decisions to address contemporary issues and opportunities in robotics, artificial intelligence and automation across various industries.

EGRE 513. Fundamentals of Modern Systems Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRE 335 and EGRE 337. The objective of this course is to teach the technical fundamentals of system engineering, such as system thinking, system design thinking, life cycle design and management in a way that leverages the newest practices in systems engineering, including topics such as emerging systems standards for complex systems, architectures of complex systems, model-based design and engineering, and agile project management methods. The course will incorporate team concepts, project designs and real-world examples to reinforce concepts and knowledge.

EGRE 521. Advanced Semiconductor Devices. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRE 303, PHYS 420 and 440, or equivalents or permission of instructor. Studies the fundamentals of semiconductor heterojunctions, metal-semiconductor contacts, metal-oxide-semiconductor structures, defects, interface states, scaled MOS transistors and heterojunction bipolar transistors.

EGRE 525. Fundamentals of Photonics Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRE 303, 309 and 310 or equivalents. An introduction to the interaction of electromagnetic lightwaves with solid-state materials. Based on the quantum mechanics of photon emission and absorption, the generation and detection of coherent light by semiconductor lasers and photodetectors are investigated. Optical waveguides also are studied for use in sensors employing interferometric and evanescent-field principles. Examples of integrated photonic sensors are presented for mechanical, chemical and biological systems.

EGRE 526. Computer Networks and Communications. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CMSC 312. Theoretical and applied analysis of basic data communication systems; design of networks in the framework of the OSI reference model; Local and Wide Area Networks; performance analysis of networks; error control and security. Students will work in teams to design and implement a small computer network. Crosslisted as: CMSC 506.

EGRE 531. Multicore and Multithreaded Programming. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 364 or CMSC 311 or permission of instructor. Introducing multicore architectures, multithreaded programming models, OpenMP, Pthreads, thread synchronization, performance evaluation and optimization, load balancing and software tools for multicore/multithread programming.

EGRE 532. GPU Computing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CMSC 502, EGRE 531 or permission of instructor. The primary objective of this course is to provide students with knowledge and hands-on experience in developing application software for graphics processing units. The course concentrates on parallel programming basics, GPU hardware architecture and software, GPU programming techniques, GPU performance analysis and optimization, and application development for GPUs.

EGRE 535. Digital Signal Processing. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Prerequisites: EGRE 337 or consent of instructor. The course focuses on digital signal processing theory and algorithms, including sampling theorems, transform analysis and filter design techniques. Discrete-time signals and systems, and filter design techniques are treated. Several applications of DSP in telecommunications, image and video processing, and speech and audio processing are studied.

EGRE 536. Introduction to Cyber-Physical Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRE 365 and EGRE 337 or equivalents, or permission of instructor. Students should have prior experience working with MATLAB and Simulink as well as familiarity with high-level programming and mathematical maturity in differential equations, matrix operations, calculus and probability theory. This course covers principles and foundations of modeling, design and analysis of cyber-physical systems. This course focuses on the top-level system design and in particular on the interplay between software components and physical dynamics. The primary emphasis of this course is to teach students how to build high confidence systems using model-based design paradigms. The course will also introduce various control techniques commonly used for managing and regulating cyber-physical systems. The course is accompanied by a project to give hands-on experience on the covered material. Students will be required to propose group-based projects.

EGRE 539. Introduction to Microwave Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 309 or permission of the instructor. Basics of electrodynamics in cartesian and cylindrical coordinates, design and fabrication of rectangular and conical waveguides, attenuators, horn antennas, wire and planar antennas, microstrip lines and microstrip RF filters.

EGRE 540. Microwave System Design. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 310 or EGRE 539, or permission of the instructor. Advanced electrodynamic principles and passive and active RF components, such as isolators, tuners, phase shifters, resonators, power amplifiers and oscillators. Antenna arrays, radiation patterns to include antenna measurements, microwave measurements using network analyzers, signal generators and signal/spectrum analyzers.

EGRE 541. Medical Devices. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Enrollment requires permission of instructor. An introduction to engineering applications in medicine and design principles for next-generation medical devices. Topics include early cancer detection using microwaves, wireless data telemetry using implantable or body-centric systems, implantable sensors, biodegradable sensors, hyperthermia/ablation for cancer treatment, magnetic resonance imaging, and deep brain and nerve stimulation.

EGRE 553. Industrial Automation. 3 Hours.

Semester course; 2 lecture and 2 lab hours (with lecture/lab overlaps). 3 credits. Prerequisites: EGRE 246 and EGRE 254, or permission of the instructor. Enrollment restricted to students with senior or graduate standing in the School of Engineering. This course provides an introduction to the systems, techniques and languages used in the control of manufacturing and process industries. Major topics include programmable logic controller operation and programming, supervisory control and data acquisition systems, and human machine interfaces. Other topics include an introduction to feedback control systems, analog-to-digital and digital-to-analog conversion, sensors and transducers, and actuators and motors.

EGRE 554. Advanced Industrial Automation. 3 Hours.

Semester course; 2 lecture and 2 lab hours (with lecture/lab overlaps). 3 credits. Prerequisite: EGRE 553. This course provides additional instruction on topics related to systems, techniques and languages used in the control of manufacturing and process industries. Major topics include advanced PLC programming and operation, motion control, and HMI programming. Other topics include feedback control systems, industrial networking and system simulation.

EGRE 555. Dynamics and Multivariable Control I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 301 and 310 or the equivalent. Systems of differential equations with controls, linear control systems, controllability, observability, introduction to feedback control and stabilization. Crosslisted as: MATH 555.

EGRE 573. Sustainable and Efficient Power Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 471. The course covers distributed power generation system and renewable energy technologies. It introduces models and tools for investigating electric power generation and efficiency analysis, the wind and solar power, energy storage, renewable integration, and environmental impacts. At the completion of the course students will be able to apply appropriate models and complete a feasibility study of practical renewable energy systems.

EGRE 591. Special Topics in Electrical and Computer Engineering. 1-4 Hours.

Semester course; variable hours. 1-4 credits. Prerequisite: senior or graduate standing in the School of Engineering or permission of the instructor. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of research training.

EGRE 610. Research Practices in Electrical and Computer Engineering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students in engineering and physical sciences. The course is an interactive course designed to introduce graduate students to the research practices in physical science and engineering, with emphasis on electrical and computer engineering, as well as mentorship and teaching. It is intended to teach students how to write competitive research grant proposals for federal, state and private funding agencies. It also improves writing skills for research papers and teaches research ethics. The focus areas include defining a valid research problem, effective survey and critique of research literature, assessment of relevance and credibility, scientific integrity, engineering and scientific ethics, scientific recordkeeping and data management, collaborative research, authorship and peer review, research compliance, intellectual property, conflicts of interest, and environmental and global issues. Finally, the students are trained to become better teachers and mentors.

EGRE 615. SYSTEMS MODELING. 3 Hours.

EGRB 615 Systems Modeling Semester course; 3 lecture hours. 3 credits. This course provides an introduction to modeling and simulation as enabling tools for optimizing engineered system and process performance. Students will discuss general concepts of abstracting system complexity to critical component interactions that allow for a holistic and realistic system representation. When coupled with specific domain knowledge, this representation can be used to optimize or maximize global system outcomes.

EGRE 620. Electron Theory of Solids. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PHYS 420 and 440 or permission of instructor. The study of electronic structures, band structure calculations, optical absorption and emission, lasing in semiconductors, electron-photon interactions, heterostructures and nanostructures. Quantum theory of electron-photon interaction, absorption and emission, semiconductor lasers, linear response transport, Landauer Buttiker formulas, mesoscopic devices and phenomena, resonant tunneling, single electronics, non-equilibrium Green's function formalism, second quantization, coupled mode theory, electrons in a magnetic field, and integer quantum Hall effect.

EGRE 621. Spintronics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 620 or equivalent, or with permission of instructor. Basic concept of spin, spin interactions, spin transport, spin-based classical devices, single spintronics and spin-based quantum computing.

EGRE 622. MEMS Design and Fabrication. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRE 303 and EGRE 334 or permission of instructor. The course provides the background required to conduct research in microelectromechanical systems. The course provides an overview as well as detailed coverage of material properties, specialized fabrication techniques and the fundamental principles of the major classes of MEMS devices. This will include mechanical sensors and actuators, surface acoustic wave devices, optical sensors, modulators and switches, bioMEMS, chemical and biochemical sensors, and microfluidic devices.

EGRE 624. Nonlinear Optical Materials and Devices. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 525 or equivalent or permission of instructor. This course describes the principles of nonlinear optics and discusses the operation of photonic devices and systems that utilize various second- and third-order nonlinear optical effects. The topics include electromagnetic wave propagation in anisotropic media, nonlinear optical susceptibility tensor, linear and quadratic electro-optic effects, second harmonic, sum- and difference-frequency generation, phase-matching, parametric amplification, optical switching, multi-photon absorption, and self-focusing and self-phase modulation.

EGRE 625. Clean Room Lab Practicum. 1 Hour.

Semester course; 3 laboratory hours. 1 credit. Prerequisite: EGRE 334 or permission of instructor. The course develops the detailed knowledge and skills required to design and fabricate advanced microscale and nanoscale devices for doctoral thesis work in a micro- and nano-fabrication facility cleanrooms. The course focuses on fabricating a nanostructured device and involves photolithography, wet and dry etching, oxidations, diffusions and thin film depositions. Students will complete the processing of the device and perform characterization experiments. Design skills will also be developed, including design and layout using software tools and fabrication of custom photomasks. Students will document all aspects of the laboratory work.

EGRE 626. Advanced Characterization of Electronic Materials and Devices. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 303 or permission of instructor. This course discusses crystal symmetry in relation with physical properties of crystalline solids, with special emphasis on semiconductor materials forming the basis of modern electronic and optoelectronic devices, point and extended defects and their effects on electronic and optical properties of semiconductor materials and device performance, and defect formation during processing. The course also covers in depth structural, electrical and optical techniques used to reveal various structural defects: the theory and practice of X-ray, neutron and electron diffraction methods, transmission and scanning electron microscopy, scanning probe microscopy, Hall effect, deep-level transient spectroscopy, photo- and cathodoluminescence, and time-resolved spectroscopy, with particular focus on their applications to real semiconductor materials and device structures.

EGRE 627. Nanophotonics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 525 or equivalent or permission of instructor. Advances in nanotechnology and fabrication have allowed scientists to control light like never before, bringing topics of science fiction such as cloaking, unlimited resolution imaging, nanometer-thick optics and breakthrough treatments for disease into the realm of reality. This course explores what is possible when students can confine light at the nanoscale and engineer materials at will, covering topics such as light guiding by metals (plasmonics), optical lattices (photonic crystals), arbitrary materials (meta-materials/surfaces), nanoscale lasers (spasers) and stopping light (static optics). Students are exposed to the newest advances in the field through discussion, projects and presentations.

EGRE 631. Real-time and Embedded Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 426 or equivalent or permission of instructor. Presents advanced material in the area of the design, implementation and testing of embedded computer systems intended to operate as part of a larger system. Topics to be discussed include design challenges of embedded computing, real-time scheduling theory, worst-case execution time analysis, embedded architectures, embedded software design and performance optimizations. Hands-on labs and a research project on advanced topics in this field will be included in this course.

EGRE 632. Dependable Embedded Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 364 or permission of instructor. This course explores the rich set of issues that must be considered when dealing with dependable embedded systems in smart energy delivery, transportation, interconnected health and medical devices and smart buildings, which have one or more of the following attributes: need for safety, continuous reliable operation, resilient to disruptions, secure against cyber-attacks, operate in real-time, maintainable and designed correctly. Among the topics covered are fault-tolerant computing, reliability and safety engineering, understanding the origins of failures and errors, design criteria, software reliability, formal verification of designs, cyber security, review of standards in safety critical systems and social/legal concerns.

EGRE 635. Advanced Computer Architecture. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 426 or with permission of instructor. This course will focus on the design and analysis of high performance computer architectures. Topics investigated include pipeline design, superscalar computers, multiprocessors, memory systems, peripherals, interfacing techniques, networks, performance and software issues. Crosslisted as: CMSC 605.

EGRE 636. Introduction to Cyber-Physical Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRE 335 and EGRE 365 or equivalents or permission of instructor. This course introduces students to the research, design and analysis of cyber-physical systems – the tight integration of computing, control and communication. The main focus is on understanding existing and emerging models of CPSs, as well as physical processes in terms of differential equations and computational models for discrete time systems, such as extended finite-state machines and hybrid automata. State-charts are introduced and combined with the physical models for analysis of embedded systems. Linear temporal logic is introduced and applied to specify the desired system behavior. Tools for analytical study and verification of the satisfaction of linear temporal logic formulae are presented and discussed in numerous applications. Dependability attributes such as safety, reliability and cyber-security are discussed in the context of high integrity CPSs.

EGRE 640. Semiconductor Optoelectronics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 309 or equivalent or permission of instructor. Discussions of optical processes in semiconductors and semiconductor heterostructures in terms of radiative and nonradiative processes, as well as absorption. Also covers in depth the theory and practice of light-emitting diodes, including those intended for solid-state lighting, lasers and detectors.

EGRE 644. Wireless Communications. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 444 or permission of instructor. The main objective of this course is to introduce the fundamental principles of wireless communications. The focus will be on the physical layer and wireless transceiver design issues. Students are expected to gain a thorough understanding of wireless channel modeling, the concept of channel fading, the means to mitigate the effect of fading through diversity techniques. Some practical wireless communication techniques will also be introduced such as space-time coding, multiple input multiple output communications and orthogonal frequency-division multiplexing.

EGRE 651. Intelligent Linear Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 337 or permission of instructor. This course covers selected topics on intelligent systems and fundamental principles of system analysis. Emphasis is placed on the student gaining mathematical modeling experience, performing computer simulations and designing systems architecture. Topics include intelligent agents, autonomous control, linear algebraic equations for state variable equations, complex dynamic systems, controllability and observability, linear discriminant functions in algorithm-independent optimization, multilayer neural networks, unsupervised learning and clustering, mobile robot localization and kinematics, and perception for planning and navigation.

EGRE 656. Estimation and Optimal Filtering. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MATH 310, EGRE 337 and EGRE 555/MATH 555. This course will expose students to the fundamental issues in parameter estimation and recursive state estimation for dynamic systems. Topics covered will include maximum likelihood estimation, maximum a posteriori estimation, least squares estimation, minimum mean square error estimation, Cramer-Rao lower bound, discrete-time Kalman filter for linear dynamic systems, extended Kalman filter for nonlinear problems and system models for the Kalman filter.

EGRE 671. Power System Operations and Controls. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGRE 471 or equivalent. This course covers the fundamental concepts of economic operation and controls of power systems, including real and reactive power balance, optimized generation dispatch, steady state and dynamic analysis, real-time monitoring and controls, and contingency analysis. Upon completion of this course, students will be able to develop equivalent circuits and compute programs for power flow analysis, define and analyze automatic generation control scheme on a power system, develop generation dispatching schemes, define and analyze state estimation of a power system using analysis programs, and perform contingency studies of the grid.

EGRE 691. Special Topics in Electrical and Computer Engineering. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Prerequisites: at least one graduate-level engineering course and permission of instructor. An advanced study of selected topic(s) in electrical and computer engineering. See the Schedule of Classes for specific topics to be offered each semester.

EGRE 692. Independent Study. 1-3 Hours.

Semester course; 1-3 lecture and 1-3 laboratory hours. 1-3 credits. Prerequisites: graduate standing and permission of instructor. The student must identify an electrical and computer engineering faculty member willing to supervise the course and submit a proposal for approval to the electrical and computer engineering graduate committee. Investigation of specialized electrical and computer engineering problems through literature search, mathematical analysis, computer simulations and/or experimentation. Written and oral reports, final report and examination are required.

EGRE 697. Directed Research in Electrical and Computer Engineering. 1-15 Hours.

Semester course; variable hours. 1-15 credits. Prerequisite: graduate standing or permission of instructor. Research directed toward completion of the requirements for the electrical and computer engineering track in the M.S. or Ph.D. in Engineering performed under the direction of an electrical and computer engineering faculty member and advisory committee. Graded as S/U/F.

Engineering (ENGR)**ENGR 591. Special Topics in Engineering. 1-4 Hours.**

Semester course; 1-4 credits. Prerequisite: senior or graduate standing in the School of Engineering, or permission of the instructor. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of research training.

ENGR 597. Vertically Integrated Projects. 3 Hours.

Semester course; 6 laboratory hours. 3 credits. Enrollment requires permission of the faculty adviser. This course provides students pursuing a Master of Science without a thesis option the opportunity to engage in research under the guidance of faculty and graduate students in their area of expertise.

ENGR 690. Engineering Research Seminar. 1 Hour.

Semester course; 1 credit. May be repeated for a maximum of 2 credits. Presentations and discussion of current problems and developments in engineering by students, staff and visiting lecturers.

ENGR 691. Special Topics in Engineering. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. An advanced study of selected topic(s) in engineering. See the Schedule of Classes for specific topics to be offered each semester.

ENGR 692. Independent Study. 1-3 Hours.

Semester course; 1-3 lecture and 1-3 laboratory hours. 1-3 credits. Prerequisites: graduate standing and consent of instructor. The student must identify a faculty member willing to supervise the course and submit a proposal for approval to the appropriate track's graduate committee. Investigation of specialized engineering problems through literature search, mathematical analysis, computer simulation and/or experimentation. Written and oral reports, final report and examination are required.

ENGR 696. Engineering Products and Economic Considerations. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment requires permission of instructor. Owing to the recent advancements in technology, engineers have become an integral part of designing the next generation of products. This course will expose students to some of the engineering concepts in product development and economy. These concepts include: the stages of engineering product development – concept design, in silico and in vitro/ in vivo testing; introduction to tools for designing engineering products; financial aspects of materials and supplies used in engineering products; and steps for launching a successful engineering product and available resources.

ENGR 697. Directed Research. 1-15 Hours.

Semester course; variable hours. 1-15 credits. Research directed toward completion of the requirements for M.S. and Ph.D. in Engineering degrees under the direction of engineering faculty and an advisory committee. Graded S/U/F.

ENGR 698. Vertically Integrated Projects. 3 Hours.

Semester course; 6 laboratory hours. 3 credits. Enrollment requires permission of the faculty adviser. This course provides students pursuing a Master of Science without a thesis option the opportunity to engage in advanced research under the guidance of faculty and graduate students in their area of expertise.

ENGR 701. Post-Candidacy Doctoral Research. 9 Hours.

Semester course; 9 research hours. 9 credits. May be repeated for credit. Enrollment is restricted to students who have been admitted to doctoral candidacy in the College of Engineering. Students will participate in supervised discipline-specific research related to their dissertation topic. Students must have approval from their current degree program coordinator to register. This course can be approved as a substitution for any post-candidacy degree requirement. Graded as satisfactory/unsatisfactory.

Mechanical and Nuclear Engineering (EGMN)**EGMN 501. Advanced Manufacturing Systems. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGMN 425 and EGMN 426, graduate standing in the School of Engineering, or permission of instructor. Studies the fundamental systems required for mechanical, chemical and electrical manufacturing, including material procurement, logistics, quality and distribution. The principles are applied to all types of manufacturing processes from project through continuous. Advanced systems for lean, agile and global manufacturing also are covered.

EGMN 502. Product Design and Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: senior or graduate standing in the School of Engineering, or permission of instructor. Presents engineering concepts and techniques necessary to successfully develop new products and introduce them to the marketplace. Topics include development processes, converting direct customer input to marketing specifications, creating technical specifications, quantifying customer input, using rapid prototyping to reduce development time, design for manufacturability and product certification issues.

EGMN 505. Characterization of Materials. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: senior or graduate standing in the School of Engineering, or permission of instructor. Focuses on characterization techniques of solids at the molecular, surface and bulk levels, including resonant, vibrational and electronic spectroscopies, X-ray methods and optical and electron microscopies. A connection will be developed between the theoretically-derived and experimentally-observed properties of materials and a rationale also will be developed for choosing an appropriate characterization technique for a given material.

EGMN 506. Industrial Hygiene. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with senior or graduate standing in the School of Engineering or by permission of instructor. The course will acquaint students with methods used by industrial hygienists to identify, evaluate and control human exposure to toxic contaminants and harmful physical agents in the workplace and in the environment. Students will develop an understanding of the ethical issues confronting industrial hygienists and other health professionals.

EGMN 507. Law and Engineering. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment restricted to students with senior or graduate standing in the school of Engineering, or by permission of instructor. The course proposes to acquaint the student with legal concepts that affect the engineering community and enable the student to understand how technical and scientific regulations are promulgated and how interest groups attempt to ensure that regulations consider their positions. In addition, the course introduces intellectual property law: patents, copyrights and trademarks.

EGMN 508. Lean Manufacturing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with senior or graduate standing in the School of Engineering or by permission of instructor. The objective of the class is to introduce lean thinking – defined as a systematic, logical method of identifying and eliminating waste using continuous assessment. The classes focus on managing flow, identifying and eliminating waste, problem-solving, and product and process design.

EGMN 509. Advanced Lean Manufacturing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with senior or graduate standing in the School of Engineering or by permission of instructor. The course builds on the knowledge gained in lean manufacturing. The class allows the student to use their lean tools in a real manufacturing environment. The course reviews automation, load leveling, distribution, logistics, flow and added work, among many other topics. At the end of the course students will be able to take the Lean Bronze Certificate Test, given by the Society of Manufacturing Engineers.

EGMN 510. Probabilistic Risk Assessment. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with senior or graduate standing in the School of Engineering, or by permission of the instructor. An introduction to probabilistic risk assessment methods as applied to nuclear power plants. Students will receive hands-on experience in PRA methods by designing and building a PRA model for an operational nuclear power plant. Students will use state-of-the-art software to design a nuclear plant model, using event trees, fault trees, industry failure and unavailability data, and current human reliability analysis methods. Using the completed model, students will calculate and use appropriate risk metrics in typical applications.

EGMN 515. Vibrations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Provides students with vibrations theory and practical applications for machines and structures necessary (a) to perform analysis and evaluation of vibrations problems and (b) to recognize suspicious results from canned computer software. Emphasis placed on the formulation of governing differential equations, solution methods, evaluation of results and interpretation of response characteristics of discrete mass systems and continuous mass systems. Work and energy methods, variational methods, and Lagrange's Equations will be used to formulate problems. Solution methods will use exact and approximate methods, including eigensolution methods. Applications to the vibrations of various mechanical systems will use computational techniques, computer simulation and analysis.

EGMN 518. Advanced HVAC. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or by permission of instructor. The course intends to reinforce the fundamentals of HVAC systems and apply them to research topics. Student will review the basics of HVAC systems; the use of psychrometric charts to deal with various moist-air processes; indoor environment health, thermal comfort and indoor air quality control; heat transmission in building structures; solar irradiation; basic space heating and cooling load calculations; and space air distribution and related equipment.

EGMN 525. Feedback Control. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: experience using MATLAB software; EGMN 315 and EGMN 410, with a minimum grade of C in both; graduate standing in the School of Engineering; or permission of instructor. In-depth study of the fundamentals of feedback control systems theory and design. Topics covered include transfer function modeling, system stability and time response, root locus, Bode and Nyquist diagrams, lead, lag, and PID compensators.

EGMN 530. System Analysis of the Nuclear Fuel Cycle. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGMN 359 or EGMN 455. Enrollment is restricted to graduate students in the College of Engineering if prerequisites have not been met. Provides an in-depth technical and policy analysis of various options for the nuclear fuel cycle. Topics include uranium supply, enrichment fuel fabrication, in-core physics and fuel management of uranium, thorium and other fuel types, reprocessing, and waste disposal. Also covered are the principles of fuel-cycle economics and the applied reactor physics of both contemporary and proposed thermal and fast reactors. Nonproliferation aspects, disposal of excess weapons plutonium and transmutation of actinides and selected fission products in spent fuel are examined. Several state-of-the-art computer programs are provided for student use in problem sets and term papers.

EGMN 535. Topics in Clean and Renewable Energy. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with senior or graduate standing or with permission of the instructor. This course introduces energy conversion systems with a focus on clean and renewable sources of energy. Topics will include an overview of energy sources, usage and trends; fossil fuels; nuclear; solar and photovoltaic; hydroelectric; hydrogen; geothermal and wind. The course will also cover topics such as energy storage, climate impact, cost, economic and political considerations. The course is appropriate as a technical elective for upper-level undergraduate students and graduate students in engineering.

EGMN 545. Energy Conversion Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGMN 204 and EGMN 301, with a minimum grade of C in both, graduate standing in the School of Engineering, or permission of the instructor. Quantitative and qualitative study of traditional and alternative systems used to generate electricity. Topics include combustion, coal-fired boilers, nuclear reactors, steam turbine blading, gas turbine combustors, turbo-generator design, internal combustion engines, solar thermal systems, photovoltaic devices, wind energy, geothermal energy and fuel cells. Additional topics of interest to the students may be discussed.

EGMN 550. Energy and Sustainability. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires senior or graduate standing in the School of Engineering or permission of instructor. This course will explore the various available energy resource options and technologies with a focus toward achieving sustainability on a local, national and global scale. The course will examine the broader aspects of energy use, including resource estimation, environmental effects, interactions among energy, water and land use, social impacts, and economic evaluations. Students will review the main energy sources of today and tomorrow, from fossil fuels and nuclear power to biomass, hydropower and solar energy, including discussions on energy carriers and energy storage, transmission, and distribution.

EGMN 551. Experimental Methods for Engineers. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: senior or graduate standing in the School of Engineering or permission of the instructor. An introduction to design of experiments theory, DoE and methods such as six-sigma and factorial experimental design to engineering projects. Provides students with the necessary background to plan, budget and analyze an experiment or project.

EGMN 555. Smart Materials. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Covers various smart materials, such as shape memory alloys and piezoelectric and magnetostrictive materials, current research in material development and diverse applications in areas such as medicine, automobiles and aerospace. The aim of the course is to bridge the gap between different areas of material development, characterization, modeling and practical applications of smart materials.

EGMN 560. Monte Carlo Simulations. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with senior or graduate standing in the School of Engineering or by permission of instructor. The course covers key aspects of computer modeling and simulation with the emphasis on statistical resampling and Monte Carlo techniques. Students will complete a number of modeling projects utilizing programming languages commonly used in the nuclear industry. As such the course includes gaining a basic proficiency in the appropriate programming language, including the development of good programming practices.

EGMN 561. Artificial Intelligence in Mechanical and Nuclear Engineering. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: EGMN 210, CMSC 210 or CMSC 254. Enrollment is restricted to students with senior or graduate standing or with permission of the instructor. This course focuses on data-driven computational artificial intelligence applications in mechanical and nuclear engineering. Specific areas of AI applications may include design and optimization of mechanical and thermal-fluid systems, engineering materials, autonomous vehicles, robotics, nuclear fuel cycle, fusion plasma disruptions in tokamaks, and engineering research. Knowledge of Python programming is required.

EGMN 565. Design Optimization. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGRM 420 and 421, with a minimum grade of C in each, graduate standing in the School of Engineering, or permission of instructor. Focuses on providing students with a methodology and set of skills to apply in improving engineering components, systems and processes. The design of better products and processes is a fundamental goal of all engineering.

EGMN 566. Advanced Computer-aided Design and Manufacturing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EGMN 420, EGMN 421, EGMN 425 and EGMN 426, with a minimum grade of C in each, graduate standing in the School of Engineering or permission of instructor. Provides students with an understanding of how modern computer techniques can enhance the generation, analysis, synthesis, manufacturing and quality of engineering products. The design and manufacture of better products and processes is a fundamental goal of all engineering disciplines.

EGMN 568. Robot Manipulators. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing in the School of Engineering or permission of instructor. Provides students with a basic knowledge in the dynamic analysis and control of robot manipulators. Topics include Jacobian analysis, manipulator dynamics, linear and nonlinear control of manipulators, force control of manipulators, robot manipulator applications and an introduction to telemanipulation.

EGMN 570. Effective Technical Writing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to juniors, seniors or graduate students in the School of Engineering or with permission of instructor. The course will involve intensive study of different aspects of technical communications. Critical reading and writing skills will be developed particularly for technical essays, targeted for both educated and specialized audience. Nontechnical writing will be used as an inspiration for technical writing. Other aspects of technical communications will also be covered.

EGMN 571. Introduction to Computational Fluid Dynamics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGMN 301 with a minimum grade of C, graduate standing in the School of Engineering or permission of the instructor. Students will become familiar with basic aspects of CFD, including characteristics of the governing equations, finite-difference and finite-volume solution methods, implicit versus explicit solution algorithms, grid generation, and numerical analysis. Emphasis placed on mechanical, chemical and bioengineering systems. The final course project will emphasize issues of current research such as biofluid mechanics, medical devices and MEMS.

EGMN 573. Engineering Acoustics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing in the School of Engineering or permission of the instructor. Designed to equip students to perform design work, testing and research in structural acoustics and vibrations. Applications from the fields of automotive, aerospace, marine, architectural, medical equipment and consumer appliance industries will be investigated.

EGMN 574. Nuclear Safeguards, Security and Nonproliferation. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with senior or graduate standing in the School of Engineering or by permission of instructor. This course will explore the political and technological issues involved with nuclear safeguards, security and nonproliferation. Topics studied will include the history of nuclear weapons development, description and effects of weapons of mass destruction, nuclear material safeguards, protection of nuclear materials, proliferation resistance and pathways in the nuclear fuel cycle, international and domestic safeguards, nuclear terrorism, and safeguards measurement techniques for material accountancy programs and physical protection mechanisms.

EGMN 575. Fast Breeder Reactors. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with senior or graduate standing in the School of Engineering or by permission of instructor. This course will examine the physical, technical and economic features of fast breeder reactors. In particular, the course will study the need for fast reactors and their design objectives, typical core design principles, and important plant systems. The course will also discuss the major nuclear safety topics and their design approaches.

EGMN 580. Flow Control. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EGMN 301 with a minimum grade of C, graduate standing in the School of Engineering or permission of instructor. Passive, active and reactive flow management strategies to achieve transition delay/advance, separation control, mixing augmentation, drag reduction, lift enhancement and noise suppression. Unified framework for flow control. Futuristic reactive control methods using MEMS devices, soft computing and dynamical systems theory.

EGMN 581. Aircraft Flight and Design. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: EGMN 301. Enrollment is restricted to students with senior or graduate standing or with permission of the instructor. This course introduces various types of flight and aircraft, the physics of flight and aircraft flight control design, such as helicopter flight and design, rotor aircraft, rockets and spacecraft. Wing design and wing dynamics, as well as powered flight will also be covered.

EGMN 582. Aerodynamics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: EGMN 301. Enrollment is restricted to students with senior or graduate standing or with permission of the instructor. This course involves Bernoulli's principle and the discussion of airplane wings and wing dynamics. Control surfaces including flaps, elevators, trim tabs, rudders and spoilers. Flow across airfoils, including angle of attack, air stagnation and secondary flows, stalls, and other flow dynamics. Airspeed discussions include subsonic flow, transitional flow, supersonic flow and hypersonic flow. Also, airflow measurements and flow visualization, including wind tunnels, pressure measurements and aircraft designed for specific flow fields.

EGMN 583. Aerospace Propulsion. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: EGMN 301. Enrollment is restricted to students with senior or graduate standing or with permission of the instructor. In this course students will review the fundamental of thermodynamics and 1-D compressible flow dynamics which apply to aircraft propulsion systems; study the performance and cycle analysis of various flight propulsion systems; design supersonic inlet nozzles; match and map the various components.

EGMN 584. Aerospace Structures. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: EGMN 202. Enrollment is restricted to students with senior or graduate standing or with permission of the instructor. This course includes a review of mechanics of deformables; two-dimensional plane stress and strain; analysis of thin-walled beams with open and closed cross-sections, unsymmetrical bending of wing sections, torsion of skin-stringer and multi-cell sections, flexural shear in open and closed cross-section; principles of stressed skin (monocoque) structural design; stress analysis of structural components of aircraft – wings, wings spars, wing ribs, fuselages and fuselage frames; and introduction to aeroelasticity.

EGMN 585. Turbomachinery. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: EGMN 301. Enrollment is restricted to students with senior or graduate standing or with permission of the instructor. This course is designed to provide a balanced coverage of theory and application of the fluid mechanics and thermodynamic principles utilized in many commonly used types of turbomachinery. Operating principles and common components of both axial flow and centrifugal turbines and compressors, pumps, and fans are covered. Additional topics may include rotordynamics and applications in renewable energies.

EGMN 586. Aerospace Materials. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: EGMN 309. Enrollment is restricted to students with senior or graduate standing or with permission of the instructor. In this course students will study the science and engineering of the materials used in aircraft, helicopters and spacecraft. The focus is on the structural materials used in the airframe and propulsion system. The materials that are used in the main structures (e.g., fuselage, wings, landing gear, control surfaces) and the propulsion systems (e.g., jet engines, helicopter rotor blades) are examined in terms of materials-structure-property relationship.

EGMN 591. Special Topics in Engineering. 1-4 Hours.

Semester course; 1-4 variable hours. 1-4 credits. Prerequisite: senior or graduate standing in the School of Engineering, or permission of the instructor. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of research training.

EGMN 602. Convective Heat Transfer. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: graduate standing in the School of Engineering, or permission of instructor. In-depth quantitative study of convective heat transfer. Topics include laminar boundary layer flow, laminar duct flow, external natural convection, internal natural convection, transition to turbulence, turbulent boundary layer flow, turbulent duct flow, free turbulent flows, convection with change of phase, convection in porous media.

EGMN 603. Mechanical and Nuclear Engineering Dynamic Systems. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in mechanical and nuclear engineering. This course presents the technical foundation for application and use of dynamic systems and presents methods to formulate the governing differential equations of such systems and to obtain realistic analytical and numerical solutions. The organization of the course presents theory and methods and specific applications for typical dynamic systems.

EGMN 604. Mechanical and Nuclear Engineering Materials. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The course consists of advanced topics in both fundamental and applied materials science including solid state fundamentals, crystal structure, diffraction in crystals, postulates of quantum mechanics, Bloch functions and energy bands, Fermi distributions, classification and processing of materials, alloys and phase diagrams, defects, dislocation dynamics, solid state diffusion, thermal and mechanical properties, corrosion, high temperature deformation mechanisms, basics of fracture mechanics, fundamentals of ionization radiation, irradiation effects on material properties, and materials selection for extreme environment applications.

EGMN 605. Mechanical and Nuclear Engineering Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in mechanical and nuclear engineering. The course covers advanced topics in applied mathematics most important for solving practical problems in mechanical and nuclear engineering. Topics include Fourier analysis, partial differential equations, boundary value problems, series solutions, complex analysis, conformal mapping, complex analysis and potential theory, applications in fluid mechanics, vibrations, and mechanical and nuclear engineering problems.

EGMN 606. Mechanical and Nuclear Engineering Continuum Mechanics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in mechanical and nuclear engineering. The topics include scalars, vectors and tensors; indicial notation; transformation law; principal values and directions; tensor fields; integral theorems of Gauss and Stokes; stress; Mohr's circle; strain; kinematics of deformation and motion; rate of deformation; general principles (continuity, momentum, energy); constitutive equations; linear elasticity; Hooke's law; three-dimensional elasticity; classical fluids; Navier-Stokes equations; Bernoulli equation; flow (viscous, steady, irrotational).

EGMN 607. Heat and Mass Transfer Theory and Applications. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in mechanical and nuclear engineering. A solid theoretical and applied understanding of heat and mass transfer is critical for training competent mechanical and nuclear engineers. This course will provide students with a theoretical understanding of the heat transport processes of conduction, convection and radiation as well as an understanding of parallels with mass transfer. Solution techniques will be both analytical and numerical, consistent with problems faced by modern engineers. Applications in the field of mechanical engineering include the design of cooling systems for automobiles, conventional power plants, heat engines and computers. Applications in the field of nuclear engineering include maintaining nuclear core temperatures and nuclear plant heat dissipation. Mass transfer applications include any process involving multiple species (e.g., two gases) as well as medically oriented transport problems (e.g., blood oxygenation), which are frequently encountered when developing materials or medical devices. Specific topics to be covered include 1D conduction, 2D and 3D conduction, transient conduction, external forced convection, internal forced convection, convection with phase change, thermal radiation, and principles of mass transfer (diffusion and advection).

EGMN 608. Solid Mechanics and Materials Behavior. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing in the School of Engineering or permission of the instructor. Studies of stresses and strains in two- and three-dimensional elastic problems. Failure theories and yield criteria. Analysis and design of load-carrying members, energy methods and stress concentrations. Elastic and plastic behavior, fatigue and fracture, and composites will be discussed.

EGMN 609. Advanced Characterization of Materials. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Study of the physical properties of a wide range of materials by advanced microscopy techniques including electron and scanning probe-based microscopy. Advanced study of deformation and failure in materials including characterization by hardness, fracture toughness and tensile testing, as well as X-ray diffraction.

EGMN 610. Topics in Nuclear Engineering. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in the School of Engineering or with permission of instructor. A survey covering the scope of nuclear engineering. Concepts of atomic and nuclear structure, mass and energy, nuclear stability, radioactive decay, radioactivity calculations, nuclear reactions, interaction of radiation (neutrons and photons) with matter, fission chain reaction, neutron diffusion, nuclear reaction theory, reactor kinetics, health physics, reactor power plants (PWR and BWR), waste disposal. Required first course for graduate students in nuclear engineering track who enter with degrees in other disciplines; suitable as a technical elective for other graduate engineering tracks.

EGMN 612. Advanced Computational Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Exposes students to the fundamentals of modern numerical techniques for a wide range of linear and nonlinear elliptic, parabolic and hyperparabolic partial differential equations. Topics include equation characteristics; finite difference, finite volume and finite element discretization methods; and direct and iterative solution techniques. Applications to engineering systems are presented, including fluid dynamics, heat transfer and nonlinear solid mechanics.

EGMN 620. Reactor Theory. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in the School of Engineering or with permission of instructor. The neutronics behavior of fission reactors, primarily from a theoretical, one-speed perspective. Criticality, fission product poisoning, reactivity control, reactor stability and introductory concepts in fuel management, followed by slowing-down and one-speed diffusion theory.

EGMN 625. Advanced Modeling and Simulations. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate standing in the School of Engineering or by permission of instructor. Use of finite element method to solve applied engineering problems at an advanced level. Special focus will be largely on solid mechanics and, to a lesser degree, on thermal problems. Topics to be covered include, but are not limited to, material and geometric nonlinearities, contact problems, dynamic problems and application of constraint equations. Commercially available finite element method software ANSYS will be utilized. Students will learn how to use ANSYS at an advanced level through utilizing commands and basic programming features.

EGMN 627. Advanced Manufacturing Simulations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Advanced mechanics of the manufacturing processes, their modeling and simulation. Fundamentals of process modeling and use of computational tools. Details and governing theory behind the construction of numerical analysis tools such as FEA will not be provided. However, the intelligent use of this kind of FEA tool in the solution of industrial problems will be taught in addition to analytical methods in rapid assessment of manufacturing processes and systems.

EGMN 630. Technology, Security and Preparedness. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An overview of the role of technology in detecting and defeating terrorism. The course begins with a detailed review of weapons of mass destruction including chemical, biological and radiological devices. This is followed by a review of the various technologies currently being developed and deployed to detect the presence of terrorist weapons and associated activities. These technologies include chemical sensors, biosensors and radiation detectors, portal monitors, satellite and infrared imaging systems, as well as acoustic sensors and magnetometers.

EGMN 640. Nuclear Safety. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Physical and biological aspects of the use of ionizing radiation in industrial and academic institutions; physics principles underlying shielding instrumentation, waste disposal; biological effects of low levels of ionizing radiation.

EGMN 650. Nuclear Radiation and Shielding. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Basic and advanced concepts in radiation sources, gamma ray and neutron shielding, geometry factors in shielding, computational techniques (such as Monte Carlo and discrete ordinates), special topics (such as shield heating, duct steaming and albedo theory) and practical aspects.

EGMN 655. Nuclear Power Plants. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Descriptions of mechanical features (containment, core design, steam generation, Rankine and Brayton cycles) of PWR and BWR power plants. Reactor core heat generation. Thermal analysis of fuel pins, fuel elements, flow channels and reactor core. Single- and two-phase heat transfer. Single- and two-phase fluid mechanics. Steady-state and unsteady-state thermodynamic analysis.

EGMN 661. Computational Fluid Dynamics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing in the School of Engineering, or permission of instructor. Teaches students how to perform two- and three-dimensional fluid flow and heat transfer analyses. Students will be able to understand and use most of the commercial flow analyses applied in industry today.

EGMN 662. Advanced Turbomachinery Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Teaches students the principles used in analyzing/designing compressors and turbines. Students will be expected to design a gas turbine to meet specific mission requirements. Upon completion of the course, students will be able to understand the design systems and techniques used in the aeropropulsion and gas turbine industries.

EGMN 663. Viscous Flows. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Designed to introduce graduate students to the fundamentals and the theoretical underpinnings of viscous fluid flows. An extensive project will be included as part of this class.

EGMN 664. Advanced Fluid Mechanics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing in the School of Engineering or permission of instructor. Covers the principles necessary to analyze viscous flow. Students learn how to formulate solutions to general viscous flow problems.

EGMN 665. Advanced Biofluid Mechanics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. Emphasizes the application of fluid mechanics to understand the properties of biological materials pertaining to the human body. This objective will be achieved through the application of fundamental laws (mass, momentum and energy) that govern fluid mechanics. Emphasis will be on respiratory flow dynamics, biofluid measurement techniques, steady and unsteady blood flow, flow through biodevices, turbulence, and mass transport with physiologic boundary conditions.

EGMN 680. Advanced Flow Control. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing in the School of Engineering or with permission of instructor. In-depth passive, active and reactive flow-management strategies to achieve transition delay/advance, separation control, mixing augmentation, drag reduction, lift enhancement and noise suppression. Unified framework and theoretical underpinnings of flow control. Futuristic reactive control methods using MEMS devices, soft computing and dynamical systems theory. An extensive project will be included as part of this class. Not open to undergraduate students. Mechanical engineering students may use EGRM 580 or EGRM 680 (but not both) to meet the requirements for the M.S. and/or Ph.D. degrees. Students cannot receive credit for both EGRM 580 and EGRM 680.

EGMN 690. Mechanical and Nuclear Engineering Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment restricted to students with graduate standing. Mechanical engineering graduate students will attend a weekly one-hour research seminar. The topic and speaker will change each week in order to cover a broad range of subjects at the forefront of mechanical engineering research. The objective is to expose students to research topics and scholars in the field of mechanical engineering. Graded as satisfactory/unsatisfactory.

EGMN 691. Special Topics in Engineering. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. An advanced study of selected topic(s) in engineering. See the Schedule of Classes for specific topics to be offered each semester.

EGMN 692. Independent Study. 1-3 Hours.

Semester course; 1-3 lecture and 1-3 laboratory hours. 1-3 credits. Prerequisites: graduate standing and consent of instructor. The student must identify a faculty member willing to supervise the course and submit a proposal for approval to the appropriate track's graduate committee. Investigation of specialized engineering problems through literature search, mathematical analysis, computer simulation and/or experimentation. Written and oral reports, final report and examination are required.

EGMN 697. Directed Research in Mechanical and Nuclear Engineering. 1-15 Hours.

Semester course; variable hours. 1-15 credits. Prerequisite: graduate standing or permission of instructor. Research directed toward completion of the requirements for the M.S. or Ph.D. in Mechanical Engineering, under the direction of a mechanical engineering faculty member and advisory committee. Graded S/U/F.

Pharmaceutical Engineering and Science (PESC)**PESC 505. Pharmaceutical Engineering Fundamentals I. 3 Hours.**

Semester course; 3 lecture hours (delivered face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program or with permission of the instructor. This is an introductory course designed to expose students to basic concepts in drug discovery as well as principles in pharmaceutics, biopharmaceutics and pharmacokinetics that are fundamental to the development of various dosage forms. Topics to be covered include a general survey from drug discovery to clinical trials; omics-guided drug target identification and strategies for the design of new drugs; the physicochemical characteristics of drugs and excipients; formulation, manufacturing and packaging of pharmaceutical dosage forms; drug and dosage form stability and degradation; physicochemical mechanisms of drug absorption, distribution, metabolism and elimination; and mathematical models and physiological principles used to describe ADME. Prior basic knowledge (B.S.-level) in physical-chemistry, calculus and statistics is required. The course content is delivered through lectures, group discussions, in-class calculations, homework and online tools.

PESC 507. Pharmaceutical Engineering Fundamentals II. 3 Hours.

Semester course; 3 lecture hours (delivered face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program or with permission of the instructor. This is an introductory course designed to expose the students to basic concepts in materials balance, thermodynamics, reaction kinetics and transport processes applied to pharmaceutical processes. Students will be exposed to common problem-solving strategies common to pharmaceutical engineering problems and various tools (software) used to enhance their ability to solve these problems. These introductory steps will provide students with the required tools to address phase equilibrium problems based on a thermodynamic framework; tools to design reaction systems for the production of active pharmaceutical ingredients; and fundamental transport properties for the design systems for the purification and separation of active pharmaceutical ingredients.

PESC 515. Nanomedicine. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in pharmaceutical engineering or with permission of the instructor. This is an introductory course designed to expose students to basic concepts in nanomedicine. Topics to be covered include: introduction to nanocarrier-based drug delivery applications; design of nanocarriers for drug delivery applications; characterization of nanocarriers, including their spatial/temporal controlled-release properties and critical quality attributes; interaction of nanocarriers and the physiological environment; nanocarriers and their dosage forms; nanocarriers for pulmonary drug delivery; nanocarriers for ocular drug delivery; nanocarriers for systemic and lymphatic drug delivery; liposomal drug products; FDA guidance to industry.

PESC 605. Advanced Topics in Pharmaceutical Engineering I. 3 Hours. Semester course; 3 lecture hours (delivered face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program or with permission of the instructor. This is an advanced course in pharmaceutical engineering covering relevant multidisciplinary topics that straddle the boundaries between pharmaceuticals and engineering. Topics include process analytical technology (PAT, situ analytical tools) with a focus on analytical techniques, including particle size analysis, and IR and other in situ spectroscopic techniques; particle solid state characterization, with a focus on methods for characterization/quantification of polymorphs, crystallinity/amorphous ratio, size and size distribution, flowability; modeling, with a focus on modeling of pharmacokinetics, aerosol properties and omics; separations, with a focus on hardware and regulatory, including LC-MS, quality control; and advanced formulations, with a focus on nanomedicine, physiological barriers and sustained release.

PESC 607. Advanced Topics in Pharmaceutical Engineering II. 3 Hours. Semester course; 3 lecture hours (delivered face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program or with permission of the instructor. This is an advanced course in pharmaceutical engineering covering relevant multidisciplinary topics that straddle the boundaries between pharmaceuticals and engineering. Topics include process analytical technology (PAT, situ analytical tools) with a focus on data processing, including data analysis, data visualization and big data; particle formation and size control, with a focus on fundamentals of crystallization, size control operations and control of particle morphology; modeling, with a focus on fundamentals of chemical kinetics, crystallization and formulation processing; separations, with a focus on theory, including analytical, membrane separation and large-scale biosynthesis; advanced formulations, with a focus on engineering materials for the pharmaceutical industry, processing dosage forms for sustained release and transport properties across physiological barriers.

PESC 609. Pharmaceutical Engineering Laboratory I. 1 Hour. Semester course; 3 laboratory hours. 1 credit. Didactic laboratory in pharmaceutical engineering. Laboratory experiments will be focused on three major themes based on the following routes of administration: pulmonary drug delivery (metered-dose and dry powder inhalers); oral drug delivery (tablets and capsules); parenteral drug delivery (sterile parenteral formulations). Experiments performed will focus on drug discovery, active pharmaceutical ingredient characterization and API pre-formulation; they will provide the platform for product formulation manufacturing in more open-ended experiments to be carried out on the same themes in subsequent courses. In situ analytical tools (process analytical technology) will be used in the laboratory experiments as appropriate.

PESC 690. Pharmaceutical Engineering Seminar. 0.5 Hours. Semester course; .5 seminar hours (delivered face-to-face or hybrid). .5 credits. May be repeated for credit. Enrollment is restricted to students in the pharmaceutical engineering Ph.D. program or with permission of the instructor. This course will provide students an opportunity to develop their scientific seminar preparation and oral presentation skills, a forum for discussion of student research, and a mechanism to expose faculty and students to cutting-edge research in pharmaceutical engineering. Feedback from the seminar audience will be provided through discussions, question-and-answer sessions and an evaluation form so the student may benefit from the ideas and experience of the audience.

PESC 691. Special Topics in Pharmaceutical Engineering. 1-5 Hours. Semester course; 1-5 lecture hours (delivered face-to-face or hybrid). 1-5 credits. Presentation of subject matter is by lectures, tutorial studies and/or library assignments in selected areas of advanced study not available in other courses or as part of the training in research. Graded as Pass/Fail.

PESC 697. Directed Research in Pharmaceutical Engineering. 1-15 Hours. Semester course; 1-15 laboratory hours. 1-15 credits. May be repeated for credit. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program. Research leading to the Ph.D. in Pharmaceutical Engineering. Graded as Satisfactory/Unsatisfactory.

PESC 701. Post-candidacy Doctoral Research. 9 Hours. Semester course; 9 research hours. 9 credits. May be repeated for credit. Enrollment is restricted to students who have been admitted to doctoral candidacy in the pharmaceutical engineering program and are graduate teaching assistants or graduate research assistants; registration requires approval from the student's current degree program coordinator. Students will participate in supervised discipline-specific research related to their dissertation topic. This course can be approved as a substitution for any post-candidacy degree requirement. Graded as Satisfactory/Unsatisfactory.

PESC 707. Process Analytical Technology. 3 Hours. Semester course; 3 lecture hours. 3 credits. Prerequisite: Basic chemistry/instrumentation lab skills, basic statistics/programming. Enrollment is restricted to students in Ph.D. in Pharmaceutical Engineering. Students should have basic chemistry/instrumentation lab skills and be familiar with basic statistics/programming. Familiarizes students with process analytical instrumentation commonly used in industrial R&D and manufacturing for process monitoring and development and product quality control. Students will gain practical lab experience of important process analytical technology and develop a better understanding of technology principles and new perspectives on data collection, data comprehension and data analysis.

PESC 709. Pharmaceutical Engineering Laboratory II. 1 Hour. Semester course; 1 laboratory hour. 1 credit. Prerequisite: PESC 609. Corequisites: PESC 605 and PESC 607. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program or with permission of the instructor. This course is the second in a sequence. Didactic laboratory in pharmaceutical engineering. Laboratory experiments will be focused on formulation development and characterization/testing in the three major themes based on the following routes of administration: pulmonary drug delivery (metered-dose and dry powder inhalers); oral drug delivery (tablets and capsules); parenteral drug delivery (sterile parenteral formulations).

College of Health Professions

Allied Health Professions (ALHP)

ALHP 573. Teaching in Health Professional Schools. 3 Hours. Semester course; 3 lecture hours. 3 credits. Study of the relationships between health education and higher education in general, current essentials, standards in education for the health professions and theoretical approaches to the implementation of these standards in both academic and clinical learning. Emphasis will be placed on modes of adapting to future needs of the professions.

ALHP 582. Supervision in the Allied Health Professions. 3 Hours. Semester course; 2 lecture and 2 laboratory hours. 3 credits. Study of the supervisory process and staff development, training in communication and interpersonal skills, and public relations within the health facility.

ALHP 591. Special Topics. 1-4 Hours.

Semester course; 1-4 credits. Prerequisite: Permission of instructor. Interdisciplinary study through lectures, tutorial study or independent research of selected topics not provided in other courses. Graded as Pass/Fail.

ALHP 594. Health Education Practicum. 1-6 Hours.

Semester course; 1 lecture and 4 laboratory hours. 1-6 credits. Preparation, presentation and evaluation of selected educational experiences in the appropriate graduate program. Section 801: general; Section 802: nurse anesthesia; Section 803: clinical laboratory science.

ALHP 596. Supervisory and Administrative Practicum in Allied Health Clinics. 1-9 Hours.

Semester course; 60 clinical hours per credit. 1-9 credits. Prerequisite: Permission of instructor. The course is designed for the student who will be assuming supervisory and administrative roles. Areas to be covered include clinical personnel management, budgeting and ordering of materials and equipment, consultation with physicians, developing and troubleshooting clinical methods, designing job descriptions and implementation of quality control programs. Section 01: Clinical Laboratory Sciences Section 02: Physical Therapy.

ALHP 701. Health Services Delivery Systems. 3 Hours.

Semester course; 3 credits. Examines the structure and function of the U.S. health-care delivery system, the concepts and processes of health and illness, the institutional and individual providers of health services and related theory. Focuses on interdisciplinary care. Emphasizes meeting the unique needs of ethnically and culturally diverse populations.

ALHP 702. Finance and Economic Theory for Health Care. 3 Hours.

Semester course; 3 credits. Focuses on foundational concepts of micro-economic theory and their application in analyzing health care; understanding the structure and dynamics of health-care markets; and on monitoring and controlling the allocation of resources within health organizations. Emphasizes each of the health-care disciplines and how finance and economics affect the practice of delivery and evaluation.

ALHP 708. Health Science Ethics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Applies the principles of biomedical and health-care ethics to develop a more informed understanding of ethical decision making in the formulation of health-care policy as well as within the clinical environment. Focuses on utilizing and searching biomedical ethics literature, current issues in biomedical ethics, the discipline and process of ethical reflection and case consultation.

ALHP 712. Instructional Design and Evaluation for Health Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines various aspects of curriculum development, including instructional design and use of multimedia technology for teacher-learner communication and learner growth and development pertinent to doctoral education. Covers relevant learning theories in higher education and implications on curriculum design. Requires students to develop a Web-based interactive, multimedia course.

ALHP 716. Grant Writing for Health Science Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines fundamentals of allied health grant writing and proposal preparation in the health related sciences, including funding source determination, responding to an RFP, basic elements of a proposal, proposal review procedures and allocation processes. Requires development of a complete proposal and critique of existing proposals.

ALHP 718. Health Informatics. 3 Hours.

Semester course; 3 credits. Analyzes current information and management systems from an allied health sciences perspective. Emphasizes knowledge representation in health care, information needs, storage and retrieval, clinical information systems, standards of health information management and the evaluation of information management systems. Stresses the efficient and innovative use of technology.

ALHP 760. Descriptive and Univariate Statistical Methods for Health Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines basic concepts and techniques of statistical methods, enabling individuals to conduct scientific inquiry as well as critical appraisal of the scientific literature. Includes the collection and display of information, data analysis and statistical measures; variation, sampling and sampling distributions; point estimation, confidence intervals and tests of hypotheses for one- and two-sample problems; principles of one-factor experimental design, one-way analysis of variance and multiple comparisons; and correlation and regression analysis.

ALHP 761. Health Science Research Design I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the design of experimental and quasi-experimental studies in the health care field. Emphasizes issues related to measurement, validity of designs, sampling and data collection. Focuses on the logic of causal inference, including formulation of testable hypotheses, and the design, methods and measures that facilitate research.

ALHP 762. Multivariate Statistical Methods for Health Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines multivariate statistical analysis and evaluation research methods with application to health related science research. Emphasizes data reduction techniques, factor analysis, principle components, discriminant analysis and logistic regression to analyze data in the health field.

ALHP 763. Health Science Research Design II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: ALHP 760, ALHP 761 and ALHP 762. Prepares students to design, implement and interpret studies that evaluate the outcome and effectiveness of health services delivery. Emphasizes identification of emerging trends in health related sciences research, identification of meaningful research questions based on existing information and the use of primary and secondary data to assess outcomes.

ALHP 764. Advanced Methods for Health Sciences Research. 3 Hours.

Semester course; 3 credits. Examines the application of multivariate statistical analysis and evaluation methods to health related sciences research. Emphasizes advanced statistical methods (e.g., LISREL, Event History Analysis) and design to analyze panel data in the health field. Elective course.

ALHP 765. Data Management for Health Science Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the Ph.D. in Health Related Sciences program or with permission from the program director. This course provides an introduction to the management, cleaning, transformation and visualization of data for use in health sciences research. Within the context of this course students will become familiar with how to use multiple statistical software packages for data management. Emphasis will be placed on organizing and naming data files, data cleaning, performing basic data transformations, transferring data across software platforms, graphing data, testing assumptions, manipulating data in preparation for data analysis, and documenting processes for reproducibility.

ALHP 781. Doctoral Seminar. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Enrollment is restricted to students with permission of the instructor. The student's desired topic of study must be identified and approved prior to enrollment. Studies specific topics in the area of the student's specialty track.

ALHP 792. Independent Study. 1-6 Hours.

Semester course; 1-6 credits. May be repeated for a maximum of 6 credits. Prerequisite: Permission of instructor. Offers special individual study or research leading toward investigation in specialty track. Conducted under the guidance of a faculty adviser.

ALHP 793. Research Practicum. 3 Hours.

Semester course; 3 credits. Offers supervised investigation of selected problems in the area of the student's specialty track. Includes conducting and analyzing field research.

ALHP 795. Teaching Practicum. 3 Hours.

Semester course; 3 practicum hours. 3 credits. Enrollment is restricted to students in the Ph.D. in Health Related Science Program with permission from their adviser or the program director. Offers students the opportunity to gain supervised practical experience related to role of academic educator. Includes applied skills of instruction, reflection and evaluation of student learning outcomes. Conducted under the guidance of a faculty adviser.

ALHP 890. Dissertation Seminar. 3 Hours.

Semester course; 3 credits. Deals with general purpose, content and functions of the dissertation process related to the student's specialty track. Leads to the preparation of dissertation proposal.

ALHP 899. Dissertation Research. 1-9 Hours.

Semester course; variable hours. Variable credit. Minimum of 9 semester hours required for Ph.D. Prerequisites: Completion of required course work and comprehensive examination. Covers dissertation research under the direction of a faculty adviser.

Clinical Laboratory Sciences (CLLS)**CLLS 500. Concepts and Techniques in Clinical Laboratory Science. 3 Hours.**

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: Permission of instructor. Restricted to candidates in the categorical master's program. Presents the basic theoretical concepts, laboratory techniques and skills employed in the areas of clinical chemistry, hematology, immunohematology and microbiology.

CLLS 501. Instrumental Methods of Analysis I. 2-4 Hours.

Semester course; 2 lecture and 4 laboratory hours. 2-4 credits. Prerequisite: Permission of instructor. A study of modern research and clinical laboratory instrumentation and procedures. Principles, theory and comparison of laboratory instruments are discussed along with the factors affecting their operation. Laboratory exercises are designed to demonstrate the practical applications of the instruments in the research and clinical laboratory. Areas covered include basic electronics, principles of photometry, spectrophotometry, fluorometry, flame emission photometry, atomic absorption spectrophotometry and computerized instrumentation.

CLLS 502. Instrumental Methods of Analysis II. 2-4 Hours.

Semester course; 2 lecture and 4 laboratory hours. 2-4 credits. Prerequisite: Permission of instructor. A study of modern research and clinical laboratory instrumentation and procedures. Principles, theory and comparison of laboratory instruments are discussed along with the factors affecting their operation. Laboratory exercises are designed to demonstrate the practical applications of the instruments in research and clinical laboratory. Areas covered include electrophoresis, chromatography, particle counters, radio-isotope counters and clinical laboratory automation.

CLLS 580. Principles of Education/Management. 1-3 Hours.

Semester course; 2 lecture and 2 practicum hours. 1-3 credits. Introduces fundamental educational theories and practice, principles of management and employee relations and health-care issues from a global perspective with an emphasis on multicultural diversity. Stresses the application in the clinical laboratory. Requires a practicum in education and in management following the completion of the didactic portion.

CLLS 595. Clinical Practicum. 1-4 Hours.

Semester course; 80-320 clock hours. 1-4 credits. Prerequisite: At least one of the following: CLLS 301-302, 306 and 310, 307-308, 311-312, or by permission of instructor. Individual participation in a hospital laboratory in a selected specialty area: clinical chemistry, hematology, microbiology or immunohematology. Students gain practical experience in the performance of procedures and use of instruments by working with the clinical staff. After gaining competence, the students are expected to properly perform and sign out routine laboratory work under supervision. Based on adviser's recommendation and student's past experience, the course may be taken for less than four credits. Graded as pass/fail.

CLLS 601. Theoretical Blood Banking. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment requires permission of the instructor. A comprehensive study of the blood groups in man, including biochemistry, genetics and clinical significance. Topics relating to problems with antibodies to the blood group antigens are discussed.

CLLS 602. Molecular Diagnostics in Clinical Laboratory Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to students in the M.S. in Clinical Laboratory Sciences' advanced master's track or permission of instructor. Provides the basic principles and techniques of molecular diagnostics and information for establishing a molecular diagnostics laboratory. Examines the utilization of molecular techniques in the clinical laboratory for patient diagnosis and therapy. Emphasizes the use of these techniques in the areas of immunology, microbiology, hematology/oncology, and inherited genetic disorders.

CLLS 605. Advanced Hematology. 2-4 Hours.

Semester course; 2 lecture and 2 laboratory hours. 2-4 credits. Prerequisite: Permission of instructor. Discusses advanced laboratory techniques used to analyze blood dyscrasias and hemostatic disorders. Students also may perform related laboratory tests.

CLLS 608. Laboratory Diagnosis of Infectious Diseases. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Applies an organ system approach to the laboratory diagnosis of infectious diseases. Emphasizes diagnostic methods to verify infections because of pathogenic micro-organisms and includes related diagnostic microbiology laboratory issues. Utilizes a distance learning format.

CLLS 610. Interpretative Clinical Hematology. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: Permission of instructor. Principles of hematopoiesis and related pathological and pathophysiological correlation of hematological disorders are discussed.

CLLS 611. Analytical Techniques for Clinical Mass Spectrometry. 2 Hours.

6-week summer session; 12 lecture and 36 laboratory contact hours. 2 credits. Enrollment restricted to student admitted to the M.S. in Clinical Laboratory Sciences program or by permission of the instructor. Focuses on the proper utilization of chemicals and equipment required for the calibration, quality control and operation of clinically relevant mass spectrometry systems. Emphasizes calculations and demonstration of proficiency with quantitative techniques.

CLLS 612. Mass Spectrometry Systems for Clinical Analyses. 4 Hours.

Semester course; 3 lecture and 2 laboratory hours. 4 credits. Prerequisite: CLLS 611 or permission of the instructor. Focuses on the principles of chemical and instrumental analysis relevant to the detection and quantitation of clinically relevant analytes using mass spectrometry systems. Emphasizes the clinical laboratory applications of different types of mass spectrometry systems, preanalytical sample preparation, and integration of chromatography and mass spectrometry.

CLLS 613. Mass Spectrometry Assay Development for In Vitro Diagnostics. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: CLLS 611 and CLLS 612 or permission of the instructor. Focuses on the principles of assay development and evaluation of methods for the measurement of clinically relevant analytes using chromatography-mass spectrometry systems. Emphasizes "best practices" as found in CLSI, SOFT and FDA guidance documents.

CLLS 622. Fundamentals of Public Health, Epidemiology and Laboratory Surveillance. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students enrolled in the medical laboratory sciences graduate program. Guided study introducing the mission and essential services of public health; epidemiological concepts, methods and goals; application, evaluation and individual and community considerations of public health interventions; the use of laboratory information management systems and informatics; and the role of the public health laboratory, including surveillance activities.

CLLS 624. Laboratory Techniques and Emergency Response and Preparedness. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students enrolled in the medical laboratory sciences graduate program. Guided study that reviews basic laboratory skills such as statistics, chain of custody and safety. Biological threat agents of public health concern are introduced along with common technologies and practices utilized as part of emerging and emergency preparedness and response technologies.

CLLS 626. Quality and Ethics. 2 Hours.

Semester course; 2 lecture hours (delivered online). 2 credits. Enrollment is restricted to students enrolled in the medical laboratory sciences graduate program. Guided study of quality management systems, nonconforming events, root cause analyses, preventive actions and corrections. Public health laboratory regulatory requirements and ethics involved in associated activities and research are also discussed.

CLLS 627. Advanced Concepts in Immunology and Immunoematology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLLS 306, 310 and 496. Presents advanced topics in clinical immunology and immunoematology. Focuses on the integration of advanced concepts in the evaluation of laboratory data and solving clinical and methodological problems related to autoimmune diseases, ABO discrepancies, compatibility testing, hemolytic disease of the fetus and newborn and transfusion reactions.

CLLS 628. Advanced Concepts in Microbiology. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisites: CLLS 307 and 308; and CLLS 496 or 595. Advances study of pathogenic microbiology principles. Includes application of laboratory data and techniques to solve clinical microbiology problems.

CLLS 629. Advanced Concepts in Hematology. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisites: CLLS 302, and CLLS 485 or 595. Focuses on developing and expanding the knowledge acquired in the prerequisite courses in hematology and hemostasis. Incorporates case study evaluations, challenging current hematology topics in the literature and the integration of assessing laboratory data and clinical problems. Emphasizes the development of skills in critical thinking and analyzing clinical data.

CLLS 630. Advanced Concepts in Clinical Chemistry and Instrumentation. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisites: CLLS 311 and 312; and CLLS 483 or 595. Focuses on advanced concepts in clinical chemistry, including endocrinology, measurement of vitamins and tumor markers, method evaluation and laboratory and hospital information systems. Integrates the basic knowledge and skills acquired in the undergraduate sequence of courses with advanced concepts in clinical chemistry/instrumentation to analyze the more complex clinical and analytical problems presented by the aforementioned topics. Includes the design and conduct of library research and laboratory experiments, and data analysis to generate recommendations that are practical and applicable in a real clinical chemistry service.

CLLS 661. Research Methodology in Medical Laboratory Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the B.S. or M.S. in Medical Laboratory Sciences program. Focuses on the principles of scientific research as applicable to problems encountered in the medical laboratory sciences. Students will develop a draft of a research proposal that would be the foundation of a project that would satisfy the research requirement for the master's degree in medical laboratory sciences.

CLLS 690. Clinical Laboratory Sciences Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Presentation and discussion of current research and topics of interest by the departmental faculty, graduate students and visiting lecturers.

CLLS 691. Special Topics in Clinical Laboratory Sciences. 1-4 Hours.

Semester course; 1-4 credits. This course provides for lectures, tutorial studies and/or library assignments in specialized areas not available in formal courses or research training.

CLLS 694. Molecular Diagnostic Practicum I. 8 Hours.

Semester course; 640 clock hours. 8 credits. Prerequisite: permission of instructor. Provides direct observation and practice in a molecular diagnostics laboratory with emphasis on nucleic acid extraction and molecular amplification techniques. Develops proficiency at performing, analyzing and reporting test results. Graded as pass/fail.

CLLS 695. Molecular Diagnostic Practicum II. 4 Hours.

Semester course; 320 clock hours. 4 credits. Prerequisite: permission of instructor. Provides direct observation and practice in molecular diagnostics laboratory. Focuses on molecular hybridization and human identity analyses. Develops proficiency at all stages of nucleic acid analyses including performing, analyzing and reporting test results. Introduces practice issues involved in management of a molecular diagnostics laboratory. Graded as pass/fail.

CLLS 696. Advanced Blood Bank Practicum. 2 Hours.

6 laboratory hours. 2 credits. Prerequisite: permission of instructor. A laboratory course with practical experiences in resolving complex blood group serological problems and discussion of these problems. Donor phlebotomy, processing of donor units, component preparation and instruction of undergraduate clinical laboratory sciences students also are performed.

CLLS 761. Research Methodology in Clinical Laboratory Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on the principles of scientific research as applicable to problems encountered in the clinical laboratory sciences. Also focuses on developing a draft research proposal that would be the foundation for a project that would satisfy the research requirement for the master's degree in clinical laboratory sciences.

CLLS 790. Research in Clinical Laboratory Sciences. 1-15 Hours.

Semester course; 1-15 credits. Research leading to the M.S. degree.

Gerontology (GRTY)**GRTY 501. Physiological Aging. 3 Hours.**

3 credits. This course is taught at an introductory level in contrast to the more substantive background required for GRTY 601. Distinguishes between normal aging and those chronic illnesses often associated with aging in humans. This course would be valuable to those interested in the general processes of human aging.

GRTY 510. Aging. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces the student to the biological, psychological, social, ethical, economic and cultural ramifications of aging. Presents an interprofessional approach to the complex issues and realities of aging. Discusses aging concepts and biopsychosocial theoretical frameworks relevant to the field of aging studies.

GRTY 601. Biological and Physiological Aging. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Biological theories of aging; cellular, physical, systemic and sensory change; health maintenance.

GRTY 602. Psychology of Aging. 3 Hours.

Semester course; 3 seminar hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment requires permission of instructor. Students must complete social sciences research methods before taking this course. Psychological adjustment in late life; special emphasis on personality, cognitive and emotional development; life crises associated with the aging process. Crosslisted as: PSYC 602.

GRTY 603. Social Gerontology. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment requires permission of the instructor. Focuses on the sociopsychological and sociological aspects of aging. Various sociopsychological and social theories of aging will be discussed. The course will provide a broad overview of several general topics such as the demography of aging, politics and economics of aging, and cross-cultural aspects of aging. The course will offer an in-depth analysis of particular role changes that accompany aging (i.e., retirement, widowhood, institutionalization).

GRTY 604. Problems, Issues and Trends in Gerontology. 4 Hours.

Semester course; 4 lecture hours (delivered online, face-to-face or hybrid). 4 credits. Covers a broad range of topics of critical interest to practitioners, policymakers and researchers working with older persons. Explores how societal trends affect the health and social services systems. Recognizes the importance of interdisciplinary approaches to the study of aging issues: Insights from practitioners and the knowledge of researchers will be combined to investigate viable responses to emerging trends. Provides a multifaceted view of these issues based on research expertise and practical experience. Students will experience a visit to the General Assembly and will follow and critically evaluate current aging-related legislation in state government.

GRTY 605. Social Science Research Methods Applied to Gerontology. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students who have completed a graduate statistics course. Application of social science methods and techniques to study of the aged; data sources; types of problems encountered; data analysis; research reporting; use of research findings.

GRTY 606. Aging and Human Values. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Identification and analysis of value systems of the aged, exploration of religious beliefs; death and dying; moral, ethical and legal rights; human values and dignity.

GRTY 607. Field Study in Gerontology. 1-4 Hours.

Semester course; 1-4 field experience hours (delivered online, face-to-face or hybrid). 1-4 credits. May be repeated to the required maximum of four credits. Focuses on identification and systematic exploration and study of a community-identified need, issue or task germane to the student's gerontology concentration with special attention given to funding opportunities and grant writing. Applies specific concepts and approaches to assessment analysis as determined in consultation with the student's program adviser. Implementation and evaluation of a terminal project and dissemination of the results through a portfolio collection, as well as potential professional presentation, grant submission or manuscript submissions. Graded as S/U/F.

GRTY 608. Grant Writing. 2 Hours.

Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Provides the skills necessary to research and write a grant. Explores how to find grant funding opportunities through both private and public sources. Describes the process of preparing a proposal including writing the narrative and preparing a budget.

GRTY 609. Career Planning. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Focuses on the transition from academia to the professional role and workforce. Identifies individual strengths and evaluates career goals. Prepares students to deliver resumé and communication strategy for job seeking in the aging workforce.

GRTY 610. Gero-pharmacology. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: undergraduate course in statistics. Discusses description of medication-related problems that may be experienced by older adults. Identifies strategies to prevent medication-related problems in older adults, defines the role of the pharmacist as a partner in resolving medication-related problems, applies the strategies for preventing medication-related problems to patient cases and evaluates the medication regimen for an older adult residing in assisted living.

GRTY 611. Death and Dying. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on questions surrounding death, dying and bereavement, with a special focus on developmental and cultural issues. Explores concepts through research, experiential learning and reflection.

GRTY 612. Recreation, Leisure and Aging. 3 Hours.

3 credits. An analysis of the quality and quantity of leisure in maximizing the quality of life for the older person. Focus will be on concepts of leisure; the interrelationship of leisure service delivery systems and other supportive services; the meaning of leisure to the elderly in the community and within institutional settings; and innovative programming.

GRTY 613. GLBT in Aging. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Explores the biopsychosocial and ecopolitical aspects of the intersection of aging and being a member of the gay, lesbian, bisexual and/or transgender-identified minority populations. Reviews normative aging factors in the context of being a member of the GLBT population. Discusses the intersection of these with such factors as race, socioeconomic status and other confounding factors.

GRTY 615. Aging and Mental Disorders. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The course deals with common psychological disorders and problems of late life, their etiology, methods of evaluating psychological status and intervention strategies that have been used successfully with older persons. Topics include epidemiology of psychological disorders and mental health service utilization; late-life stressors and crises; psychology of health, illness and disability; techniques and procedures in the evaluation of the older adult; functional and organic disorders; institutionalization; individual, group and family therapy; behavioral techniques; peer counseling and crisis intervention; and drugs and the elderly. Crosslisted as: PSYC 615.

GRTY 616. Geriatric Rehabilitation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of the process in geriatric rehabilitation with an assessment, psychosocial aspects and rural issues in rehabilitation. Considers major disabling conditions in late life, and emphasizes the nature of the interdisciplinary rehabilitation process with aging clients.

GRTY 618. The Business of Geriatric Care Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Evaluates information and materials needed for a basic understanding of the fundamentals of geriatric care management. Distinguishes and critically evaluates the tasks required of a geriatric care manager and the knowledge and skills needed to perform those tasks. Compares and contrasts multiple geriatric care management business models.

GRTY 619. Geriatric Care Management Practicum. 1-3 Hours.

Semester course; 1-3 lecture hours (delivered online, face-to-face or hybrid). 1-3 credits. Prerequisites: GRTY 601, GRTY/PSYC 602 and GRTY 603. Pairs a student with a geriatric care manager practicing in the field. Applies information learned in gerontology core classes to hands-on clinical experience with a geriatric care manager. Supervises field experience with clients, providing advocacy and supervision, and coordinating needs to ensure independence and safety.

GRTY 620. Geriatric Interdisciplinary Team Training. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Emphasizes interdisciplinary teamwork with a focus on geriatrics. Increases the awareness of the importance of interdisciplinary teamwork when working with older adults. Uses a case-focused approach to discuss care for older adults in a variety of settings, including acute care, long-term care, rehabilitation, PACE and home health care.

GRTY 621. Professional Writing. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Provides instruction on APA guidelines for writing and referencing articles in scholarly papers. Emphasizes critical thinking and awareness skills for reviewing journal articles.

GRTY 624. Community and Community Services for the Elderly. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. A conceptual/theoretical overview of community focusing on the ecological, psychological and social dimensions of community and on communities of the aged. Crosslisted as: SOCY 624.

GRTY 625. Aging and the Minority Community. 3 Hours.

3 credits. An analysis of the relationship between the aging process and American minority communities. In addition to the sociological factors, the course will examine demographic, physiological and psychological aspects of minority aging. Attention also will focus on dominant social problems and federal policies toward the aged.

GRTY 627. Psychology of Health and Health Care for the Elderly. 3 Hours.

Focuses on factors in the etiology, course and treatment of illness; patient/practitioner relationship; patient compliance and psychosocial issues in terminal care.

GRTY 629. Spirituality and Aging. 2-3 Hours.

Semester course; 2 or 3 lecture hours. 2 or 3 credits. Explores the spiritual, psychological and social dynamics associated with aging. Provides special attention to the spiritual and emotional impact on caregivers who work with aging patients. Crosslisted as: PATC 629.

GRTY 638. Long-term Care Administration. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Explores the history and development of the long-term care continuum in the United States. Emphasizes assisted living and the knowledge and skills required to be a successful assisted living administrator. Utilizes the five domains of assisted living administration as the framework. Facilitates learning on leadership and management, with a focus on providing optimal, person-centered care and services to older adults living in a licensed and regulated environment.

GRTY 639. Human Resource Management and Leadership for Gerontologists. 1 Hour.

Semester course; 1 lecture hour (delivered online, face-to-face or hybrid). 1 credit. Provides an introduction and foundation to human resources in aging services geared toward administrative and entrepreneurial gerontologists. Emphasizes leadership theory and utilizes the human resource management domain of practice as a guide for structure. Emphasizes developing the culture of an organization to facilitate effective practices in managing a safe and healthy work environment. Reviews state and federal laws, rules and regulations. Allows students to apply skills through cases and exercises relevant to their intended career path.

GRTY 640. Financial Management for Gerontological Leaders. 1 Hour.

Semester course; 1 lecture hour (delivered online, face-to-face or hybrid). 1 credit. Provides an introduction and foundation to financial management in aging services geared toward administrative and entrepreneurial gerontologists. Utilizes the financial management domain of practice as structure for this course. Emphasizes creating and managing organizational finances and multiple payment systems. Reviews state and federal laws, rules and regulations. Allows students to apply skills through cases and exercises relevant to their intended career path.

GRTY 641. Survey of Psychological Assessment and Treatment of the Older Adult. 3 Hours.

3 lecture hours. 3 credits. A combination didactic and skills training course; review of major treatment strategies and techniques for utilization with the older adult client with emphasis on group, individual and paraprofessional delivery systems; evaluation of crisis intervention and consultation team approaches; lectures, demonstration and classroom practice of actual treatment techniques. Crosslisted as: PSYC 641.

GRTY 642. Practicum in Clinical Geropsychology. 3 Hours.

3 practicum hours. 3 credits. An initial practicum geared as an entry to the team practicum experience; focus on familiarizing the student with mental health service delivery systems for the elderly in the Richmond community; rotation through a limited number of facilities such as nursing homes, retirement centers, nutrition sites, emergency hotline services for the elderly and various agencies involved in deinstitutionalization; possible extended placement in a particular facility. Crosslisted as: PSYC 642.

GRTY 691. Topical Seminar. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Seminars on specialized areas of gerontological interest. Examples of special topic courses taught in previous years: nutrition and aging; psychophysiology and neurobiology of aging; wellness and aging; and preretirement planning.

GRTY 692. Independent Studies. 1-3 Hours.

Semester course; 1-3 independent study hours (delivered online, face-to-face or hybrid). 1-3 credits. Directed in-depth independent study of a particular problem or topic in gerontology about which an interest or talent has been demonstrated.

GRTY 792. Independent Studies for Master's-/Ph.D.-level Students. 3 Hours.

Semester course; 3 credits. Independent study in selected area under supervision of gerontology faculty. Focuses on in-depth research and analysis of a major focus area of gerontology, leading to a comprehensive, publishable quality review paper. Emphasizes integrating previous graduate training into aging topical area.

GRTY 798. Thesis. 3-6 Hours.

3-6 credits. A research study of a topic or problem approved by the thesis committee and completed in accordance with the acceptable standards for thesis writing.

GRTY 799. Thesis. 3-6 Hours.

3-6 credits. A research study of a topic or problem approved by the thesis committee and completed in accordance with the acceptable standards for thesis writing.

Health Administration (HADM)**HADM 602. Health System Organization, Financing and Performance. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Examines the structure, functioning and financing of the U.S. health services system. Emphasizes foundational concepts for understanding and analyzing patterns of health and illness; health care cost, quality, access and utilization; workforce; competition in health care markets; and supplier, provider and payer effectiveness and efficiency.

HADM 603. Data Basecamp. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Introduces students to academic and professional spreadsheet and business analytics skills. Topics include but are not limited to the entering of text, numbers and formulas; formatting; moving; copying; recalculation; retrieving; charting; saving; and printing with introductory coverage of data manipulation. The course will help students prepare analyses, tables and charts to assist with professional tasks and other VCU course work.

HADM 606. Health Care Managerial Accounting. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A foundation course covering health care financial accounting, financial statement analysis, budgeting, reimbursement, costing and short-term decision-making. Emphasizes accounting concepts and using financial data in management of providers and payers.

HADM 607. Financial Management in Health Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HADM 606. Examines theory and techniques of corporate financial management as applied to health services providers and insurers including time value of money, working capital management, capital budgeting techniques, cash flow analysis and capital structure planning.

HADM 608. Seminar in Health Care Finance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: HADM 606 and HADM 607. Advanced studies of financial issues and the application of analytic tools in case studies and exercises. Designed to enhance and strengthen the knowledge and skills provided in the graduate program's foundation and required courses in accounting and finance.

HADM 609. Population Health Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course introduces students to the core concepts, methods and tools of population health management and quality improvement. The focus is on applications and considerations for health care managers and administrators in the United States.

HADM 610. Health Analytics and Decision Support. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: undergraduate course in statistics. Applications of analytics and decision support to health services institutions. Applications of operations research and industrial engineering techniques using large institutional data for health care planning, control and decision-making including deterministic and stochastic decision analysis models and their use in health services administration.

HADM 611. Health Care Law and Bioethics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Presents elements of law and legal principles as they apply to the administration of hospitals and health care systems. Emphasizes medical malpractice, medical-legal issues, informed consent, antitrust, health care business law and bioethics. Provides a legal foundation for the practice of health administration and clinical ethics through the use of case law and case analysis.

HADM 612. Information Systems for Health Care Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is restricted to majors only. Introduces and applies basic vocabulary, foundational principles and practical strategies associated with information systems relevant to the health care administrator. Examines health care information and information systems, technology standards and security, as well as management challenges.

HADM 614. Health Care Marketing. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Combines the theory of marketing with its practical application to today's dynamic health care environment. This course provides students with an understanding of the marketing function, process and activities within health services organizations. In particular, the course provides opportunities for learning about the purpose of marketing, its role in achieving organizational performance, the activities involved in health care marketing, challenges in marketing health services and the development of marketing skills for managers of health services organizations. Students will develop a marketing plan for a health services organization.

HADM 615. Health Care Politics and Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the political process with particular emphasis on the impact of politics on health care. Focuses on current political issues in the health field, examining conflicts and anticipating effects on the health system.

HADM 620. Problem-solving in Health Care Organizations. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in the Master of Health Administration program. This course teaches students how to apply systematic problem-solving techniques to develop strategic and financial solutions to common problems in health care organizations.

HADM 621. Advanced Medical Informatics: Technology-Strategy-Performance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on use of technology for improving operational efficiencies, quality of care and market competitiveness. Explores various application technologies within the framework of technology-strategy-performance including: telemedicine, cyber surgery, Web-enabled clinical information systems, clinical decision support systems, artificial intelligence and expert systems, and risk-adjusted outcome assessment systems.

HADM 624. Health Economics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of the instructor. Develops an understanding of (1) economics as a managerial tool in making choices or decisions that will provide for an optimum allocation of limited health care resources and (2) economics as a way of thinking about and approaching issues of public policy in financing and organizing health and medical services. Individual research on crucial or controversial issues in the health care field.

HADM 626. International Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of and/or introduction to international health. Focus is on the relationship between external factors and the health of populations.

HADM 630. Sustainability, Health and Health Care. 3 Hours.

Semester course; 2 lecture and 1 research hours (delivered online). 3 credits. This course will examine the issue of sustainability as it relates to the health care industry using a multidisciplinary lens, with a focus on solutions. Students will review what is known about the extent of climate change, its impact – both direct and indirect – on health, the distribution of that impact on different demographic groups, the economic and political actions that got us to this place, and the possible paths to a more stable climate future. Because the health care industry is heavily affected by climate change and is also a major contributor to it, most of the materials will specifically examine the impact on and the actions of this industry. The course will be primarily online, with no less than bi-weekly assignments and interactions. Reading materials and videos will be complemented by narrated slide presentations created by the instructor. Students will be expected to complete a number of written assignments, including some interaction on a discussion board. The major project for the course will be completed by students in groups, with an option for an individual project for students unable to participate in a group assignment. Students will meet with the instructor in the classroom at two points in the semester: a two-hour session in week one, and a session in the final week for groups to present the results of their projects. The number of hours for this session will be determined by the number of students and projects.

HADM 638. Administration of Long-term Care Facilities and Programs. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on unique knowledge and skills considered essential to effective long-term care administration. Emphasis is on the professional role of the long-term care administrator in providing for the health and social needs of the chronically ill and elderly. Applied skills in addressing the technical, human and conceptual problems unique to LTC are addressed through cases and field exercises.

HADM 645. Structure and Functions of Health Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Surveys concepts from organizational and management theories applicable to health organizations. Considers issues in organizational structure, strategy and processes for health care organizations.

HADM 646. Health Care Organization and Leadership. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores the challenges of managing and leading health care organizations in the 21st century. Introduces concepts, vocabulary and ways of thinking to enable students to be more effective and insightful participants in organizational life in health care. Intended to provide the student with the basic knowledge necessary to benefit from the more detailed and advanced courses that follow in the curriculum.

HADM 647. Management of Health Care Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HADM 646. Analyzes the current state of management study and practice with the objective of achieving a balanced development of both knowledge and skills in solving the operations problems of health care institutions. Examines critically the managerial process; emphasizes leadership behavior and development, performance improvement, structure and purpose of health care organization subunits, interfunctional coordination, and organizational processes.

HADM 648. Strategic Management in Health Care Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HADM 647. Integrative seminar on strategic decision making in health care organizations. Considers the concepts and alternative models of strategic management, the strategic management process and the evaluation of strategic decisions.

HADM 649. Human Resources Management in Health Care. 2 Hours.

Semester course; 2 lecture hours. 2 credits. This course addresses human resource topics from a management perspective, considering how human resource management can aid in developing a high-performance health care organization. This course provides the operations manager with a framework for human resource practice – from identifying the role of strategic HR planning to operational implementation of HR strategies within the organization.

HADM 661. Physician Practice Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Provides a practical overview of management skills and tools necessary to assist a physician group with an efficient service delivery organization. Discusses issues in the larger health care business environment that affect physician professional practice and the operational factors that define a successful organization now and in the future.

HADM 662. Foundations of Health Equity. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to graduate students. This course provides an overview of the historical context and existing research on causes and impact of health disparities. The field of health equity focuses on understanding that all populations – no matter their race, ethnicity, age, gender, gender identity, sexual orientation, immigration status, disability status or geographical origin – have equal opportunity to achieve and maintain a healthy life. The course is designed take an in-depth look at multiple populations impacted by health inequities. It explores the values and ethical framework that relate to health equity.

HADM 663. Reducing Health Disparities. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: HADM 662 or permission of instructor. Enrollment is restricted to graduate students. This course explores the current strategies used to reduce health disparities, including how health care organizations and public entities are funding efforts to address unconscious bias, patient-centered care and the social determinants of health, such as housing, food insecurity and environmental conditions, as well as increased access to health care as a means to reduce health disparities. It applies knowledge of existing strategies to critical-thinking models for further assessment. At the end of the course, students will be able to identify strategies to address unconscious bias and promote patient-centered care for themselves and colleagues; apply models of critical thinking to assess existing strategies; identify gaps left to be addressed; and begin to identify/crystallize the community partnership for their final health equity project.

HADM 664. Health Equity: Policy and Advocacy. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: HADM 662. Enrollment is restricted to graduate students. This course facilitates development of skills to understand and influence policy process. It applies advocacy skills to influence policies that affect health equity. At the end of the course, students will be able to demonstrate an understanding of policy process, identify policy leverage points, demonstrate the ability to advocate for policies that address health disparities and promote health equity, and further crystallize the community partnership for their final health equity project if applicable.

HADM 665. Applications of Health Equity. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: HADM 662; and HADM 663 or HADM 664; or permission of the instructor. Enrollment is restricted to graduate students. This course consists of independent design and implementation of a student-initiated project relating to some aspect of health equity. Guidance for the project will be provided by faculty and, where appropriate, a community partner. At the end of the course, students will be able to synthesize concepts from didactic courses, identify salient problems related to health equity, identify a project mentorship team and use the course framework to analyze problems, propose solutions and outline advocacy strategies.

HADM 681. Clinical Concepts and Relationships. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Introduces students without clinical backgrounds (nursing, medicine, other) to medical and health care terminology. Reviews and discusses concepts that are related to health, healing, health professions and the experience of the patient. Examines the role of health professionals; emphasizes communication, problem solving and patient care improvements across professional boundaries.

HADM 682. Executive Skills I. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Applied course in executive skills and behavior of the health care executive. Focus is on the health care executive leadership development and personal effectiveness.

HADM 683. Executive Skills II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: HADM 682. Advanced applied course in executive skill development. Focus is on the health care executive leader and development of skills relating to the external environment of health care organizations. Emphasizes relationships with physicians, governing boards, regulatory bodies, donors and other key stakeholders.

HADM 690. Departmental Research Seminar. 1-9 Hours.

Semester course; variable hours. Variable credit. Research seminar that focuses on research design and methods organized under a single topic or a series of related topics in health services research. Applied research training for master's-level students.

HADM 691. Special Topics in Health Services Organization and Research. 3 Hours.

3 lecture hours. 3 credits. Prerequisite: permission of instructor. Course is devoted to specialized content area for health administration. Examples include physician practice management and advanced managed care.

HADM 692. Independent Study in Health Administration. 1-3 Hours.

1-3 credits. Prerequisite: Permission of instructor. Special study conducted under the guidance of a faculty sponsor.

HADM 693. Internship in Health Administration. 3 Hours.

3 credits. Prerequisite: Completion of year one of the MHA curriculum. Restricted to dual-degree students (MHA/MD and MHA/JD). Assesses and examines administrative and organizational structures and cultures of the assigned site with perspectives from macro- and micro-organizational views. Students develop an understanding and gain knowledge of the complex health care industry and the internal and external factors that influence decision-making in the organization. Students will research and prepare a management project with recommendations to assist the organization in decision-making, policy development and/or performance improvement. Graded as S/U/F.

HADM 694. Practicum in Health Administration I. 5 Hours.

5 credits. Course is restricted to students completing a one-year administrative residency. Examines contemporary problems and issues in the organization, administration and evaluation of health services. Focuses on the application of alternative approaches to administrative problem solving. Emphasizes internal and external stakeholder interests and factors that influence decision-making in health care organizations. Graded as S/U/F.

HADM 695. Practicum in Health Administration II. 3-5 Hours.

3-5 credits. Course is restricted to students completing a one-year administrative residency. Students will examine contemporary problems and issues in the organization, administration and evaluation of health services. Focus on the application of alternative approaches to administrative problem solving. Course emphasizes internal and external stakeholder interests and factors that influence decision-making in health care organizations. Students design, conduct and present the results of a management project. Additional projects will be required for students enrolling in more than 3 credits. Graded as S/U/F.

HADM 697. Directed Research. 1-6 Hours.

Semester course; variable hours. Variable credit. Special course offered under the guidance of a faculty sponsor for one or more students to design and implement an applied research project in the field setting. Focuses on the application of research methods to policy or operational problems of health care institutions.

HADM 701. Organizational Behavior for Health Services Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: HADM 704 and HADM 705, or permission of instructor. Provides intellectual insights into central topics of micro organizational behavior. Requires critical evaluation of organizational behavior and health services research based on organizational behavior topics. Requires identification and application of organizational behavior theoretical perspectives to issues in the health sector.

HADM 702. Applied Theory and Methods for Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: HADM 701, HADM 704 and HADM 705, or permission of the instructor. Designed to enhance students' abilities to apply theoretical and conceptual thinking in their research areas of interest, integrate theory with methodological approaches for a specific research question and clearly and effectively articulate their research plan. This course is intended for doctoral students in their final semester of course work (or similar) to support the development of a successful research or dissertation proposal, thus enrolled students are expected to have a working knowledge of social science concepts, key theories in their area of interest, and research design and methods.

HADM 704. Foundations of Health Service Organization Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the roots of foundational theories and concepts in organization theory and their application to research on health care organizations and systems. Emphasizes the environment and structure of health care organizations and systems.

HADM 705. Seminar in Health Services and Organizational Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Health services researchers and health services organizational researchers produce and consume research; these activities inform one another. This course focuses predominantly on the latter role, developing students' abilities to be effective, critical consumers of health services research and health services organizational research, and cultivating an appreciation for this important role. An effective consumer is a critical thinker who can clearly explain and support why they concur or disagree with study rationale, design, analysis, interpretation and importance; can situate a study in the literature; assess its relevance and added value; and articulate its theoretical and practical implications for research, practice and policy. Being a sound, thoughtful consumer of research and information is important for successfully building knowledge and translating this knowledge to improve health and well-being and health organization effectiveness. This course also lays the foundation for how to begin to critically think, as well as to design and produce health services and health services organizational research. This class uses a combination of didactic and experiential learning, including lecture, reading, discussion, group work and written and oral exercises. Course readings and exercises use both classic and contemporary research.

HADM 711. Introduction to Health Services Organization Research I. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Open only to Ph.D. students in health services organization and research. Assists doctoral students in becoming members of the health services research community and developing skills to be successful researchers. Introduces students to health services research as a field, major databases for health services research, career paths and related ethical issues. Develops key foundational skills including database management, statistical software, grant applications and career development. First in a two-course sequence.

HADM 713. Introduction to Health Services Organization Research II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Open only to Ph.D. students in health services organization and research. Assists doctoral students in becoming members of the health services organization research community and developing skills to be successful researchers. Introduces students to health services organization research as a field, major databases for health services research, career paths and related ethical issues. Develops key foundational skills including management of frequently used health services organization research databases, statistical software, grant applications and career development. Second in a two-course sequence.

HADM 760. Quantitative Analysis of Health Care Data. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MRBL 624 and HADM 609, or permission of instructor. Research course emphasizing computer application and statistical analyses of health care data generated from secondary sources, including data envelopment analysis.

HADM 761. Health Services Research Methods I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Upper-division course in statistics. Research as a systematic method for examining questions derived from related theory and/or health service practice. Major focus is on the logic of causal inference, including the formulation of testable hypotheses relating to health services organization and management, the design of methods and measures to facilitate study, and the concepts, principles and methods of epidemiology.

HADM 762. Health Services Research Methods II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: HADM 761 and MRBL 632, or equivalent. Application of multivariate statistical analysis and evaluation research methods to health services research. Emphasis is placed on the use of advanced statistical methods (e.g., LISREL, Event History Analysis) and designs to analyze panel data in the health field.

HADM 763. Applied Health Services Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: HADM 761 and ECON 501, or permission of instructor. Seminar for Ph.D. students who have had courses in quantitative analysis of health care data and research methods. Develops framework for classifying the major topics and issues addressed by health services research. Explores the relationships between health services research, policy analysis and program evaluation. Emphasizes assessment of the effectiveness, efficiency and equity of the health system at various levels of analysis. Stresses the importance of conceptual modeling as a foundation to rigorous empirical research.

HADM 792. Independent Study in Health Services Organization and Research. 1-3 Hours.

Semester course; 1-3 credits. Special study or research leading to a publication. Conducted under the guidance of a faculty sponsor.

HADM 793. Research Practicum. 1-3 Hours.

Semester course; 1-3 credits. Available only to second year students. Supervised investigation of selected problems in health services research. Includes conducting and analyzing field research.

HADM 898. Doctoral Dissertation in Health Services Organization and Research. 1-9 Hours.

Semester course; 1-9 credits. A minimum of 9 semester hours required for Ph.D. degree. Prerequisite: Completion of required course work and comprehensive examination. Dissertation research under direction of faculty adviser.

HADM 899. Doctoral Dissertation in Health Services Organization and Research. 1-9 Hours.

Semester course; 1-9 credits. A minimum of 9 semester hours required for Ph.D. degree. Prerequisite: Completion of required course work and comprehensive examination. Dissertation research under direction of faculty adviser.

Health Administration/Executive (HADE)**HADE 602. Health Systems Organization, Financing and Performance. 3 Hours.**

Semester course; 3 credits. Examines the structure, functioning and financing of the U.S. health services system. Emphasizes foundational concepts for understanding and analyzing patterns of health and illness; health care cost, quality, access and utilization; workforce; competition in health care markets; and supplier, provider and payer effectiveness and efficiency.

HADE 606. Health Care Managerial Accounting. 3 Hours.

Semester course; 3 credits. Prerequisite: Permission of the instructor. A foundation course covering health care financial accounting, financial statement analysis, budgeting, reimbursement, costing and short-term decision making. Emphasizes accounting concepts and using financial data in management of providers and payers.

HADE 607. Financial Management in Health Organizations. 3 Hours.

Semester course; 3 credits. Prerequisite: HADE 606. Examines theory and techniques of managerial corporate management as applied to health service providers and insurers including time value of money, working capital management, capital budgeting techniques, cash flow analysis and capital structure planning.

HADE 608. Seminar in Health Care Finance. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisites: HADE 606 and HADE 607. Enrollment is restricted to students enrolled in the graduate certificate in health care financial management. Advanced studies of financial issues and the application of analytic tools in case studies and exercises. Designed to enhance and strengthen the knowledge and skills provided in the graduate program's foundation and required courses in accounting and finance.

HADE 609. Population Health Management. 2 Hours.

Semester course; 2 lecture hours. 2 credits. This course introduces students to the core concepts, methods and tools of population health management and improvement. The focus is on applications and considerations for health care managers and administrators in the United States.

HADE 610. Health Analytics and Decision Support. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: undergraduate course in statistics. Applications of analytics and decision support to health services institutions. Applications of operations research and industrial engineering techniques using large institutional data for health care planning, control and decision-making, including deterministic and stochastic decision analysis models and their use in health services administration.

HADE 611. Health Care Law and Bioethics. 3 Hours.

Semester course; 3 credits. Presents elements of law and legal principles as they apply to the administration of hospitals and health care systems. Emphasizes medical malpractice, medical-legal issues, informed consent, antitrust, health care business law and bioethics. Provides a legal foundation for the practice of health administration and clinical ethics through the use of case law and case analysis.

HADE 612. Information Systems for Health Care Management. 3 Hours.

Semester course; blended on-campus/online format. 3 credits. This course is restricted to majors only. Introduces and applies basic vocabulary, foundational principles and practical strategies associated with information systems relevant to the health care administrator. Examines health care information and information systems, technology standards and security, as well as management challenges.

HADE 614. Health Care Marketing. 3 Hours.

Semester course; 3 credits. Fundamental theories, concepts and techniques of marketing applied to the distinctive properties of health care services. Emphasizes the role of marketing and aligning organizational capacity and health care needs; market analysis and planning; strategic marketing management; tactical marketing mix design; designing and managing service delivery systems and developing new offerings.

HADE 615. Health Care Politics and Policy. 3 Hours.

Semester course; blended on-campus/online format. 3 credits. Examines the political process with particular emphasis on the impact of politics on health care. Focuses on current political issues in the health field, examining conflicts and anticipating effects on the health system.

HADE 621. Advanced Medical Informatics: Technology, Strategy and Performance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: HADE 612 and permission of the instructor. Focuses on using technology for improving operational efficiencies, quality of care and market competitiveness. Explores various application technologies within the framework of technology-strategy-performance including: telemedicine, cyber surgery, Web-enabled clinical information systems, clinical decision support systems, artificial intelligence and expert systems, and risk-adjusted outcome assessment systems.

HADE 624. Health Economics. 3 Hours.

Semester course; 3 credits. Foundational concepts of microeconomic theory and their application in analyzing health care policy; understanding the structure and dynamics of health care markets; and monitoring and controlling the allocation of resources within health organizations.

HADE 646. Health Care Organization and Leadership. 3 Hours.

Semester course; blended on-campus/online format. 3 credits. Explores the challenges of managing and leading health care organizations in the 21st century. Introduces concepts, vocabulary and ways of thinking to enable students to be more effective and insightful participants in organizational life in health care. Intended to provide the student with the basic knowledge necessary to benefit from the more detailed and advanced courses that follow in the curriculum.

HADE 647. Management of Health Care Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HADE 646. Analyzes the current state of management study and practice with the objective of achieving a balanced development of both knowledge and skills in solving the operations problems of health institutions. Critically examines the managerial process with emphasis on leadership behavior and development, performance improvement, structure and purpose of health care organization subunits, interfunctional coordination, and organizational processes.

HADE 648. Strategic Management in Health Care Organizations. 3 Hours.

Semester course; 3 credits. Focuses on the formulation, implementation, and evaluation of strategy in health care financing/delivery organizations. Emphasizes concepts dealing with industry structure; the strategic management process; achieving and sustaining competitive advantage.

HADE 649. Human Resources Management in Health Care. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Presents concepts in human resources management as applied to health care organizations. Explores relationships between human resources management and general management, nature of work and human resources, compensation and benefits, personnel planning, recruitment and selection, training and development, employee appraisal and discipline, organized labor issues, and employment and labor law.

HADE 651. Applications in Health Care Financial Management. 3 Hours.

Semester course; 3 independent study/practicum hours (delivered online). 3 credits. Enrollment is restricted to students in the M.H.A., the M.S.H.A. or the graduate certificate in health care financial management. Requires students to apply concepts introduced through earlier courses by completing an applied project within a health care organization. Instruction is provided through faculty advising on an applied project and independent study. In addition, this course will require students to prepare for the Healthcare Financial Management Association's Certified Healthcare Financial Professional examination. Students who pass the examination will have earned a certification from a recognized professional organization. This certification will help students communicate their newly acquired skills to current and future employers.

HADE 681. Special Topics in Health Administration. 1-3 Hours.

Variable hours. 1-3 credits. Investigate a specialized content area in a semester-long, seminar format. Topics may change from semester to semester.

HADE 691. Health Care Organization Diagnosis and Planning. 3 Hours.

1 credit. Provides an opportunity for students to integrate as well as apply knowledge gleaned from prior course work and to share individual experiences in assessment of and correction of organizational problems that are either operational or strategic.

HADE 692. Independent Study in Health Administration. 1-5 Hours.

Variable hours. Variable credit. Offered in all semesters for students to investigate and study topics of major interest.

Nurse Anesthesia Lab (NRSZ)**NRSZ 601. Laboratory in Principles and Practice of Nurse Anesthesia I. 1 Hour.**

Semester course; 3 laboratory hours. 1 credit. Provides the nurse anesthesia graduate student guided practical experience associated with those concepts presented in NRSA 601. Includes practice in and evaluation of task-specific skills in both simulated and actual operating room environments.

Nurse Anesthesia Practice (DNAP)**DNAP 701. Human Factors and Patient Safety for Nurse Anesthetists. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Explores the theoretical basis of human error, patient safety and quality assurance in anesthesia care. Introduces a systems approach to error investigation and analysis. Integrates concepts of teamwork, crisis management, simulation and monitoring systems in anesthesia practice.

DNAP 702. Nurse Anesthesia Patient Safety Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on analysis of adverse anesthesia events from a systems perspective, use of multidisciplinary teams to solve management problems and constructive techniques for communicating with patients, families and health care providers who are involved in medical errors.

DNAP 703. Health Services Delivery Systems for the Nurse Anesthetist. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides the necessary scientific foundation, both in theory and practice application, to explore the structure and function of the U.S. health care delivery system as it specifically relates to specialized nurse anesthesia practice, the components of select theories and the translation of these theories to practice.

DNAP 704. Advanced Physiology/Pathophysiology for Nurse Anesthetists I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines normal human physiology and pathophysiology using a body-systems approach, with emphasis on the interrelationships between form and function at the gross and cellular levels of organization. Includes analysis of cellular structure and function as well as the individual components of body systems.

DNAP 705. Advanced Physiology/Pathophysiology for Nurse Anesthetists II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: DNAP 704. Examines normal human physiology and pathophysiology using a body-systems approach with emphasis on the interrelationships between form and function at the gross and cellular levels of organization. Includes an analysis of cellular structure and function as well as the individual components of body systems. Incorporates an overview of genetics.

DNAP 706. Advanced Pharmacology for Nurse Anesthetists I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an opportunity to focus on the advanced principles of anesthesia related to pharmacology. Presents in-depth material on the pharmacology of various classes of anesthetics and adjuvant therapeutics employed by nurse anesthetists, with an emphasis on general anesthetics.

DNAP 707. Advanced Pharmacology for Nurse Anesthetists II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: DNAP 706. Provides an opportunity to focus on the advanced principles of anesthesia-related pharmacology. Includes discussions on adjuvant therapeutics employed by nurse anesthetists, with an emphasis on local anesthetics.

DNAP 708. Ethics and Health Care. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Applies the principles of biomedical and health care ethics to develop a more informed understanding of ethical decision-making in the formulation of health care policy as well as within the clinical environment. Focuses on utilizing and searching biomedical ethics literature, current issues in biomedical ethics, the discipline and process of ethical reflection, and case consultation.

DNAP 711. Policy and Practice for Nurse Anesthetists. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines governmental and non-governmental issues that influence nurse anesthesia practice. Focuses on developing skills that contribute to leadership and personal effectiveness in implementing change in nurse anesthesia and health care. Emphasizes interdisciplinary relationships between CRNAs, nurses, physicians, administrators, policy-makers and other key stakeholders.

DNAP 712. Leadership in Nurse Anesthesia Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines principles of teaching and learning applicable to the anesthesia didactic and clinical environment. Presents strategies in teacher/learner communication, presentation development and strategies, curriculum design and methods of evaluation pertinent to nurse anesthesia education.

DNAP 716. Advanced Chemistry and Physics Concepts for Nurse Anesthetists. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Provides advanced theoretical foundations of chemistry, biochemistry and physics relevant for critical application to the practice of anesthesia nursing utilizing the hybrid (blended learning) format.

DNAP 717. Advanced Physiological Concepts for Nurse Anesthetists. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Explores properties of advanced physiology including physiology terms, levels of organization of the human body, homeostasis and feedback systems, anatomic terms, planes and sections, cell physiology and diffusion, transport systems, pressure-volume relationships, pressure-flow-resistance relationships, Fick's principle, the Frank-Starling relationship, and math for physiology utilizing the hybrid (blended learning) format.

DNAP 718. Advanced Health Assessment for Nurse Anesthetists. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides a systematic, evidence-based, advanced physical, psychosocial and cultural evaluation of human systems to acquire and analyze relevant information for the development of a comprehensive patient assessment. Emphasizes advanced preoperative and postoperative techniques in a process whereby the learner translates information pertinent to anesthesia care into practice. Focuses on the symptom and health problem assessment and selection and interpretation of screening and diagnostic tests in order to implement an informed plan of care. Utilizes the hybrid (blended learning) format.

DNAP 721. Clinical Practicum I. 3 Hours.

Semester course; 3 practicum hours (300 clocked clinical hours). 3 credits. Introduces clinical care with supervised participation in actual administration of anesthesia. Demonstrates internalization of theoretical concepts and techniques and application in anesthetic management toward the achievement of the terminal objectives for competency in entry-level anesthesia practice. Graded as pass/fail.

DNAP 722. Clinical Practicum II. 4 Hours.

Semester course; 4 practicum hours (400 clocked clinical hours). 4 credits. Prerequisite: DNAP 721. Introduces clinical care with supervised participation in actual administration of anesthesia. Demonstrates internalization of theoretical concepts and techniques and application in anesthetic management toward the achievement of the terminal objectives for competency in entry-level anesthesia practice. Graded as pass/fail.

DNAP 723. Clinical Practicum III. 5 Hours.

Semester course; 5 practicum hours (500 clocked clinical hours). 5 credits. Prerequisite: DNAP 722. Provides intensive experience in all clinical anesthesia areas. Represents an integral phase of sequenced clinical progress toward the achievement of competency in entry-level anesthesia practice. Includes clinical rotations to various affiliate sites to gain experience in management of specialized anesthetic considerations. Emphasizes increased responsibility for the delivery of a comprehensive anesthetic regime along the educational/experiential continuum. Graded as pass/fail.

DNAP 724. Clinical Practicum IV. 5 Hours.

Semester course; 5 practicum hours (500 clocked clinical hours). 5 credits. Prerequisite: DNAP 723. Provides intensive experience in all clinical anesthesia areas. Represents an integral phase of sequenced clinical progress toward the achievement of competency in entry-level anesthesia practice. Includes clinical rotations to various affiliate sites to gain experience in management of specialized anesthetic considerations. Emphasizes increased responsibility for the delivery of a comprehensive anesthetic regime along the educational/experiential continuum. Graded as pass/fail.

DNAP 725. Clinical Practicum V. 5 Hours.

Semester course; 5 practicum hours (500 clocked clinical hours). 5 credits. Prerequisite: DNAP 724. Provides intensive experience in all clinical anesthesia areas. Represents an integral phase of sequenced clinical progress toward the achievement of competency in entry-level anesthesia practice. Includes clinical rotations to various affiliate sites to gain experience in management of specialized anesthetic considerations. Emphasizes increased responsibility for the delivery of a comprehensive anesthetic regime along the educational/experiential continuum. Graded as pass/fail.

DNAP 731. Professional Aspects of Nurse Anesthesia Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an opportunity to focus on a variety of professional issues including but not restricted to the history of nurse anesthesia, professional practice roles, settings and responsibilities of the nurse anesthetist, effective communications, accountability and patient advocacy, cultural competency, professional involvement, code of ethics, regulations, and standards of practice using a hybrid (blended learning) format.

DNAP 733. Evidence-based Decision-making in Nurse Anesthesia. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides a foundation of literature relevant to nurse anesthesia practice. Emphasizes a systematic framework that is termed “evidence-based practice” for clinical interventions and critiquing the literature in an appropriate and manageable fashion. Culminates in a broad overview of scientific foundations for nurse anesthesia practice in selected domains. Utilizes the hybrid (blended learning) format.

DNAP 734. Research Methods and Statistical Measures in Nurse Anesthesia Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines relationships among theory, research and causal inference; quantitative and qualitative methodologies will be considered. Surveys issues relevant to research design, measurement, data collection, statistical analysis, interpretation and ethical issues in conducting research — and grounded in work in the domain of anesthesia and critical care. Prepares students to access, critically evaluate and utilize research-based literature and independently initiate a systematic approach to addressing a research hypothesis or research question. Utilizes a hybrid (blended learning) format.

DNAP 735. Principles and Practice of Nurse Anesthesia Practice I. 4 Hours.

Semester course; 3 lecture and 3 laboratory hours. 4 credits. Introduces the nurse anesthesia student to concepts necessary to plan and execute safe and individualized anesthetics. Covers formulation of the anesthesia care plan, anesthetic techniques, prevention of complications, fluid management, monitoring and utilization of anesthesia equipment. Provides guided practical experience associated with course concepts, including practice with and evaluation of task-specific skills in both simulated and actual operating room environments.

DNAP 736. Principles and Practice of Nurse Anesthesia II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: DNAP 735. Delineates techniques of anesthesia management that are considered situation-specific for specialized procedures, diagnostic or individualized procedures, including advanced airway management and anesthesia care individualized for the patient with cardiovascular or respiratory conditions.

DNAP 737. Principles and Practice of Nurse Anesthesia III. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: DNAP 736. Presents fundamental concepts and techniques essential to clinical anesthesia practice focusing on the theoretical and practical considerations involved in the administration and management of regional anesthesia and pain management.

DNAP 738. Principles and Practice of Nurse Anesthesia IV. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: DNAP 737. Covers the advanced concepts and principles of anesthetic management in obstetrics, pediatrics, hematologic disorders and endocrine disorders.

DNAP 739. Principles and Practice of Nurse Anesthesia V. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: DNAP 738. Covers the advanced concepts and principles of anesthetic management including anesthesia delivery in specialty settings and other specialty topics.

DNAP 789. Nurse Anesthesia Professional Practice. 1-6 Hours.

Semester course; 1-6 clinical hours (100 clocked clinical hours per credit). 1-6 credits. May be repeated for a maximum of six credits. Emphasizes analysis and evaluation of experiential learning through the use of critical-thinking skills and reflection. Explores concepts of competency and expertise. Focuses on methods of determining best anesthesia practices through identification of problems, review and systematic evaluation of current research, and consideration of economic and other factors that may impact patient outcomes. Graded as pass/fail.

DNAP 799. Nurse Anesthesia Doctoral Project. 1-6 Hours.

Semester course; 1-6 practicum hours. 1-6 credits. May be repeated for a maximum of six credits. Focuses on identification of relevant clinical issues in anesthesiology with attendant formulation of critically applicable questions and examination of the relevant research evidence that addresses those questions. Students implement and evaluate a terminal project and disseminate the results through an oral and/or poster presentation, manuscript submission to a peer-reviewed journal or another appropriate medium. Graded as S, U or F.

Occupational Therapy (OCCT)**OCCT 520. Occupational Therapy Applications: Kinesiology. 2 Hours.**

Semester course; 1 lecture and 2 laboratory hours. 2 credits. Addresses basic components of motion, biomechanics, joint structure, specific muscle groups and muscle function. Analyzes functional activities necessary to carry out the tasks and roles of productive living using these principles.

OCCT 521. Neuroscience Applications to Occupational Therapy. 3 Hours.

Semester course; 2 lecture hours. 2 lab hours, 3 credit hours. Links basic structure and organization of nervous system to function in typical individuals. Examines neuroscience correlates of diseases and disabilities. Relies on current review of neuroscience literature in matching function and dysfunction with structure and organization. Case examples across the life span used to understand these potential relationships and link material to OT theories and frames of reference guiding practice.

OCCT 522. Interdisciplinary Medical Lectures. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Presents information on medical conditions commonly seen by occupational therapists, providing diagnostic features, associated conditions, prevalence and course for each. Addresses value and limitations of this knowledge to occupational therapy process, and need for therapists to search out information about other conditions. Introduces medical terminology and therapeutic uses, side effects and precautions of medication. Describes occupational therapy interventions and clinical pathways for certain impairments.

OCCT 530. Nature of Occupational Therapy. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Provides an overview of fundamentals of occupational therapy through use of official documents of the American Occupational Therapy Association and other authoritative sources. Introduces practice definitions, philosophical and ethical underpinnings, professional roles, and organizations in the field of occupational therapy.

OCCT 531. Interpersonal Communication and Group Dynamics. 2 Hours.

Semester course; 1 lecture and 2 laboratory hours. 2 credits. Introduces oral and written communication skills and group process techniques. Addresses interpersonal relationships, principles of therapeutic involvement, observation, analysis of communication patterns, interview methods and OT terminology. Provides experiences in group leadership, assertiveness techniques. Laboratory exercises chart path of personal development, professional socialization.

OCCT 532. Life Span Occupational Development. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Explores principles and theories of normal growth and development and their influence on occupational performance across the life span. Presents all domains of development and life span roles. Focuses on work/productivity, leisure/play and activities for daily living. Explores importance of significant others and environment, maintaining balance between performance areas and fulfilling expected and desired social roles. Stresses influence of temporal and environmental contexts.

OCCT 533. Occupational Therapy Principles, Values and Theories. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Examines theoretical constructs used in various models of occupational therapy practice along with legislation, advocacy and empowerment using an historical framework. Addresses influence of legislation relevant to clients and the profession, their dynamic impact on practice patterns and advocacy issues. Emphasizes concepts integral to understanding and using human occupation as a basis for practice as well as the dynamic relationship among occupational therapy principles, values and theories.

OCCT 534. Occupational Therapy Evaluation and Intervention Overview. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Provides an introduction to evaluation and the intervention process as it relates to performance components, areas and contexts. Focuses on general evaluation of assessments for various treatment settings and environments. Emphasis on use of assessment data to determine appropriate treatment intervention and discharge planning for individuals. Verbal communications and written documentation will be covered.

OCCT 580. Introduction to the Profession of Occupational Therapy. 2 Hours.

Semester course; 1 lecture and 2 laboratory hours. 2 credits. Provides an overview of the foundations of occupational therapy including practice definitions, philosophical and ethical underpinnings, professional roles and organizations, the scope of occupational therapy, and development of the profession. Content addresses both historical and contemporary professional perspectives, guided by the Official Documents of the American Occupational Therapy Association.

OCCT 589. Advanced Functional Anatomy. 7 Hours.

Semester course; 4 lecture and 6 laboratory hours. 7 credits. Examines the structural and functional anatomy of the human musculoskeletal system through lecture and cadaver dissection. Develops understanding of fundamental facts and principles that apply to professional practice through lecture, dissection, radiographic examination and clinical correlation.

OCCT 590. Functional Movement Analysis in Occupational Therapy. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: OCCT 589. Addresses kinesiology and functional anatomy including the basic components of palpation, joint structure and the study of kinematics, specific muscle groups and muscle function. Functional activities necessary to carry out the tasks and roles of productive living are analyzed and emphasized using these principles.

OCCT 591. Neuroscience Applications to Occupational Therapy. 4 Hours.

Semester course; 3 lecture and 2 laboratory hours. 4 credits. Lab focuses on structures, basic function and inter-relationships; lecture addresses structure-function relationships, system organization and structure relationships, and higher order functions in the typical nervous system. Case examples across the lifespan will link function with dysfunction, and application to injury, disorder, disease processes common to occupational therapy practice. Course relies on a current review of neuroscience literature in matching function and dysfunction with structure and organization.

OCCT 592. Introduction to Injury, Illness and Disability. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Presents information on medical conditions commonly seen by occupational therapists, providing diagnostic features, associated conditions, prevalence and course of disease for each. Addresses value and limitations of this knowledge to the occupational therapy process and need for therapists to search out information about other conditions. Introduces medical terminology and therapeutic uses, side effects, and precautions of medication. Describes occupational therapy interventions for certain impairments.

OCCT 593. Analysis of Human Occupation. 1 Hour.

Semester course; 2 laboratory hours. 1 credit. Prerequisite: OCCT 580. Explores activities and occupation and related professional terminology, activity analysis and therapy as a teaching/learning process. Emphasizes analysis of occupational performance skills and the transaction between client factors, activity demands and context.

OCCT 594. Theoretical Foundations of Occupational Therapy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: OCCT 580. Examines theoretical constructs underlying occupational therapy practice. Considers the historical context from which current conceptual models of practice evolved. Emphasizes concepts integral to the understanding and use of human occupation as a basis for practice as well as the dynamic relationships among occupational therapy principles, values and theories.

OCCT 613. Adult Occupational Performance I. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: OCCT 590, OCCT 591, OCCT 592 and OCCT 594. Examines adult evaluation and treatment fundamentals that support occupational performance interventions. Covers evaluation and treatment content underlying and applicable to all areas of occupational performance. Includes specific assessments, practical information on understanding clients with a variety of conditions and therapist skills.

OCCT 614. Pediatric Occupational Performance I. 4 Hours.

Semester course; 2 lecture and 4 laboratory hours. 4 credits. Prerequisites: OCCT 590, OCCT 591, OCCT 592 and OCCT 594. Focuses on occupational performance of young children (infants, toddlers and preschoolers). Explores principles and theories of normal development as a baseline for identifying the impact of illness, injury or environmental factors on occupational engagement. Examines a variety of frames of reference, evaluative and intervention approaches for children and their families in medical, home, community and educational settings. Uses a holistic approach to develop a child's abilities to engage in their occupations while meeting expectations of family and environment.

OCCT 615. Level I Fieldwork in Occupational Therapy. 1 Hour.

Semester course; 1 clinical hour (40 contact hours). 1 credit. Enriches classroom learning by providing directed observation, participation and supervision by professionals in practice settings. Includes classroom activities related to professional development and reflective practice. Prepares students for the more complex level II fieldwork clinical experience. Graded as Pass/Fail.

OCCT 616. Research Process in Occupational Therapy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers basic steps in research process, including problem definition, literature review, design, data collection and analysis, and dissemination of findings. Addresses qualitative and quantitative research approaches, critical analysis of literature and reviews statistical concepts.

OCCT 617. Therapeutic Process in Occupational Therapy. 2 Hours.

Semester course; 1 lecture and 2 laboratory hours. 2 credits. Focuses on essential knowledge and skills of therapeutic use of self as a key for enabling occupation. Explores therapist interaction skills, principles of therapeutic involvement, observations and analysis of communication in relation to client-centered practice.

OCCT 618. Systems, Policy and Management. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Through a dynamic systems perspective, this course will explore the U.S. health care and non-medical environments as they specifically relates to occupational therapy. Examines how policy, federal and state legislation and regulations, and national requirements influence service delivery. Addresses the application of health care management and supervision principles within the context of occupational therapy services in diverse health care environments. The interplay of management skills, reimbursement sources, policy and outcome measures will be examined in relationship to political, regulatory, economic and societal forces.

OCCT 620. Occupational Therapy Practice Activities I: Activity Analysis. 1 Hour.

Semester course; 2 laboratory hours. 1 credit. Explores activities and occupation and related professional terminology, activity analysis, and therapy as a teaching/learning process. Emphasizes analysis of occupational performance skills and the transaction between client factors, activity demands and context.

OCCT 621. Occupational Therapy Practice Activities II: Assistive Technologies. 1 Hour.

Semester course; 2 laboratory hours. 1 credit. Focuses on the evaluation, activity analysis and intervention process with a range of assistive technology, including software, hardware and low-tech solutions. Includes the development of skills for adaptation of activities and contexts.

OCCT 623. Occupational Therapy Practice Activities III: Activity and Occupational Synthesis. 1 Hour.

Semester course; 2 laboratory hours. 1 credit. Emphasizes altering, adapting and modifying activities and contexts to increase occupational performance. Includes experiential learning in the community and exposure to adapted leisure activities.

OCCT 630. Adult Evaluation and Intervention I: Foundations. 2 Hours.

Semester course; 1 lecture and 2 laboratory hours. 2 credits. Examines adult evaluation and treatment fundamentals that support occupational performance interventions. Covers evaluations and treatment content underlying and applicable to all areas of occupational performance. Includes specific assessments, practical information on understanding clients with a variety of conditions and therapist skills.

OCCT 633. Adult Evaluation and Intervention II: Facilitating Function With Disability Across the Continuum of Care. 4 Hours.

Semester course; 2 lecture and 4 laboratory hours. 4 credits. Introduces students to assessment and intervention strategies, tools and equipment typically used in adult physical disability settings across the continuum of care. Focuses on occupational performance while considering client factors, tasks and context. Draws on practical experience and application of materials taught in previous adult physical disability course work. Working with the instructor, clinical faculty and people with disabilities in laboratory and lecture sessions, utilizes clinical reasoning skills, technologies and strategies typically employed to treat a variety of adult functional disability conditions across the continuum of care, including ADL, IADL, community living vocational training, play and leisure.

OCCT 635. Psychosocial Evaluation and Intervention I: Foundations. 2 Hours.

Semester course; 1 lecture and 2 laboratory hours. 2 credits. Examines fundamental knowledge of adolescent and adult psychosocial evaluation and intervention to support adaptation and participation in occupation. Includes core and specialty practice psychosocial knowledge, information on stigma and stereotyping, therapist skills, specific assessments and interventions, and leadership of a community-based group intervention.

OCCT 636. Fieldwork I in Psychosocial Occupational Therapy. 2 Hours.

Semester course; 1.5 lecture and .5 clinical hours. 2 credits. Focuses on occupational performance of adolescents and adults with psychosocial dysfunction. Provides service-learning fieldwork I experiences applying clinical reasoning, and conceptual practice models to plan, implement and evaluate evidence-based intervention in community-based mental health settings. Preliminary step to the more complex level II fieldwork experience.

OCCT 640. Pediatric Evaluation and Intervention I: Infant and Preschool Children. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Focuses on occupational performance of infants, toddlers and preschoolers with disabilities. Explores a variety of frames of reference and evaluative and intervention approaches for children and their families in medical, home, community and educational settings. Uses a holistic approach to develop child's abilities to play/perform basic ADLs while meeting expectations of family and environment.

OCCT 641. Pediatric Evaluation and Intervention II: Ages 6 to 12. 4 Hours.

Semester course; 2 lecture and 4 laboratory hours. 4 credits. Focuses on occupational performance of children with disabilities ages six through adolescence. Explores a variety of frames of reference, evaluative and intervention approaches for children, their families in multiple practice arenas emphasizing the child's performance in educational settings. Uses a holistic approach to develop child's competence in school, activities of daily living, play, work and community while meeting expectations of family and environment. Includes field-based experiences.

OCCT 650. Occupational Therapy in Health Care. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces contemporary issues, trends in occupational therapy health-care settings. Covers principles of managed care and impact on occupational therapy practice. Focuses on changes in practice sites, service delivery models and patient demographics. Emphasizes how occupational therapists can influence health policy, advocate for change and address emerging professional ethical issues. Encourages consideration of integrating holistic/biopsychosocial nature of occupational therapy into biomedical health-care systems.

OCCT 651. Administration and Supervision of Occupational Therapy Services. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Covers management of human and non-human resources to provide efficient and effective occupational therapy services; nature of formal and informal organizations, administrative process and administrative tasks. Includes supervision, consultation and the planning of occupational therapy fieldwork education.

OCCT 654. Children and Young Adult Advanced Assistive Technology Applications in Occupational Therapy. 3 Hours.

Semester course; 3 credits. Provides an in-depth view of assistive technology and human-environment/technology interface for children and young adults. Focuses on the use of AT in occupational therapy evaluation and intervention. Exposes students to tools and strategies for integrating computer hardware and software, augmentative communication devices, ECUs, powered mobility, toys and low technology solutions into home, school, recreation, community and work environments. Requires student problem-solving relative to their area of pediatric or young adult research and clinical practice.

OCCT 655. Older Adult Advanced Assistive Technology Application in Occupational Therapy. 3 Hours.

Semester course; 3 credits. Provides an in-depth view of assistive technology and human-environment/technology interface for older adults with disabilities. Focuses on use of assistive technology in occupational therapy evaluation and intervention. Exposes occupational therapy students to tools and strategies for integrating environmental control units, powered mobility, computer hardware and software, augmentative communication devices, low vision, hearing impaired and low technology solutions into the lives of elderly assistive technology consumers. Requires students to problem solve within their area of gerontology research and clinical practice.

OCCT 656. Advanced Neuroscience Applications in Occupational Therapy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Requires instructor's permission for non-occupational therapy majors. Briefly reviews basic structure and organization of nervous system in typical individuals. Emphasizes student examination of current neuroscience literature relative to diseases and disabilities encountered in clinical practice, matching function and dysfunction with structure and organization. Students explore individual topics of interest; present to other professionals. Addresses specific cases from participants' clinical and professional experience, and links this to contemporary OT theories and frames of reference guiding practice.

OCCT 660. Level I Fieldwork in Occupational Therapy. 1 Hour.

Semester course; 45 clinical/seminar hours. 1 credit. Enriches classroom learning by providing directed observation and participation in clinical practice settings. Provides experiences supervised by professionals working in one of a variety of clinical settings (e.g., early intervention, schools, hospitals, nursing homes, home health agencies or mental health settings). Placements arranged to complement the treatment/intervention courses. A preliminary step to the more complex Level II Fieldwork clinical experience.

OCCT 661. Occupational Therapy in the Schools. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Registration open to other professional students with permission of the instructor. Studies the roles and functions of occupational therapists in school settings as defined by the educational model, government regulations and service provision patterns. Emphasizes person-centered planning, parent and professional collaboration and educationally relevant approaches. Integrates the use of research and clinical reasoning to provide occupation-based practice for students with disabilities of all ages.

OCCT 662. Neuroscience Review and Sensory Integration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Reviews neuroscience basics related to function and dysfunction. Overviews brain structures and function on both gross and cellular levels. Examination of the sensory integration neuroscience theory base which provides foundation for additional study of brain structure as it relates to function and dysfunction. Links understanding of neuroscience with occupation and occupational performance.

OCCT 663. Beyond the Basics: Advanced Evaluation and Intervention in Pediatric Occupational Therapy. 3 Hours.

Semester course; 3 credits. Restricted to post-professional master's level students. Provides in-depth view of selected occupational therapy assessment and intervention techniques for children and youth with disabilities. Exposes students to practical tools and strategies for integrating treatment into home, school, recreation, community and work environments. Requires students to investigate their own clinical reasoning skills relative to their area of pediatric interest, clinical practice and research. Specifically focuses on use of sensory integration theory and practice for infants and children, issues related to feeding and play, and the transition of adolescents with disabilities into postsecondary, work and community environments.

OCCT 670. Case-based Clinical Reasoning in Occupational Therapy. 2 Hours.

Semester course; 4 laboratory hours. 2 credits. Utilizes case studies to develop clinical reasoning skills and examine evaluation and treatment alternatives for persons with occupational performance limitations. Focuses on life-span development issues. Uses cases designed to integrate and develop strategies based on previously presented material. Incorporates assistive technology as an intervention tool into the case-based learning process. Graded as Pass/Fail.

OCCT 671. Advanced Theory in Occupational Therapy. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated for a maximum of 4 credits. Integrates examination of historical and current theoretical constructs reflected in professional literature and published conceptual models of practice with the clinical expertise of experienced occupational therapists. Examines the clinical reasoning process and fosters high-level theoretical and clinical thinking. Builds upon entry-level study of theory to emphasize dynamic relationship between theory, clinical reasoning and client-based and occupation-based practice.

OCCT 673. Health Care Delivery and Occupational Therapy Practice Models. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to post-professional master's level students. Introduces contemporary issues and trends in occupational therapy health-care settings. Covers principles of managed care and impact on occupational therapy practice. Focuses on changes in practice sites, service delivery models and patient demographics. Emphasizes on how occupational therapy influences health policy, advocates change and addresses emerging professional and ethical issues. Encourages consideration of integrating holistic/biopsychosocial nature of occupational therapy into biomedically oriented health-care system.

OCCT 680. Level II Fieldwork in Occupational Therapy: A. 1-9 Hours.

Semester course; students must complete 480 clinical hours. Variable credit. Maximum of 9 credits per semester. Clinical experience must be different from that offered in OCCT 681. Expands experience in delivering occupational therapy services to a variety of individuals across the lifespan and in a variety of settings. Promotes interpretation of previously learned skills and knowledge through clinical reasoning and reflective practice. Extends skills of professionalism and competence as entry-level occupational therapists. Graded as P/F or PR.

OCCT 681. Level II Fieldwork in Occupational Therapy: B. 1-9 Hours.

Semester course; students must complete 480 clinical hours. Variable credit. Maximum of 9 credits per semester. Clinical experience must be different from that offered in OCCT 680. Expands experience in delivering occupational therapy services to a variety of individuals across the lifespan and in a variety of settings. Promotes interpretation of previously learned skills and knowledge through clinical reasoning and reflective practice. Extends skills of professionalism and competence as entry-level occupational therapists. Graded as P/F or PR.

OCCT 685. Advanced Clinical Reasoning: Asking the Right Questions. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides foundation and understanding of the source of clinical reasoning as a basis of clinical practice in occupational therapy through case-based learning. Promotes clinical reasoning within the practice of occupational therapy, bridging practice theories, evidence-based practice and clinical skills. Requires examination of existing knowledge and data, and development of a clinical project proposal.

OCCT 686. Advanced Clinical Reasoning Applications. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: OCCT 685. Forms the application component of clinical reasoning process; offers opportunity to experience clinically based project implementation within the context of ongoing practice. Facilitates mentoring relationships with colleagues in an identified specialty area to promote leadership in clinical reasoning. Implements project proposals developed in OCCT 685; data will be collected, interpreted and summarized.

OCCT 689. Occupational Therapy Assessment and Evaluation. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: OCCT 592. Provides introduction to evaluation and intervention process as it relates to areas of occupation, occupational performance skills, client factors and context. Focuses on general evaluation as well as specific use of assessments for various clients, practice settings and environments. Emphasizes oral and written communication, accurate documentation and use of assessment data to develop intervention and discharge plans for individuals.

OCCT 690. Occupational Therapy Seminar. 1-3 Hours.

Variable hours. 1-3 credits. May be repeated for a maximum of 4 credits. Investigation, presentation and discussion of current problems and issues in the field of occupational therapy.

OCCT 691. Special Topics in Occupational Therapy. 1-3 Hours.

Semester course; 1-3 credits. Designed around the interests of students, faculty expertise, and availability and expertise of Richmond-area occupational therapists or visiting lecturers. Format may include intensive mini-courses or workshops, an advanced course with some opportunity for election and development of knowledge and skills in a specialized area of occupational therapy.

OCCT 692. Assistive Technologies for Occupational Engagement. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: OCCT 593 and OCCT 693. Focuses on the evaluation, activity analysis and intervention process with a range of assistive technology, including software, hardware and low-tech solutions. Includes the development of skills for adaptation of activities and contexts.

OCCT 693. Occupational Synthesis and Adaptations. 2 Hours.

Semester course; 4 laboratory hours. 2 credits. Prerequisite: OCCT 593. Builds upon activity analysis skills. Emphasizes altering, adapting and modifying activities and contexts to promote increased occupational performance. Includes development of planning and construction skills, experiential learning and exposure to adapted leisure activities in the community, and design and production of an adaptive project for an individual with a disability, therapist or facility.

OCCT 695. Fieldwork: Specialty (Optional). 1-9 Hours.

Twelve weeks full-time experience in programs providing occupational therapy services. 1-9 credits. Minimum total required for all fieldwork courses is 18 semester hours. Determination of the amount of credit and permission of the instructor and department chair must be secured prior to registration for the course. Supervised fieldwork experiences are arranged in various settings for the application of academically acquired knowledge. Placements include experiences in prevention, health maintenance, remediation, daily life tasks and vocational adjustment. Fieldwork settings may include hospitals, rehabilitation centers, school systems, community agencies, camping programs, penal systems and the like. Fieldwork experiences are arranged individually, but placement in a specified location cannot be guaranteed. In the event of failure, the course may be repeated only upon recommendation by the academic and clinical faculty. Fieldwork must be completed no later than 24 months following completion of the academic phase.

OCCT 697. Independent Study. 1-3 Hours.

1-3 credits. The student will submit a proposal for investigating some area or problem in occupational therapy not ordinarily included in the regular curriculum. The student's desired study must be described in a contract written by the student and approved by the faculty member. The results of the study will be presented in a written or oral report.

OCCT 698. Research in Occupational Therapy. 1-3 Hours.

Semester course; 1-3 credits. Completion of a proposal for a research project relevant to occupational therapy.

OCCT 700. Enabling Occupational Performance: The Canadian Perspective. 3 Hours.

International study course; 2 lecture and 2 laboratory hours. 3 credits. Introduces guiding principles for enabling occupation within a Canadian context. Examines client-centered practice from perspective of Canadian occupational therapists and publications by the Canadian Association of Occupational Therapists. Focuses on theory and implementation. Characteristics of components of the Canadian Occupational Performance Model will be examined as determinants of health, well-being and participation of individuals, groups and communities. Examines issues pertaining to Canadian society, culture and history, trends that have affected the Canadian health and social services system, and comparisons between Canadian and American systems. Course takes place in summer semester in London, Ontario, Canada.

OCCT 707. Psychosocial Interventions in Occupational Therapy. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits.
Prerequisites: OCCT 592 and OCCT 617. Focuses on the application of mental health practices to address psychosocial and behavioral health related to occupational performance. Explores psychosocial frames of reference and the role of occupation in the promotion of mental health and well-being across the continuum of care. Includes evaluation, intervention, documentation, reimbursement and outcome considerations across the continuum of care in psychosocial settings (acute, inpatient, outpatient, community).

OCCT 709. Research Process and Statistical Analysis in Occupational Therapy. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Restricted to entry-level master's students. Prepares students to write research proposal for completion of the requirements of the master's degree. Covers basic steps in research process, including problem definition, literature review, design, data collection and analysis, and dissemination of findings. Students will demonstrate understanding of statistical analysis after completing a review of introductory statistical concepts. Addresses quantitative and qualitative approaches. Students will review and critically analyze literature in preparation for subsequent research experiences.

OCCT 710. Quantitative Research Processes. 3-4 Hours.

Semester course; 3-4 lecture hours. 3-4 credits. Prepares students as critical consumers of research. Provides overview to basic steps in research process, including problem definition, literature review, design, data collection and data dissemination. Students critically analyze each step and compare across different examples. Discussion of strengths and weaknesses in all areas of research. Focus on quantitative approaches with general introduction to basics of qualitative research for comparison.

OCCT 711. Research Process in Occupational Therapy: Qualitative Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces qualitative methods of research with goals of understanding the theoretical underpinnings, gaining practical experience and developing an understanding of the "self" as an instrument. Focuses on qualitative methods in occupational therapy research and their application to practice.

OCCT 713. Adult Occupational Performance II. 4 Hours.

Semester course; 2 lecture and 4 laboratory hours. 4 credits. Prerequisite: OCCT 613. Expands the depth and breadth of content introduced in prerequisite course. Analyzes assessment and intervention strategies, tools and equipment typically used in adult occupational therapy settings across the continuum of care. Examines evaluation and treatment of functional disability for adults in clinical and natural environments. Focuses on occupational performance, while considering client factors, tasks and context. Stresses application of knowledge of clinical reasoning, theoretical practice models and cultural and contextual issues in evaluating and planning treatment.

OCCT 714. Pediatric Occupational Performance II. 4 Hours.

Semester course; 2 lecture and 4 laboratory hours. 4 credits. Prerequisite: OCCT 614. Focuses on occupational performance of children with disabilities kindergarten age through transition into adulthood. Explores a variety of frames of reference and evaluative and intervention approaches for children and their families in multiple practice arenas, emphasizing the child's performance in educational settings. Uses a holistic approach to develop the child's competence in school, activities of daily living, play, work and community while meeting expectations of family and environment. Includes field-based experiences.

OCCT 715. Level I Fieldwork in Occupational Therapy. 1 Hour.

Semester course; 1 clinical hour (40 contact hours). 1 credit. Prerequisite: OCCT 615. Enriches classroom learning by providing directed observation and participation in clinical practice settings. Provides experiences supervised by professionals working in practice settings. Includes classroom activities related to professional development and reflective practice. Prepares students for the more complex level II fieldwork clinical experience. Graded as Pass/Fail.

OCCT 716. Evidence-based Practice in Occupational Therapy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: OCCT 616. Examines one of the roots of clinical practice: the existence of evidence. Provides an overview of evidence-based practice in general, and more specifically, in occupational therapy. Emphasizes in-depth information on levels of evidence, developing practice questions and understanding available resources. Analyzing existing evidence is included. Addresses clinical application and resources for further study. Emphasizes practical application of EBP concepts to OT, laying groundwork for best practice.

OCCT 717. Level I Fieldwork in Psychosocial Occupational Therapy. 1 Hour.

Semester course; 1 clinical hour. 1 credit. Prerequisites: OCCT 617 and OCCT 707. Enriches classroom learning by providing directed observation and participation in a psychosocial setting. Provides experiences supervised by professionals working in one of a variety of psychosocial settings in a community setting. Prepares students for the more complex level II fieldwork clinical experience.

OCCT 720. Policy, Advocacy and Management for Occupational Therapy Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Addresses the principles and application of leadership and management skills within the context of occupational therapy services, federal and state legislation and regulations, national requirements, and the various contexts of service delivery. Focuses on knowledge and skills for the management of human and nonhuman resources for efficient and effective occupational therapy services. Evaluates contemporary policy issues, including trends in occupational therapy settings. Covers principles of reimbursement systems with analysis on the impact on occupational therapy practice. Focuses on changes in practice sites, service delivery models and patient demographics. Emphasizes how occupational therapists can influence policy, advocate for change and address emerging professional ethical issues. Encourages consideration of integrating holistic/biopsychosocial nature of occupational therapy into biomedical health care systems.

OCCT 721. Clinical Reasoning in Occupational Therapy. 3 Hours.

Semester course; 1 lecture and 4 laboratory hours. 3 credits. Prerequisites: OCCT 617, OCCT 713, OCCT 714. Utilizes case studies to develop clinical reasoning skills and examine evaluation and treatment alternatives for persons with occupational performance limitations. Focuses on lifespan development issues. Uses cases designed to integrate and develop strategies based on previously presented material.

OCCT 729. Research Practicum. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Supervised investigation of selected problems in occupational therapy. Exposes students to varied tasks integral to research implementation. Addresses overall research design and implementation process and skills needed for publication and presentation of research. Students complete an individualized learning contract. Graded as "S," "U" or "F".

OCCT 735. Evidence Bases for Occupational Therapy Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines one of the roots of clinical practice: the existence of evidence. Provides an overview of evidence-based practice (EBP) in general and, more specifically, in occupational therapy. Provides in-depth information on levels of evidence; developing practice questions, understanding available resources and analyzing existing evidence is included. Ties in with clinical reasoning skills, extending them to understanding the literature. Clinical application and resources for further study will be addressed. Emphasis on practical application of EBP concepts to OT, laying groundwork for best practice.

OCCT 736. Developing Fundable Projects. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the environment and opportunities for seeking and obtaining external funding in the area of health-related sciences. Will address proposals for program development and evaluation, training and research. Studies components of typical proposals and supports proposal development by student. Analyzes and critiques student proposals using both peer and instructor review. Discusses relationships between proposal writing and leadership skills and knowledge.

OCCT 739. Program Development and Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores basic program development, program evaluation and needs-assessment methods necessary for developing upcoming capstone leadership projects. Focuses on conceptualization, design, models and approaches, and operational procedures used in program development and evaluation. Presents the planning and evaluation cycle, categories of evaluation, program development models and needs-assessment techniques used in creating programs. Explores ideas for program development from a variety of perspectives, including potential for evaluation of processes and outcomes, social and clinical indicators of need, asset mapping, and potential impact of the program. Emphasizes the roles of key stakeholders, regulatory bodies and evaluators, development and use of program theory, and dissemination of evaluation results for improvement of programs and policies.

OCCT 740. Concepts in Disability Leadership for Occupational Therapists. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides basic descriptions of leadership and innovation, especially as they apply to the disability community, and presents theoretical concepts of organizational leadership. Presents concepts of change in organizational, community, political and social action/social movement contexts. This is the first of a series of three courses on leadership in disability for occupational therapists.

OCCT 741. Disability Leadership Applications for Occupational Therapists. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Fosters development of skills needed to assume leadership roles in disability-related areas of practice by creating detailed proposals for the practicum in disability leadership for occupational therapists, to be implemented in the third course in the series. Students increase understanding of leadership concepts by conducting needs assessments and collecting other pilot data in community settings that provide services for people with disabilities. The second of a series of three courses on leadership in disability for occupational therapists, course focuses on application of theoretical concepts learned in the first leadership course.

OCCT 742. Practicum in Leadership for Occupational Therapists. 4 Hours.

Semester course; 1 lecture and 3 laboratory hours. 4 credits. Builds leadership skills in occupational therapists for work in health care, education and disability-focused organizations. Emphasizes relationships with other professionals, governing boards, regulatory bodies and other key stakeholders through an identified and pre-approved leadership project. Promotes exploration of personal styles of leadership. Serves as applied practicum course in leadership development.

OCCT 743. Synthesis and Evaluation of Capstone Leadership Project. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Culminating course in the four-part leadership series. Focuses on synthesis and evaluation of capstone leadership project. Leads to assessment and critique of project implementation through compilation and analysis of project results. Re-examines leadership theories, personal leadership styles and their relationship to program outcomes. Proposes and critiques resources for project sustainability, clinical application and dissemination. Requires written and verbal presentation of final project and assessment of its value to the health care community.

OCCT 759. Fieldwork Education Seminar. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: OCCT 715. Promotes professional formation through the integration of foundation concepts and skills necessary for succeeding in fieldwork II and professional practice. Emphasizes policies and procedures, self-awareness and growth, and supervision and communication skills. Extends skills of professionalism and preparation for level II fieldwork experiences.

OCCT 760. Level II Fieldwork in Occupational Therapy. 1-9 Hours.

Semester course; 1-9 clinical hours (52 clinical contact hours/credit). 1-9 credits. Prerequisites: IPEC 501, OCCT 617, OCCT 689, OCCT 693, OCCT 713, OCCT 714, OCCT 715, OCCT 716, OCCT 717, OCCT 721, OCCT 759, OCCT 780 and OCCT 781. Expands experience in delivering occupational therapy services to variety of individuals across the lifespan in a variety of settings. Promotes interpretation of previously learned skills and knowledge through clinical reasoning and reflective practice. Students extend skills of professionalism and competence as entry-level occupational therapists. Graded as Pass/Fail.

OCCT 761. Level II Fieldwork in Occupational Therapy. 1-9 Hours.

Semester course; variable hours (54 clinical hours/credit). 1-9 credits, Prerequisite: OCCT 760. Clinical experience must be different from that offered in OCCT 760. Expands experience in delivering occupational therapy services to variety of individuals across the lifespan in a variety of settings. Promotes interpretation of previously learned skills and knowledge through clinical reasoning and reflective practice. Students extend skills of professionalism and competence as entry-level occupational therapists. Students must complete 480 clinical hours of OCCT 761.

OCCT 780. OTD Leadership Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on exploration of professional development skills integral to the advancement of occupational therapy practice. This course will guide students in self-analysis to identify academic, personal and professional goals. Topics presented will include, but are not limited to, principles of leadership theory, leadership traits and skills, global health perspectives, emerging areas of practice, advocacy, and models of teaching and learning. As the introductory course into the doctoral capstone experience students will learn the process for creating an evidence- and theory-based innovative capstone project and experience.

OCCT 781. Program Development and Evaluation. 2 Hours.

Semester course; 1 lecture and 2 laboratory hours. 2 credits. Prerequisite: OCCT 616. Explores basic program development, program evaluation and needs assessment methods necessary for developing upcoming leadership-based doctoral practicum. Focuses on conceptualization, design, models and approaches, and operational procedures used in program development and evaluation. Presents the planning and evaluation cycle, categories of evaluation, program development models and needs assessment techniques used in creating programs. Explores ideas for program development from a variety of perspectives including potential for evaluation of processes and outcomes, social and clinical indicators of need, asset mapping and potential impact of the program. Emphasizes the roles of key stakeholders, regulatory bodies and evaluators, development and use of program theory, and dissemination of evaluation results for improvement of programs and policies.

OCCT 782. Professional Development Seminar. 2 Hours.

Semester course; 1 seminar and 2 laboratory hours. 2 credits. Prerequisites: OCCT 780 and OCCT 781. Requires development of an independent proposal for leadership and professional development for the doctoral capstone. Ensures completion of literature review and needs assessment to guide capstone development. This seminar will result in individual learning objectives, deliverables, evaluation plan and plans for supervision, as well as evaluation of professional performance written by the student in collaboration with faculty and/or capstone mentors.

OCCT 783. Doctoral Capstone. 10 Hours.

Semester course; 1-10 practicum hours (54 contact hours/credit). 1-10 credits. Prerequisites: OCCT 716 and OCCT 782. Provides practical leadership opportunity and advanced skills in one or more areas of interest in clinical practice, administration, research, program or policy development, advocacy, education or theory development. Implements previously proposed, developed and approved project. Completes individualized specific learning objectives and evidence of learning under direct supervision or mentorship. Student must complete 540 practicum hours. Graded as Pass/Fail.

OCCT 784. Practicum Evaluation and Dissemination. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: OCCT 761. Focuses on synthesis and evaluation of doctoral practicum experience, compilation and analysis of practicum outcomes, and interpretation and application of findings or outcomes. Requires development and critique of dissemination products, written and verbal presentation.

OCCT 793. Clinical Specialty Practicum. 2-4 Hours.

Three to nine hours of concentrated clinical experience in the student's chosen area of specialization under the supervision of an experienced clinician (minimum three hours per week for each credit), and one credit hour for guided library research related to topic of practice with preparation of a paper examining the theoretical and empirical bases of practice in specialty area. A contract is prepared by the student and approved by a faculty adviser and clinical supervisor.

OCCT 798. Thesis. 3-6 Hours.

3-6 credits. Completion of a proposal for a master's degree thesis relevant to occupational therapy.

OCCT 799. Thesis. 1-6 Hours.

1-6 credits. Completion of a master's degree thesis relevant to occupational therapy.

Patient Counseling (PATC)**PATC 501. Introduction to Spiritual Care in Health Care. 1 Hour.**

Semester course; 1 lecture and 1 field experience hours. 1 credit. Introduces the student to the hospital environment through observation, reading and reflection.

PATC 510. Introduction to Patient Counseling. 3-5 Hours.

Semester course; 3 lecture and optional clocked clinical hours. 3-5 credits. Introduces the student to the development and practice of spiritual care of patients and families. Includes case review and peer interaction. Assignment to the hospital is available to those seeking clinical pastoral education credit. Designed for the nonspecialist.

PATC 511. The Professional Caregiver. 4 Hours.

Semester course; 3 lecture hours and 150 clocked clinical hours. 4 credits. Prerequisite: PATC 510. Focuses upon development of professional identity and growth within the helping professions. Emphasizes the context of the health-care environment and its impact upon caregivers, patients and families. Includes practical application of theory. Incorporates the use of clinical material. Designed for the nonspecialist.

PATC 515. Basic Spiritual Care. 7 Hours.

Semester course; 7 lecture hours. 7 credits. Provides an intensive course of study toward the development of spiritual care skills in the hospital context. Utilizes group process and individual supervision for the review of clinical material.

PATC 516. Introduction to Spiritual Care Clinical Practicum. 2 Hours.

Semester course; 2 practicum hours (300 documented clinical hours). 2 credits. Corequisite: PATC 515. Introduces clinical spiritual care with supervision and direct patient care. Graded as pass/fail.

PATC 551. Selected Issues in Health Care. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated to a maximum of 2 credits. Exposes the student to a number of current trends and topics relevant to the contemporary U.S. health care delivery system. Content changes from semester to semester. Utilizes the expertise of hospital personnel.

PATC 592. Independent Study in Spiritual Care. 1-4 Hours.

Semester course; 1-4 independent study hours. 1-4 credits. May be repeated for a maximum of four credits. Provides opportunity to increase clinical and interpersonal skills in specialty areas through patient care, parallel reading and individual faculty supervision.

PATC 611. Theory of Spiritual Care and Chaplaincy Practice I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PATC 515 or equivalent. Emphasizes the philosophical and theological foundations of spiritual care and chaplaincy. Provides an in-depth examination of clinical material in a seminar setting.

PATC 612. Theory of Spiritual Care and Chaplaincy Practice II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PATC 515 or equivalent. Emphasizes psychological foundations of spiritual care. Provides an in-depth examination of clinical material in a seminar setting.

PATC 613. Group Process I. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PATC 515 or equivalent. Explores, in a small group setting, the dynamics common to group behavior. Reflects upon the use of group process learning. Utilizes an experiential method of learning.

PATC 614. Group Process II. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PATC 515 or equivalent. Focuses upon the various theories of group process. Focuses upon application of theory to a variety of clinical and administrative settings. Utilizes an experiential method of learning.

PATC 615. Group Process III. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PATC 613 or 614. Explores various theories of group leadership. Provides opportunity to test skill development within a peer context.

PATC 617. Theory of Spiritual Care and Chaplaincy Practice III. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PATC 611 and PATC 612. Provides the opportunity to examine the integration of theological, psychological and sociological aspects of spiritual care within varied clinical contexts.

PATC 618. Supervised Clinical Practice II. 5 Hours.

Semester course; 3 lecture and 300 clocked clinical hours. 5 credits. May be repeated for a total of 10 credits. Prerequisites: PATC 611 and PATC 612. Provides the opportunity to apply and practice clinical skills in a pastoral care specialty under faculty supervision. Utilizes university and hospital personnel in specialty areas.

PATC 619. Spiritual and Social Integration Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course is a summary course required for persons in the dual-degree program. Provides in-depth reflection on the theological and social implications of ministry within the health-care environment. Course is taught jointly with seminary faculty.

PATC 620. Religious and Social Factors in Patient Counseling. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Provides an understanding of the theological and social factors related to hospitalization. Focuses on the use of ritual and tradition in caring for persons in crisis.

PATC 621. Care of the Dying. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Explores the spiritual and psychological dynamics associated with loss for patients and families. Offers special attention to the emotional and spiritual impact on caregivers that work with dying patients. Includes the use of clinical material within a group experience.

PATC 627. Living Well. 2-3 Hours.

Semester course; 2 or 3 lecture hours. 2 or 3 credits. Focuses on the development, facilitation and leadership of support groups for bereaved families. Provides students the opportunity to increase interpersonal and clinical skills in supporting families who have experienced a significant death. Special attention is offered to the needs of children. Requires participation in "Living Well," a contracted component of VCU Health System's bereavement program that utilizes art and group discussion.

PATC 629. Spirituality and Aging. 2-3 Hours.

Semester course; 2 or 3 lecture hours. 2 or 3 credits. Explores the spiritual, psychological and social dynamics associated with aging. Provides special attention to the spiritual and emotional impact on caregivers who work with aging patients. Crosslisted as: GRTY 629.

PATC 635. Clinical Ethics. 2-3 Hours.

Semester course; 2-3 lecture hours. 2-3 credits. Applies the principles of biomedical and health care ethics to a more informed understanding of ethical decision-making in the clinical environment. Concerned with the identification, analysis and resolution of ethical problems that arise in planning for the care of patients. Emphasizes the ethical responsibilities of clinicians.

PATC 636. Professional Identity and Ethics. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Focuses on guidelines for professional ethics in the development and maintenance of professional and personal integrity, leadership ability and the enhancement of a congruency between spiritual, psychological and physical maturity.

PATC 639. Spiritual Care Management. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Surveys the theory and practice of spiritual care management within the present health care environment including personnel management, process improvement, benchmarking and qualitative research design.

PATC 640. Research Basics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Provides an overview of research basics within the context of spirituality, religion and health. Explores the foundations of research literacy.

PATC 641. Evidence-based Spiritual Care and Chaplaincy Inquiry. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: PATC 640. Provides an overview of data collection, data quality and data usage within the context of spirituality, religion and health care. Practices synthesizing the findings of multiple research articles.

PATC 642. Developing and Presenting Spiritual Care and Chaplaincy Research. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: PATC 641. Provides an overview of how to analyze and present evidence-based project findings and develop recommendations. Emphasizes understanding different objectives and dissemination routes for evidence-based projects.

PATC 646. Clinical Practicum I. 2 Hours.

Semester course; 2 practicum hours (300 documented clinical hours). 2 credits. Corequisite: PATC 611. Integrates students in clinical spiritual care with supervision and direct patient care. Clinical time includes supervision and direct patient care. Graded as pass/fail.

PATC 647. Clinical Practicum II. 2 Hours.

Semester course; 2 practicum hours (300 documented clinical hours). 2 credits. Prerequisite: PATC 646. Corequisite: PATC 612. Student continues academic application of spiritual care skills within health care context. Clinical time includes supervision and direct patient care. Graded as pass/fail.

PATC 648. Clinical Practicum III. 2 Hours.

Semester course; 2 practicum hours (300 documented clinical hours). 2 credits. Prerequisite: PATC 647. Corequisite: PATC 617. Students continue academic application of spiritual care skills and gains experience with providing clinical mentorship. Emphasizes professional competence in preparation for board certification. Clinical time includes supervision and direct patient care. Graded as pass/fail.

PATC 653. Patient Counseling Evaluation I. 4 Hours.

Semester course; 2 lecture and 6 practicum hours. 4 credits. Focuses upon the theory and practice of case based education and clinical evaluation relevant for pastoral supervision. Observation of and reflection upon the work of ACPE supervisors are required.

PATC 654. Patient Counseling Evaluation II. 4 Hours.

Semester course; 2 lecture and 6 practicum hours. 4 credits. Continues the theoretical and practical focus of PATC 653. Students move from observation to participation in clinical evaluation of pastoral care interns.

PATC 661. History of Pastoral Supervision. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on the history and development of clinical pastoral education as a movement. Exposes the student to theoretical basis of clinical pastoral education as established in professional and organizational standards.

PATC 663. Theory of Pastoral Supervision I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on the literature in pastoral supervision. Emphasizes the applicability of educational and personality theory relevant for clinical pastoral education.

PATC 664. Theory of Pastoral Supervision II. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Focuses on the literature related to cultural and gender factors relevant for pastoral supervision.

PATC 665. Selected Topics in Pastoral Supervision. 2 Hours.

2 lecture hours. 2 credits. May be repeated for a total of 4 credits. Presents a variety of topics on supervisory theory and practice for persons seeking certification by the ACPE. Utilizes ACPE supervisors as well as university and local seminary faculty.

PATC 692. Independent Study in Pastoral Supervision. 1-4 Hours.

Semester course; 1-4 credits. May be repeated for a total of 4 credits. Provides individual focus and direction of student readings in theories of pastoral supervision. Readings are selected from bibliography of the ACPE Certification Commission.

PATC 694. Advanced Clinical Pastoral Supervision. 7 Hours.

Semester course; 2 lecture and 15 practicum hours. 7 credits. Prerequisite: PATC 654. Advanced attention to integration of education and personality theories with theology. Includes the actual practice of supervision under faculty guidance. Restricted to individuals admitted to candidacy status in ACPE, Inc. May be repeated.

PATC 696. Intensive Supervisory Practicum. 9 Hours.

Semester course; 3 lecture and 18 practicum hours. 9 credits. Prerequisite: PATC 694. Provides opportunity for independent supervision of pastoral care interns with mentoring and evaluation by faculty. Utilizes ACPE supervisory personnel. Restricted to individuals admitted to candidacy status in ACPE. May be repeated.

PATC 697. Clinical Research. 1-5 Hours.

Semester course; 1-5 credits. May be repeated for a total of 5 credits. Provides the opportunity to test the practical application of research and process improvement methods within the clinical context. Encourages the development of collaborative and interdisciplinary project development.

Physical Therapy (PHTY)**PHTY 501. Gross Anatomy (Physical Therapy). 7 Hours.**

Semester course; 4 lecture and 6 laboratory hours. 7 credits. Examines the structural and functional anatomy of the human musculoskeletal system through lecture and cadaver dissection. Develops understanding of fundamental facts and principles that apply to professional practice through lecture, dissection, radiographic examination and clinical correlation.

PHTY 502. Kinesiology. 4 Hours.

3 lecture and 2 laboratory hours. 4 credits. Introduces the student to the kinematics and kinetics of human movement. Emphasis is placed on osteokinematics, arthrokinematics and the structures that limit and/or guide movement.

PHTY 503. Applied Exercise Physiology. 3 Hours.

for Wellness and Health Promotion Semester course; 2 lecture and 2 laboratory hours. 3 credits. Restricted to students in the professional Doctor of Physical Therapy program. Integrates principles and practices of applied physiology, health promotion, wellness and adult fitness. Emphasizes the underlying physiology with assessing physical fitness and developing therapeutic exercise prescriptions which meet recommended guidelines for achieving and maintaining optimal physical fitness and health.

PHTY 505. Applied Microscopic Anatomy for Physical Therapy. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Examines the basic components of cells in terms of their structure and function. Cells and tissues of greatest importance to physical therapists are studied in detail, and their response to injury is explored. Reviews methods of studying cells.

PHTY 506. Functional Neuroanatomy. 4 Hours.

Semester course; 3 lecture and 2 laboratory hours. 4 credits. Examines the basic structure and function of the nervous system with special emphasis on topics of greatest concern to physical therapists. Uses neurobiological approach to integrate the basic health sciences of neuroanatomy, neurophysiology and clinical neuroscience.

PHTY 508. Musculoskeletal Physical Therapy I. 6 Hours.

Semester course; 4 lecture and 4 laboratory hours. 6 credits. Teaches some of the basic evaluation methods and measurement procedures used by physical therapists in history taking and physical examination. Includes lecture, demonstration and practice in measurement of the length and girth of body parts, manual and mechanical muscle testing, joint range of motion, accessory motion testing, and palpation.

PHTY 510. Rehabilitation I. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Introduces basic clinical skills and procedures, including measurement of vital signs, patient lifting and moving techniques, progressive mobilization, medical asepsis and principles of bandaging. Introduces medical documentation, record keeping and professional communication. Introduces communication methods and skills appropriate for interaction with patients, families and colleagues.

PHTY 512. Health Care Systems. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Restricted to students in the professional Doctor of Physical Therapy program. Introduces students to issues in health care related to organization, finance, access and regulation of services for individuals, groups and communities. Provides a general overview of inter-relationships among health care consumers, providers, organizations, regulators and third-party payers. Discusses implications for public policy and legislative action. Critically reviews supplemental readings to illustrate key concepts and their relevance to the practice of physical therapy.

PHTY 520. Clinical Education I: Introduction to Clinical Education. 3 Hours.

Semester course; 1 lecture and 4 laboratory hours. 3 credits. Enrollment is restricted to Doctor of Physical Therapy students. Introduces the profession of physical therapy. Emphasizes professionalism, ethics, professional behaviors, physical therapy extenders role and individual differences that may impact patient care. Provides an introduction to the educational concepts that are related to personal growth and patient management. Includes an integrated clinical experience in local clinical facilities that is designed to introduce the student to physical therapy practice. Utilizes a variety of teaching strategies, including simulation-based learning, to allow students to develop interpersonal skills with patients, peers and other health care professionals while applying and practicing skills learned in the first professional year of education in a clinical setting.

PHTY 531. Evidence-based Practice Concepts. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Introduces concepts and principles of the research process including question, theory and hypothesis development, research design and methodology, and statistical reasoning and analysis. Discusses the basis of critical review of professional literature and determination of the relevance and applicability of research findings to specific patients with the goal of promoting evidence-based practice.

PHTY 537. Rehabilitation II. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Restricted to students in the professional Doctor of Physical Therapy program. Presents evaluation and treatment methodology for the acute care patient. Focuses on the rehabilitation phase of patient care for different patient diagnoses. Provides interprofessional opportunities with other health care professional students.

PHTY 540. Psychosocial Aspects of Physical Therapy. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Introduces the student to sociocultural and psychosocial characteristics of patient populations that impact the rehabilitation process. Addresses the patient and family in the health care system, including sexuality, impact of disability, grief processes, death and dying, and selected counseling techniques.

PHTY 601. Advanced Measurement Concepts. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Investigates the principles of measurement theory as applied to clinical practice. Reviews basic principles guiding electronic instrumentation and electromyography. Examines the theoretical bases for the examination and treatment approaches used in orthopedic physical therapy or neurologic physical therapy.

PHTY 603. Evidence-based Practice I. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Introduces concepts and principles of the research process including question, theory and hypothesis development, research design and methodology, and statistical reasoning and analysis. Introduces critical review of professional literature and determination of the relevance and applicability of research findings to specific patients with the goal of promoting evidence-based physical therapy practice. Teaches how to access and implement electronic search engines to locate and retrieve professional literature. Twelve lecture hours will be provided on site at the beginning of the semester; the remainder of the course will be distance-based.

PHTY 604. Evidence-based Practice II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHTY 603. Continuation of PHTY 603. Provides an advanced review of the concepts and principles of the research process and evidence-based practice. Focuses on skills needed to develop relevant clinical questions for specific patient scenarios, perform a critical appraisal of professional literature and determine the applicability of the research findings for patient management. Includes preparation of a publication-ready paper on a topic relevant to the student's practice interests. Course is entirely distance-based.

PHTY 605. Foundations for Pathokinesiology. 3,4 Hours.

Semester course; 3-4 lecture hours. 3-4 credits. A study of the principles that form a foundation for understanding pathokinesiology and therapeutic kinesiology. Integration of principles of motor development, control and learning with emphasis on abnormal motor behavior and its remediation.

PHTY 606. Therapeutic Kinesiology. 2-4 Hours.

Semester course; 1-3 lecture and 3 clinical hours. 2-4 credits. A study of motor behavior in both normal and pathological conditions. Reading and discussion of the basic literature of current neurologic approaches to therapeutic exercises and an integration of these concepts into a comprehensive model of human movement.

PHTY 609. Clinical Biomechanics. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Provides an opportunity to develop knowledge in sufficient depth to understand how selected biomechanical factors influence normal and pathologic human form and movement. Stresses validity and reliability of methods of evaluating musculoskeletal form and function.

PHTY 610. Physical Therapy Evaluation in the Direct Access Setting. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Covers critical physical therapy evaluation skills necessary for autonomous practice in the adult outpatient orthopaedic setting; recognition of the clinical manifestations of medical problems that may mimic mechanical neuromusculoskeletal seen by physical therapists and screening for medical referral. Through topic discussions, case presentations and self-paced tutorials, develops skills to screen for conditions that merit physician referral when practicing in the direct access setting. Eight lecture hours will be provided on site; the remainder of the course will be distance-based.

PHTY 611. Research Process. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Readings, discussions and reports on the current status of professional literature and validation of clinical practice, clinical administration and professional education. A model for professional development, the role of research in the validation process and the basis of research design are presented non-mathematically. Required of all advanced master of science degree students unless excused by the faculty.

PHTY 613. Evidence for Orthopaedic Practice. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PHTY 603. Evidence-based medicine course for orthopedic physical therapy. Through presentations, topic discussions and case presentations students will acquire evidence on selected topics of the evaluation and treatment of musculoskeletal dysfunctions in physical therapy practice. Promotes development of skills needed for the acquisition, reading and interpretation of published studies in the area of orthopaedic physical therapy. The entire course is distance-based.

PHTY 614. Evidence for Neurologic Practice. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PHTY 603. Evidence-based medicine course for neurologic physical therapy. Through Web-based presentations, topic discussions and case presentations, students will acquire evidence for selected topics related to the evaluation and treatment of neurologic dysfunctions in physical therapy practice. Promotes the development of skills in the acquisition, reading and interpretation of published studies in the area of neurologic physical therapy. The entire course is distance-based.

PHTY 615. Pharmacology (Physical Therapy). 1 Hour.

Semester course; 1 lecture hour. 1 credit. Restricted to students in the Professional Doctor of Physical Therapy program. Series of lectures on the integrated approach to the study of human disease and pharmacotherapeutics. Covers the pharmacological management of common disease states affecting physical function. Emphasizes the utilization of subjective and objective patient data for the assessment, monitoring and optimization of pharmacotherapy.

PHTY 616. Evidence of Tissue Healing and Therapeutic Modalities. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PHTY 603. Distance-based course that focuses on current trends and topics of tissue healing including the effects of physical therapy interventions on healing tissues using an evidence-based approach. Reviews histology and cytology concepts relevant to clinical practice or necessary for interpreting scientific literature on the topic.

PHTY 617. t-DPT Gross Anatomy. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Focuses on musculoskeletal anatomy with high clinical relevance for physical therapists. Incorporates introductory material on diagnostic imaging of the spine and extremities. Self-directed distance learning modules will be augmented with a series of on-campus cadaver dissection laboratories over a four-day visit to campus.

PHTY 621. Biophysical Agents. 4 Hours.

Semester course; 3 lecture and 2 laboratory hours. 4 credits. Examines the theoretical bases for and therapeutic application of thermal, mechanical and electrical agents. Emphasizes the physical and physiological effects, indications and contraindications for electrical current, diathermy, superficial heat and cold, massage, ultraviolet, traction, ultrasound, laser and compression therapy. Analyzes relative current scientific literature and uses laboratories for practice and clinical problem-solving.

PHTY 623. Cardiopulmonary Physical Therapy. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Applies principles of pathophysiology of the cardiovascular and respiratory systems; includes physical therapy assessment and treatment of patients with cardiac and respiratory disorders.

PHTY 624. Clinical Problem-solving I. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Restricted to students in the Professional Doctor of Physical Therapy program. Provides an advanced review of the concepts and principles of the research process and evidence-based practice. Focuses on skills needed to perform a critical appraisal of professional literature and to determine the relevance and applicability of research findings to a specific patient or series of patients based on information collected during the first summer clinical experience. Provides opportunity to develop oral patient case presentation skills.

PHTY 626. Lifespan I. 6 Hours.

Semester course; 9 lecture and laboratory hours. 6 credits. Restricted to students in the professional Doctor of Physical Therapy program. Covers models of typical motor, psychosocial, neurological and musculoskeletal development from birth through adolescence; models of neurologic dysfunction in developmental disabilities; principles of examination and evaluation in pediatrics; commonly seen diagnoses; and treatment planning for a pediatric population.

PHTY 627. Lifespan II. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Discusses age related changes in physical structure, motor control and psychosocial/cognitive issues in humans from middle adulthood to the end of life. Emphasizes the geriatric population and the physical therapy management of problems with the integumentary system. Highlights the role of the physical therapist in making program modifications based on age related changes.

PHTY 629. Special Topics in Physical Therapy. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Provides an opportunity to pursue and present a topic of interest that is related to physical therapy evaluation and treatment.

PHTY 640. Neurologic Physical Therapy. 6 Hours.

Semester course; 4 lecture and 4 laboratory hours. 6 credits. Applies principles of motor development, control and learning to the evaluation and remediation of motor disorders. Critically surveys current theory and practice of neuromotor therapeutics.

PHTY 644. Orthotics and Prosthetics. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prepares the student to participate as a member of the professional prosthetic or orthotic clinic team, integrates material from other courses, and teaches basic skills in orthotic and prosthetic assessment, prescription, and training and performing initial and final prosthetic and orthotic checkouts.

PHTY 646. Clinical Medicine. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Covers topics in clinical medicine and the sciences relevant to the practice of physical therapy. Medical practitioners from the VCU Medical Center and surrounding areas participate.

PHTY 648. Musculoskeletal Physical Therapy II. 6 Hours.

Semester course; 5 lecture, 2 laboratory and 24 clinical hours. 6 credits. Examines principles and techniques used by physical therapists for the treatment of patients with orthopaedic disorders. Uses scientific evidence and theoretical rationale in a problem-solving approach to develop treatment plans for patients with orthopaedic musculoskeletal disorders. Provides opportunities for students to gain hands-on experiences with patients in a clinical setting.

PHTY 650. Clinical Education II. 8 Hours.

Semester course; 320 clock hours. 8 credits. Restricted to students in the Professional Doctor of Physical Therapy program. Eight-week, full-time clinical experience designed to develop competency in physical therapy evaluation and treatment. Teaches the use of sound scientific rationale and problem solving skills in aspects of patient care. Promotes the development of an independent professional through synthesis and utilization of advanced academic theory in evaluation and treatment. Encourages the exploration of interest areas in a variety of practice settings.

PHTY 651. Professional Issues in Physical Therapy. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Restricted to students in the Professional Doctor of Physical Therapy program. Discusses professional issues facing the modern physical therapy practitioner, including ethical decision making, state and national current physical therapy issues, and legislative efforts. Provides opportunity for advancing skills in educational techniques, assertiveness skills, conflict resolution, as well as preparation for employment via resume and portfolio writing and interview skills.

PHTY 654. Clinical Problem-solving II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Restricted to students in the Professional Doctor of Physical Therapy program. Provides the opportunity to review, integrate and develop strategies using previously presented material and research to present an oral case study of a patient or patients from the clinical experience in the previous summer.

PHTY 660. Musculoskeletal Physical Therapy III. 1 Hour.

Semester course; .75 lecture and .5 laboratory hours. 1 credit.
Prerequisites: PHTY 508 and PHTY 648. Synthesizes information from the prerequisite classes through case study examples, hands-on practice and lecture on the incorporation of musculoskeletal evaluation and treatment. Emphasizes clinical reasoning in determining individualized physical therapy interventions based off of a comprehensive physical therapy evaluation. Focuses on case study examples of complicated patient presentations to help better prepare students to treat patients with multiple co-morbidities and impairments. Highlights commonly seen movement pattern dysfunctions throughout the course to help students to both identify and treat regional interdependent impairments related to the patient's primary complaint.

PHTY 661. Administration and Management in Physical Therapy. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Restricted to students in the Professional Doctor of Physical Therapy program. Provides students with a basic understanding of operational issues related to physical therapy practice in a variety of settings. Topics include leadership, operational and business success measures, reimbursement, quality assurance, performance improvement, utilization review, risk management, documentation and marketing. Skill sets include, at an introductory level, supervision, delegation, hiring practices, budget development and analysis, peer review, outcomes measurement, and ethical decision making.

PHTY 670. Clinical Integration of Physical Therapy Concepts. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students in the Doctor of Physical Therapy program. Uses a problem-based learning approach to challenge students to integrate knowledge and current literature to support clinical decisions related to patient case studies. Students will be asked to appraise examination findings to develop a PT evaluation, including diagnosis and prognosis, and design a treatment plan of care inclusive of implementation and progression. Students will facilitate group discussion related to the case scenarios to foster intraprofessional collaboration. As a capstone course, topics are selected annually to be comprehensive of the curriculum with a focus on increased medical complexity to advance student understanding for progression toward entry-level practitioner.

PHTY 674. Clinical Problem-solving III. 1 Hour.

Semester course; 1 lecture 1 credit. Restricted to students in the Professional Doctor of Physical Therapy program. Integrates material from D.P.T. courses with clinical research. Provides experience in writing individual case reports dealing in depth with the history, current status and problems in a given area of clinical specialization.

PHTY 676. Comprehensive Study of Physical Therapy Practice. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Reviews topics in practice patterns of neuromuscular, musculoskeletal, cardiovascular, integumentary and professionalism relative to physical therapy practice. Prepares students for the national physical therapy examination.

PHTY 680. Clinical Education III. 12 Hours.

Semester course; 480 clinical hours. 12 credits. Twelve-week full-time clinical experience designed to allow the student to develop entry-level competence in physical therapy evaluation and treatment techniques. Includes the use of sound scientific rationale and problem-solving skills in all aspects of patient care. Promotes the development of an independent professional through synthesis and utilization of advanced academic theory in evaluation and treatment. Graded P/F.

PHTY 690. Physical Therapy Graduate Seminar. 16 Hours.

Semester course; 1 credit. Provides opportunity to develop knowledge and skills in evaluating published scientific literature related to physical therapy, developing researchable questions and orally presenting the material in a professionally appropriate manner.

PHTY 691. Special Topics in Physical Therapy. 1-4 Hours.

1-4 credits. Guided independent study of specific topics not discussed in courses or discussed in less detail in courses. Student's desired topic of study must be identified and approved prior to enrollment.

PHTY 692. Clinical Specialty Seminar. 0.5-3 Hours.

Semester course; 0.5-3 credits. Individual reports dealing in depth with the history, current status and problems in a given area of clinical specialization.

PHTY 693. Clinical Specialty Practicum. 1-9 Hours.

60 clock hours per credit. 1-9 credits. Concentrated clinical experience under the guidance of an approved preceptor.

PHTY 695. Clinical Education IV. 12 Hours.

Semester course; 480 clinical hours. 12 credits. Twelve-week full-time clinical experience designed to allow the student to develop entry-level competence in physical therapy evaluation and treatment techniques. Includes the use of sound scientific rationale and problem-solving skills in all aspects of patient care. Promotes the development of an independent professional through synthesis and utilization of advanced academic theory in evaluation and treatment. Graded P/F.

PHTY 798. Research in Physical Therapy. 1-15 Hours.

1-15 credits. Research in preparation for the advanced master of science degree thesis or doctoral dissertation.

Rehabilitation and Movement Sciences (REMS)**REMS 540. Cardiovascular Pathophysiology and Pharmacology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: HPEX 375 and HPEX 440 or equivalents. Presents theoretical principles of electrocardiography and the effects of pharmacological intervention in the treatment of cardiovascular disease. Specific emphasis placed on myocardial ischemia, myocardial infarction and their treatment through exercise rehabilitation protocols. The impact of pharmacological agents on the ECG and on exercise are explored.

REMS 608. Advanced Musculoskeletal Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students registered in the REMS program or by permission of instructor. Examines the structure and function of tissues of the musculoskeletal system. Investigates mechanisms of healing of these tissues and explores the affects of various modalities, altered use and disease on the structure and function of musculoskeletal tissues.

REMS 611. Biomechanics of Human Motion. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Enrollment restricted to students registered in the REMS program or by permission of instructor. Applies knowledge and methods of mechanics in the study of the structure and function of the human body as applied to sport, physical activity and rehabilitation. Topics include kinematics, kinetics and methods of biomechanical analysis.

REMS 612. Advanced Biomechanics. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: REMS 611 or permission of instructor. Enrollment restricted to students registered in the REMS program or with permission of instructor. Applies advanced biomechanics techniques to the evaluation and quantification of human performance. Encourages scientific thought with practical applications.

REMS 660. Neuromuscular Performance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students registered in the REMS program or by permission of instructor. Examines the interrelationships between the musculoskeletal and neuromuscular systems. Includes examination of normal and abnormal biomechanics of the musculoskeletal system, biomechanical factors related to human performance, as well as acute and chronic adaptations of the neuromuscular system. Emphasizes how these principles can be applied to physical training in healthy and diseased populations and treatment and rehabilitation in the sports medicine setting.

REMS 665. Instrumentation in Motion Analysis. 3 Hours.

2 lecture and 2 laboratory hours. 3 credits. Designed for students in the interdisciplinary Ph.D. in Rehabilitation and Movement Science Program. Examines theories, principles, and applications of systems used to qualify and characterize movement.

REMS 690. Research Seminar in Rehabilitation and Movement Science. 0.5 Hours.

Seminar course; 0.5 credit. Seminar course designed for students in the interdisciplinary Ph.D. in Rehabilitation and Movement Science Program. Presentation and discussion of research reports and topics of interest. Advances skills in critical analysis and discussion leadership. Topics and research presentations vary from semester to semester and are coordinated by the instructor of record. May be repeated. Graded as pass/fail.

REMS 692. Independent Study. 1-3 Hours.

Semester course; 1-3 independent study hours. 1-3 credits. May be repeated for 6 credits. Determination of the amount of credit and permission of the instructor and division head must be procured prior to registration. Cannot be used in place of existing courses. An individual study of a specialized issue or problem in health or movement sciences. Crosslisted as: HEMS 692.

REMS 701. Advanced Exercise Physiology I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501 or other graduate-level mammalian physiology course or permission of instructor. Investigates the effect of acute and chronic exercise stimuli on human performance and select disease states. Topics to be addressed include exercise bioenergetics, metabolic responses to exercise, contributions to substrate selection and utilization during exercise, muscular performance and adaptations to exercise training, cardiovascular adaptation to exercise, aerobic and anaerobic training programs, and effects of training on fitness and performance.

REMS 702. Advanced Exercise Physiology II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PHIS 501 or other graduate-level mammalian physiology course or permission of instructor, and REMS 701. Investigates the effect of physiological stressors on human performance and health through lecture and article discussion. Topics to be addressed include exercise in the heat and cold, effects of altitude on physical performance, acute and chronic endocrine responses to exercise, role of adipokines in chronic disease conditions, the use of ergogenic aids in sport.

REMS 703. Cardiovascular Exercise Physiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. Investigates the structural, functional and cellular principles of human cardiovascular physiology as applied to health and human performance. Emphasis will be placed on the metabolic, contractile and hemodynamic adaptations to acute and chronic exercise training.

REMS 704. Psychobiology of Physical Activity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. "Psychobiology" is defined as the integrative study of behavior from the social, cognitive and biological levels of analysis. This course will include an examination of the research that encompasses psychophysiology, psychoneuroendocrinology, psychoneuroimmunology, neuroscience, physiological psychology and behavioral genetics applied to exercise.

REMS 705. Metabolic Aspects of Physical Activity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. This course is designed to explore the thermic effects of physical activity in apparently healthy individuals, as well as those with increased risk for cardiovascular, metabolic or other inflammatory diseases. Additionally, the relationship between physical activity and food intake, resting metabolic rate and dietary-induced thermogenesis will be reviewed. The examination of gastrointestinal function during dietary manipulation will also be assessed to address performance enhancement in several types of physical activities. This course will emphasize the metabolic control of ATP synthesis, which includes carbohydrate, lipid and protein metabolism and their interaction with one another in response to biological needs during rest and physical activity.

REMS 706. Development and Motor Control. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students admitted to the REMS program or by permission of instructor. Explores theories of developmental motor control and examines theoretical influences on development of infants and young children who are typically developing as well as those with developmental disabilities. Engages students in critical literature review relevant to motor development and rehabilitation and in the application of theory to practice and research design.

REMS 707. Programing for Rehabilitation Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: REMS 611 or equivalent. Enrollment is restricted to students in the rehabilitation and movement sciences program or with permission of the instructor. Develops proficiency in processing and analyses of kinematic, kinetic and electrophysiological data (e.g. EMG) typically associated with biomechanical labs. Focuses on coding in common packages to achieve the goals of reading in data from various sources, construction of multidimensional arrays, filtering, data visualization and extraction. Upon completion of this course, students will be able to independently import time series data, process and extract variables of interest, and write the output variables of interest to a format suitable for statistical analyses packages (e.g., SPSS, SAS, R).

REMS 710. Research Techniques in Rehabilitation and Movement Science. 1-3 Hours.

50 hours of laboratory times per credit hour. 1-3 credits. Prerequisite: Permission of instructor required. Examines and explores laboratory techniques used in rehabilitation and movement science research. Provides opportunity to begin transitioning clinical problems to research questions. Opportunities in laboratories of the rehabilitation and movement science program or other laboratories approved by the adviser or program directors. Focuses on individual student learning needs. Graded as pass/fail.

REMS 793. Teaching Practicum in Higher Education. 1 Hour.

50 hours of contact/preparation time for each credit. 1 credit. Practicum designed for students in the interdisciplinary Ph.D. in Rehabilitation and Movement Science degree program. Develops skills necessary for classroom teaching including preparing and presenting selected topic (s), writing test questions, and grading examinations. May be repeated for additional teaching experience. Graded as pass/fail.

REMS 794. Research Presentation Seminar. 1 Hour.

1 lecture hour. 1 credit. Seminar course designed for students in the interdisciplinary Ph.D. in Rehabilitation and Movement Science Program. Develops presentation skills. Requires preparation and presentation of research at a public research forum scheduled by the instructor of record. Students are expected to submit their research for presentation at a selected regional, national or international conference in a related field. Graded as pass/fail.

REMS 798. Research in Rehabilitation and Movement Science. 1-12 Hours.

Semester course; 1-12 credits. Research leading to the Ph.D. degree and elective research projects for students in the Rehabilitation and Movement Science doctoral program. May be repeated. Graded as "S," "U" or "F".

Rehabilitation Counseling (RHAB)**RHAB 502. American Sign Language I. 3 Hours.**

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Introduces the rules and grammatical structure of ASL with a focus on grammar and vocabulary to increase the learner's expressive and receptive understanding of the language. Provides an introduction to Deaf culture and cross-cultural interactions, as well as to tactile and close-vision communication techniques used by individuals who are deaf-blind.

RHAB 503. American Sign Language II. 3 Hours.

Semester course; 3 credits. Provides continued study of the grammatical structure of ASL; introduction of additional vocabulary with emphasis on expressive and receptive competence; continued study of the tactile and close-vision communication techniques used by individuals who are deaf-blind; and continued study of the Deaf culture.

RHAB 521. Addiction Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides a biopsychosocial overview of addiction and addictive disorders. Reviews contemporary theories of addiction, pharmacological classification of psychoactive substances and contemporary approaches toward assessment, diagnosis, treatment and community support. Reviews cultural, legal and historical factors regarding substance use and addictive processes.

RHAB 522. Clinical Evaluation, Assessment and Treatment Planning in Substance Abuse Rehabilitation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: RHAB 521. Stresses development of professional competencies. Focuses on systematic approach to screening and on-going assessment; diagnostic criteria for dependence and abuse; testing and interviewing; co-morbidity; collaborative approaches to individualized clinical treatment planning; awareness of treatment resources.

RHAB 523. Contemporary Issues in Substance Abuse Treatment and Recovery. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: RHAB 521. Examines current issues and research in the field. Includes topics such as denial, social isolation, intervention; lifelong nature of recovery, support needs, relapse prevention; legal, political and ethical issues; special populations (e.g., physical disability); poly-drug abuse; perinatal addiction; program administration; professional readiness.

RHAB 525. Introduction to Rehabilitation Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of history, philosophy, legislation, organizational structure and trends in the rehabilitation profession. Focuses on attitudinal, social and environmental barriers to the inclusion of people with disabilities; professional identity, roles and functions; CRC Code of Ethics; CRC Standards of Practice; and career options.

RHAB 526. Introduction to Mental Health Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of history, philosophy, legislation, organizational structure and trends in mental health counseling. Focuses on advocacy; professional identity, roles and functions; ethics; counseling certification and licensure; and career options.

RHAB 533. Directed Readings in Rehabilitation. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for a maximum of 6 credits. Provides intensive study in one or more topical areas of rehabilitation through directed readings under the supervision of a faculty member.

RHAB 611. Theories of Professional Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides a deep understanding of the major theoretical approaches, models and strategies to effective counseling, consultation, prevention, advocacy and wellness programs with an emphasis on common factors and evidence-based effectiveness. The intent is to assist students in developing an ethical and culturally relevant yet personal model of counseling.

RHAB 612. Group Counseling Theories and Techniques. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Reviews theoretical foundations of group work, group dynamics and processes, group therapeutic factors, and characteristics and functions of effective group leaders. Reviews ethical and culturally relevant strategies for designing, implementing and facilitating a variety of group approaches. Provides experience in group participation and development of group leadership skills.

RHAB 613. Advanced Rehabilitation Counseling Seminar. 3-9 Hours.

3-9 lecture hours. 3-9 credits. Prerequisites: RHAB 611 and RHAB 612 or permission of instructor. This course is designed to provide an opportunity for students to undertake a more in-depth study of selected approaches to individual and/or group counseling of rehabilitation clients. Principles and techniques relevant to vocational, educational, and personal adjustment problems related to severe and multiple disabilities will be systematically explored and studied. Audio visual tape experience will be offered.

RHAB 614. Counseling, Death and Loss. 3 Hours.

3 lecture hours. 3 credits. Prerequisite: RHAB 611 or permission of instructor. Explores the psychosocial processes of adaptation to severe losses such as those occasioned by the onset of disability, death and developmental life changes. Emphasizes the knowledge and skills required by rehabilitation counselors in dealing with losses experienced by their clients.

RHAB 615. Human Growth and Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the major themes of research on human development over the lifespan – from conception through adulthood. Focuses on the physical, emotional, social and cognitive aspects across the lifespan. Emphasizes how developmental processes relate to persons with disabilities and impact the work of rehabilitation and other helping professions.

RHAB 616. Couples and Family Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of approaches to couples and family counseling. Instruction in the theoretical foundation and interventions in couples and family therapy will be examined.

RHAB 623. Career Counseling and Job Placement. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of major theories of career development with emphasis on theories relevant to rehabilitation practice. Explores occupational information and job matching systems, career counseling techniques, and major job placement approaches and techniques, with emphasis on demand-side job placement.

RHAB 624. Assessment and Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines principles of measurement, assessment and diagnosis in rehabilitation and mental health counseling; test selection, administration and interpretation; accommodating individuals with disabilities in the testing process. Includes an overview of the major domains in assessment.

RHAB 625. Research and Program Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines basic principles rehabilitation research and program evaluation, including an emphasis on the critical review of published research for use in rehabilitation and mental health counseling practice. Focuses on students' understanding of the application of research and program evaluation tools to enhance the quality of rehabilitation services delivered.

RHAB 633. Case Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores history, theory, practice and ethics of case management as well as the full range of community resources as these contribute to successful outcomes. Reviews and critically analyzes benefit systems, treatment and life care planning, coordination and delivery of services, disability management, documentation, and case studies.

RHAB 640. Medical and Psychosocial Aspects of Disabilities. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of the major disabilities encountered by rehabilitation and mental health counselors. Focuses on functional limitations and the process of psychological adjustment.

RHAB 642. Diagnosis and Treatment of Mental Health Disorders. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the major mental disorders and their etiology, prevalence, diagnosis and impact on individuals and society. Reviews the prevailing multi-axial classification systems and diagnostic processes, procedures and nomenclatures currently used in clinical practice. Provides an overview of rehabilitation and mental health treatment planning and interventions using a biopsychosocial framework.

RHAB 644. Alcohol and Human Behavior. 3 Hours.

3 credits. Prerequisites: RHAB 521, RHAB 522, RHAB 523 and RHAB 695, or permission of instructor. Understanding the significance of behavior as a tool in diagnosing, treating and/or referring the addict; appreciation of particular cues to observe the predominant behavior associated with living problems and reflected by the alcohol or drug abuser.

RHAB 654. Multicultural Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of multicultural counseling theories and techniques. Provides an understanding of how human development, family, gender, race and ethnicity impact upon the process of adjustment to disability.

RHAB 681. Institutes and Workshops in Rehabilitation. 1-3 Hours.

Orientation institutes and other short-term training programs are offered for rehabilitation counselors newly recruited to the rehabilitation field and for the further professional development of those already employed. Content will vary according to the aims of the institutes or workshops. Length of time and number of credits are announced prior to each institute or workshop.

RHAB 682. Institutes and Workshops in Rehabilitation. 1-3 Hours.

Orientation institutes and other short-term training programs are offered for rehabilitation counselors newly recruited to the rehabilitation field and for the further professional development of those already employed. Content will vary according to the aims of the institutes or workshops. Length of time and number of credits are announced prior to each institute or workshop.

RHAB 683. Institutes and Workshops in Rehabilitation. 1-3 Hours.

Orientation institutes and other short-term training programs are offered for rehabilitation counselors newly recruited to the rehabilitation field and for the further professional development of those already employed. Content will vary according to the aims of the institutes or workshops. Length of time and number of credits are announced prior to each institute or workshop.

RHAB 684. Institutes and Workshops in Rehabilitation. 1-3 Hours.

Orientation institutes and other short-term training programs are offered for rehabilitation counselors newly recruited to the rehabilitation field and for the further professional development of those already employed. Content will vary according to the aims of the institutes or workshops. Length of time and number of credits are announced prior to each institute or workshop.

RHAB 685. Institutes and Workshops in Rehabilitation. 1-3 Hours.

Orientation institutes and other short-term training programs are offered for rehabilitation counselors newly recruited to the rehabilitation field and for the further professional development of those already employed. Content will vary according to the aims of the institutes or workshops. Length of time and number of credits are announced prior to each institute or workshop.

RHAB 686. Institutes and Workshops in Rehabilitation. 1-3 Hours.

Orientation institutes and other short-term training programs are offered for rehabilitation counselors newly recruited to the rehabilitation field and for the further professional development of those already employed. Content will vary according to the aims of the institutes or workshops. Length of time and number of credits are announced prior to each institute or workshop.

RHAB 687. Institutes and Workshops in Rehabilitation. 1-3 Hours.

Orientation institutes and other short-term training programs are offered for rehabilitation counselors newly recruited to the rehabilitation field and for the further professional development of those already employed. Content will vary according to the aims of the institutes or workshops. Length of time and number of credits are announced prior to each institute or workshop.

RHAB 688. Institutes and Workshops in Rehabilitation. 1-3 Hours.

Orientation institutes and other short-term training programs are offered for rehabilitation counselors newly recruited to the rehabilitation field and for the further professional development of those already employed. Content will vary according to the aims of the institutes or workshops. Length of time and number of credits are announced prior to each institute or workshop.

RHAB 689. Institutes and Workshops in Rehabilitation. 1-3 Hours.

Orientation institutes and other short-term training programs are offered for rehabilitation counselors newly recruited to the rehabilitation field and for the further professional development of those already employed. Content will vary according to the aims of the institutes or workshops. Length of time and number of credits are announced prior to each institute or workshop.

RHAB 691. Counseling Techniques. 3 Hours.

Semester course. 3 credits. Provides experience and practice in the basic counseling skills related to the helping process. Examines the variety of clinical settings available for professional preparation. Provides the necessary level of skill development for students to participate in internship.

RHAB 692. Advanced Professional Issues in Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: RHAB 691. Provides an advanced overview of professional identity, roles and functions; counseling practice issues; supervision; and specialized counseling techniques in rehabilitation and mental health counseling. Includes 100 hours of supervised rehabilitation and mental health counseling practicum.

RHAB 693. Supervised Clinical Practice in Rehabilitation Counseling. 3-9 Hours.

Semester course; 3-9 clinic/field experience hours (3 credits per 200 hours of supervised internship). 3-9 credits. May be repeated in increments of three credits; must have nine credits toward degree completion. Prerequisite: RHAB 692. Enrollment is restricted to students who have completed 30 graduate credits. Emphasizes mastery of setting-specific roles and functions of the professional clinical rehabilitation counselor. Stresses ethical decision-making in practice. Involves scheduled seminars, supervision and meetings with faculty and agency supervisor.

RHAB 694. Job Placement in Rehabilitation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores occupational information, job matching systems and job placement approaches. Focuses on demand-side job development, job seeking skills training, supported employment, transitional work and placement techniques including job analyses, ADA implementation and labor market surveys.

RHAB 695. Supervised Clinical Practice in Mental Health Counseling. 3-9 Hours.

Semester course; 3-9 clinic/field experience hours (3 credits per 200 hours of supervised internship). 3-9 credits. May be repeated in increments of three credits; must have nine credits toward degree completion. Prerequisite: RHAB 692. Enrollment is restricted to students who have completed 30 graduate credits. Emphasizes mastery of setting-specific roles and functions of the professional clinical mental health counselor. Stresses ethical decision-making in practice. Involves scheduled seminars, supervision and meetings with faculty and agency supervisor.

RHAB 696. Supervised Clinical Practice in Rehabilitation and Mental Health. 3-9 Hours.

Semester course; 3-9 clinic/field experience hours. 3-9 credits (3 credits per 200 hours of supervised internship). May be repeated in increments of three credits; must have nine credits toward degree completion. Prerequisite: RHAB 692. Enrollment is restricted to students who have completed 30 graduate credits. Emphasizes mastery of setting-specific roles and functions of the professional rehabilitation and mental health counselor. Stresses ethical decision-making in practice. Involves scheduled seminars and meetings with faculty and agency supervisor.

RHAB 697. Supervised Clinical Practice in Counseling. 1-6 Hours.

Semester course; 1-6 credits. (1 credit per 100 hours of supervised internship.) May be repeated to a maximum of 9 credits. Prerequisite: Admission into advanced certificate in professional counseling program. Emphasizes advanced development of counseling skills pursuant to licensure or other post-master's training needs. Stresses ethical decision making in practice. Involves scheduled seminars and meetings with faculty and agency supervisor.

College of Humanities and Sciences

Anthropology (ANTH)

ANTH 551. Anthropology for the Museologist. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A discussion and investigation of contemporary anthropological themes and questions and identification of how they can be depicted with museum materials. Students are expected to develop a research design for an exhibit.

ANTH 556. Historical and Cultural Landscapes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open only to seniors who have completed ANTH 302 or 303 and graduate students with permission of instructor. Students will study historical and contemporary landscapes as the products of the producers of human culture, with particular attention to riverine landscapes. Focus will be on the ways in which humans shape and respond to their ecosystems. Students will participate in an active field research program, including the archaeological recovery and analysis of historical landscapes. Crosslisted as: ENV5 556.

Biology (BIOL)

BIOL 502. Microbial Biotechnology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MICR/ BIOC 503 or BIOC 530, 531, 532 and 533 or equivalent, and MICR/ BIOC 504 or equivalent. Open to qualified seniors and graduate students only. Discussion of the application of basic principles to the solution of commercial problems. The course will cover the historical principles in biotransformations as related to primary and secondary metabolism, as well as recombinant DNA technology and monoclonal antibodies and products resulting from the application of recombinant DNA technology.

BIOL 503. Fish Biology. 4 Hours.

Semester course; 3 lecture and 3 laboratory hours. 4 credits. Prerequisite: BIOL 317 or equivalent. Open to qualified seniors and graduate students only. Classification, behavior, physiology and ecology of fishes. Laboratories will emphasize field collection of fish and identification of specimens.

BIOL 507. Aquatic Microbiology. 4 Hours.

Semester course; 2 lecture and 4 laboratory hours. 4 credits. Prerequisites: BIOL 303 and 307 or equivalents. Open to qualified seniors and graduate students only. This course will involve a practical approach to the methods used to culture, identify and enumerate specific microorganisms that affect the cycling of elements in aquatic systems and those that affect or indicate water quality.

BIOL 508. Barrier Island Ecology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 317 or equivalent, or permission of instructor. A study of the physical factors affecting the formation of barrier islands, adaptations of plants and animals for colonization and persistence in these harsh environments, and how coastal ecological processes conform to general ecological theory. Examples and problems pertaining to Virginia and the southeastern United States are emphasized.

BIOL 509. Microbial Ecology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 317 or equivalent with a grade of C or better. Open only to qualified seniors and graduate students. Explores the interactions of microorganisms and their environment, including discussion of microbial diversity, nutrient cycling, symbiosis and selected aspects of applied microbiology.

BIOL 510. Conservation Biology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open to qualified seniors and graduate students only. Explores the accelerated loss of species due to increasing human population pressure and the biological, social and legal processes involved in conserving biodiversity.

BIOL 511. Coastal Ecology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 317. Enrollment is restricted to seniors and graduate students who have passed the VCU prerequisite or an equivalent general ecology course at another university. This course will provide students with an introduction to the topics of coastal ecosystems, drivers shaping these systems and the organisms that live in these environments. As 80 percent of the world's population (and 50 percent of Americans) lives within 50 miles of the coastline and humans use coastal areas extensively, understanding the natural roles and services provided by coastal ecosystems and their constituent organisms is fundamental for addressing management, conservation and response to climate change.

BIOL 512. Plant Diversity and Evolution. 4 Hours.

Semester course; 3 lecture and 4 laboratory hours. 4 credits. Prerequisites: BIOL 300 and 310 or equivalents, or permission of instructor. Taxonomy, diversity and evolutionary history of vascular plants (including ferns, gymnosperms and flowering plants). Lecture emphasis on evolutionary relationships; laboratory emphasis on plant recognition and identification, especially of the Virginia flora, including some field trips to areas of local botanical interest.

BIOL 514. Stream Ecology. 4 Hours.

Semester course; 3 lecture and 3 laboratory hours. 4 credits. Prerequisite: BIOL 317. Open to qualified seniors and graduate students only. A study of the ecology of streams and rivers. Laboratory emphasis is on the structure and functioning of aquatic communities in mountain to coastal streams.

BIOL 516. Population Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT/BIOS 543. Theoretical and empirical analyses of how demographic and evolutionary processes influence neutral and adaptive genetic variation within populations.

BIOL 518. Plant Ecology. 4 Hours.

Semester course; 3 lecture and 2 laboratory hours. One three-day field trip is required. 4 credits. Prerequisite: BIOL 317. Open to qualified seniors and graduate students only. A lecture, field and laboratory course concerned with the development, succession and dynamics of plant communities and their interrelations with climate, soil, biotic and historic factors.

BIOL 519. Forest Ecology. 4 Hours.

Semester course; 3 lecture and 3 laboratory hours. 4 credits. Prerequisite: BIOL 317 or equivalent. Enrollment restricted to graduate students and upper-level undergraduates. Covers advanced topics in forest ecology, with a particular emphasis on Virginia's diverse forest ecosystems. Students gain an understanding of the principal controls on forest structure, growth and distribution and apply these principles to the development and execution of a graduate-level field research project.

BIOL 520. Population Ecology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 310 and BIOL 317 or permission of instructor. Open to qualified seniors and graduate students only. Theoretical and empirical analysis of processes that occur within natural populations, including population genetics, population growth and fluctuation, demography, evolution of life history strategies and interspecific interactions. Quantitative models will be used extensively to explore ecological concepts.

BIOL 521. Community Ecology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 317 or equivalent. Open to qualified seniors and graduate students only. Theoretical and empirical analysis of the structure and function of natural communities, ecosystems and landscapes.

BIOL 522. Evolution and Speciation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 310 or equivalent. Open to qualified seniors and graduate students only. Evolutionary principles, with emphasis on genetic and environmental factors leading to changes in large and small populations of plants and animals, and the mechanisms responsible for speciation.

BIOL 524. Endocrinology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 300 and CHEM 301-302 and CHEZ 301L, 302L or equivalent. Open to qualified seniors and graduate students only. Hormonal control systems at the organ, tissue and cellular level. Although the major emphasis will be on vertebrate endocrine systems, some discussion of invertebrate and plant control systems will be covered.

BIOL 530. Introduction to Human Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to qualified seniors and graduate students. Basic knowledge of genetics is recommended. Provides a comprehensive examination of the fundamentals of human genetics. Explores topics including Mendelian and non-Mendelian inheritance, pedigree analysis, cytogenetics, aneuploid syndromes, cancer, gene structure and function, epigenetics, gene expression, biochemical genetics, and inborn errors of metabolism.

BIOL 535. Wetlands Ecology. 4 Hours.

Semester course; 3 lecture and 3 laboratory hours. 4 credits. Prerequisite: BIOL 317 or equivalent or permission of instructor. A study of the ecology of freshwater and coastal wetlands, including the physical and biological aspects of these systems, wetland functions at local, landscape and global scales, and wetland regulations and restoration. Students will acquire skills with analytical techniques used in laboratory settings and in field-based applications for purposes of identifying and delineating wetland ecosystems.

BIOL 540. Fundamentals of Molecular Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 310 or consent of instructor. The basic principles and methodologies of molecular biology and genetics are applied to genome organization, replication, expression, regulation, mutation and reorganization. Emphasis will be placed on a broad introduction to and integration of important topics in prokaryotic and eukaryotic systems. Crosslisted as: BNFO 540.

BIOL 541. Laboratory in Molecular Genetics. 2 Hours.

Semester course; 1 lecture and 4 laboratory hours. 2 credits. Pre- or corequisite: BIOL 540 or equivalent. Experiments are designed to apply advanced techniques and concepts of molecular biology and genetics using prokaryotic and eukaryotic systems. Emphasis will be placed on experimental design, integrating results throughout the semester, making use of relevant published literature, scientific writing and providing hands-on experience with advanced equipment and methodologies. Crosslisted as: BNFO 541.

BIOL 545. Biological Complexity. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: physics and calculus, or permission of instructor. Open only to graduate students and qualified seniors. An introduction to the basis of complexity theory and the principles of emergent properties within the context of integrative life sciences. The dynamic interactions among biological, physical and social components of systems are emphasized, ranging from the molecular to ecosystem level. Modeling and simulation methods for investigating biological complexity are illustrated. Crosslisted as: LFSC 510.

BIOL 548. Bioinformatic Technologies. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: BIOL 545/LFSC 510 or permission of instructor. Introduction to the hardware and software used in computational biology, proteomics, genomics, ecoinformatics and other areas of data analysis in the life sciences. The course also will introduce students to data mining, the use of databases, meta-data analysis and techniques to access information. Crosslisted as: LFSC 520.

BIOL 550. Ecological Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open to qualified seniors and graduate students only. Introduces the principles of ecological genetics, especially those with foundations in population and quantitative genetics, and illustrates conceptual difficulties encountered by resource stewards who wish to apply genetic principles. Explores various types of biological technologies employed by conservation geneticists and provides means for students to gain experience in analyzing and interpreting ecological genetic data.

BIOL 560. Conservation Medicine. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces students to key elements of wildlife diseases, zoonoses, emerging infectious diseases associated with wildlife and humans, and both the conservation and health impacts of these topics. Included are discussions of the interactions among environmental quality and wildlife and human diseases and health. Topics include diseases of fish, amphibians, reptiles, birds and mammals, the effects of environmental contaminants and climate on those diseases, and their interaction with human health.

BIOL 565. Advances in Cell Signaling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 300 or equivalent. Topical course focusing on advances in cellular communication by cytokines, hormones and neurotransmitters. Each semester, the course focuses on a different topic. Past topics have included cancer biology, allergy and asthma, and autoimmunity.

BIOL 580. Eukaryotic Biotechnology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 300 and BIOL 310, both with a minimum grade of C, or graduate standing in biology or a related field. Enrollment is restricted to graduate students and senior undergraduates. Discussion of principles, concepts, techniques, applications and current advances in cellular and molecular biology aspects of biotechnology for animal and plant cells. The course will cover molecular construction of foreign genes; DNA cloning; technologies for DNA, RNA and protein analyses; nonvector and vector-mediated genetic transformation; gene regulation in transgenic cells; cell and tissue culture; cell fusion; and agricultural, medical and other industrial applications.

BIOL 591. Special Topics in Biology. 1-4 Hours.

Semester course; 1-4 credits. An in-depth study of a selected topic in biology. See the Schedule of Classes for specific topics to be offered each semester and prerequisites. If several topics are offered, students may elect to take more than one.

BIOL 601. Integrated Bioinformatics. 4 Hours.

Semester course; 3 lecture and 3 laboratory hours. 4 credits. Enrollment requires permission of instructor. Presents major concepts in bioinformatics through a series of real-life problems to be solved by students. Problems addressed will include but not be limited to issues in genomic analysis, statistical analysis and modeling of complex biological phenomena. Emphasis will be placed on attaining a deep understanding of a few widely used tools of bioinformatics. Crosslisted as: BNFO 601.

BIOL 602. Professional and Career Development in Biology. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students with graduate standing. This course will equip students early in their graduate experience with the knowledge, resources and skills to rapidly and successfully complete the requirements for an M.S. in Biology while enhancing their communication and planning skills in several critical formats and areas, as well as exploring alternative career paths based on their personal goals and values.

BIOL 603. Fundamentals of Scientific Leadership. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing. The purpose of this course is to prepare students to successfully work as members and leaders of diverse scientific teams during their graduate studies and in multiple scientific career paths. Students will be familiarized and gain experience with key concepts of teams and leading teams, including values-based missions and goals, effective communication and feedback, stages of team development and leadership, diversity and inclusivity, mentoring and coaching, resolving conflict, project management, leading change, leaving a legacy, and assessment.

BIOL 604. Research Integrity. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students with graduate standing. This course is designed to provide a discussion-based approach to research integrity. By the end of the course students will be acutely aware of how science interacts with and informs society. They will have digested an array of topical issues relating to responsible conduct of research and be able to clearly articulate ethical and legal solutions to problems posed. This course addresses issues across a broad biosciences background including laboratory and field studies. This course targets master's- and entry-level Ph.D. students. Graded as pass/fail.

BIOL 605. Diversity and Inclusion in Science. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students with graduate standing. This course will familiarize and engage students with multiple forms of diversity in science through presentations, diverse guest speakers, class discussions and student assignments, preparing them to recognize and leverage this diversity by employing inclusiveness throughout their scientific careers and lives.

BIOL 606. Quantitative Ecology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Principles and applications of mathematical ecology at the community level, including experimental design; sampling techniques, assumptions and limitations; and the use of cluster analysis, gradient analysis and ordination to evaluate, summarize and compare large data sets.

BIOL 607. Science Communication: Fundamentals. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students with graduate standing. The goal of this course is to provide training in science communication to diverse audiences from scientific and nonscientific backgrounds and across diverse career paths. The course covers fundamental rules of writing, the writing process, technical writing, visual presentation, oral presentation, engaging audiences and communication with the public. Students will attain science communication skills through writing exercises, videotaped oral exercises and peer review to prepare them for graduate school and beyond.

BIOL 608. Science Communication: Research Proposals. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students with graduate standing. The goal of this course is to provide training in writing competitive research proposals. Students will learn the necessary skills for the proposal-writing stage of scientific research preparatory stage, including reference managers, annotated bibliographies, selling the idea, mock review panels, short-form proposals, long-form proposals and thesis/dissertation proposals. Students will learn proposal-writing skills that will provide an edge in applications for a diversity of funding sources.

BIOL 609. Scientific Communication: Public Discourse. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: BIOL 607. Enrollment is restricted to students with graduate standing. The mission of this course is to train students nearing completion of a thesis/dissertation to apply skills they learned in the prerequisite course to effectively communicate their own thesis/dissertation research, and its relevance to global issues in biology, to nonscientific audiences. Students successfully completing this course will be able to effectively communicate the science and relevance of their own research in verbal and written formats with non-scientists in the lay public, government and nongovernment institutions and the media. Graded as satisfactory/unsatisfactory.

BIOL 610. Conservation Applications. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the implementation of conservation techniques including monitoring, planning, education, habitat management and combining conservation with human development strategies. Focuses on how to make conservation work where biodiversity and human livelihoods must be reconciled. Students will utilize a number of computer programs to analyze and interpret management strategies.

BIOL 618. Ecosystems Ecology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 317 or equivalent or permission by instructor. Introduction to the structure and functioning of aquatic and terrestrial ecosystems. The course complements other offerings in the graduate program by considering ecological processes at higher orders of organization and in the context of abiotic factors. Students will gain discipline-specific knowledge through lectures and readings while building quantitative and critical thinking.

BIOL 620. Biogeochemistry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to graduate students. This course will examine the biogeochemical cycles of carbon, nitrogen, phosphorus, sulfur and iron on Earth from both a historical perspective and in the context of global environmental change, considering the cycles individually while also acknowledging that there are significant interactions between these cycles. Examples of biogeochemical processes will be drawn from multiple ecosystems, ranging from terrestrial soils to the deep ocean.

BIOL 626. Physiological Ecology. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Prerequisite: BIOL 317 or equivalent. This course examines the physiological adjustments and adaptations made by organisms in response to their environment.

BIOL 630. Patterns of Mammalian Reproduction. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A comprehensive ecological and evolutionary study of specializations and adaptive radiation in mammalian reproductive anatomy, the reproductive cycle, seasonality of reproduction and factors affecting litter size and developmental state of neonates. Human reproductive biology is included when pertinent.

BIOL 631. Biology Integration: From Molecules to Organisms. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students with graduate standing that have completed at least a minor in biology or equivalent. This course will expose students to the recent advances in the biology subdisciplines that span from molecules to organisms, by examining how molecular and cellular processes scale and culminate to affect organisms. Students will focus on understanding experimental approaches and practical applications critical to evaluate research in molecular, cellular, developmental and organismal biology. The course is the first of two courses with the goal of equipping the students with the conceptual framework that will allow them to make sense and integrate the broad biological information they will be exposed to during their careers. The overall approach reflects the broad multidisciplinary, multi-scale reality of modern/contemporary biological sciences and will help students identify themes, patterns and processes that transcend the scales of biological organization from molecules to organisms.

BIOL 632. Biology Integration: From Organisms to Landscapes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 631. Enrollment is restricted to students with graduate standing that have completed at least a minor in biology or equivalent. This course will expose students to the recent advances in the biology subdisciplines that span from organisms to landscapes by examining how the spatial patterns of organisms, populations, communities and landscapes impact ecological processes. Students will focus on understanding experimental approaches and practical applications critical to evaluate research in evolutionary biology and the ecology subdisciplines. The course will also highlight the impact of human activities on the global environment. The course is the second of two courses with the goal of equipping the students with the conceptual framework that will allow them to make sense and integrate the broad biological information they will be exposed to during their careers. The overall approach reflects the broad multi-disciplinary, multi-scale reality of modern/contemporary biological sciences and will help students identify themes, patterns, and processes that transcend scales of biological organization from organisms to landscapes.

BIOL 640. Evolution and Molecular Markers. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Methodologies and applications of molecular biology as they pertain to the study of evolution, with a focus on systematics, speciation and biogeography. The course provides proficiency in the understanding, interpretation and choice of appropriate molecular markers for evolutionary research, with particular attention to current methods and recent literature. Designed to benefit students of both natural history (ecologists, systematics, evolutionary biologists) and molecular biology.

BIOL 650. Conservation Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the application of molecular genetics to biodiversity conservation. Essential topics include molecular measures of genetic diversity, estimating loss of genetic diversity in small populations, detecting inbreeding, resolution of taxonomic uncertainties, genetic management of T&E species, captive breeding and reintroduction. Students will utilize a number of computer programs to analyze and interpret molecular genetic data.

BIOL 654. Environmental Remote Sensing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 602, or permission of the instructor. This course provides a basic and applied understanding on the use of digital remote sensor data to detect, identify and characterize earth resources. Students are required to demonstrate an understanding of the spectral attributes of soils, vegetation and water resources through various labs involving both image- and non-image-based optical spectral data. Crosslisted as: ENVS 654/URSP 654.

BIOL 660. Developmental Biology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: biochemistry or cell biology or their equivalent. Molecular and cellular principles of developmental biology in model systems, including flies, worms, fish and mammals. Understanding of morphogen gradients, transcription, cell movements and signaling in development. Advanced methods are taught enabling students to interpret and present findings from the primary literature.

BIOL 676. Plant and Animal Cell Biology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: biochemistry or cell biology or permission of instructor. Molecular and cellular principles of cell behavior and function in plant and animal cells. Topics include intracellular transport, cell cycle control, signaling and cell motility. Advanced methods are taught enabling students to interpret and present findings from the primary literature in this field.

BIOL 690. Biology Seminar. 1 Hour.

Semester course; 1 credit. May be repeated for credit. Presentations by faculty and visiting lecturers, and discussions of research and developments in biology and related fields. Graded as S/U/F.

BIOL 691. Special Topics in Biology. 1-4 Hours.

Semester course; variable hours. 1-4 credits. An advanced study of a selected topic in biology. See the Schedule of Classes for specific topics to be offered each semester and prerequisites. If several topics are offered, students may elect to take more than one.

BIOL 692. Independent Study. 1-4 Hours.

Semester course; hours to be arranged. Credits to be arranged. Determination of the amount of credit and permission of instructor, adviser and department chair must be obtained prior to registration for this course. A course designed to provide an opportunity for independent research in any area of biology outside the graduate student thesis area.

BIOL 693. Current Topics in Biology. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for credit. Designed to develop skills in preparing and delivering oral presentations in conjunction with an in-depth study of a current topic in biology. Students present talks and lead discussions on the selected topic.

BIOL 698. Thesis. 1-16 Hours.

Semester course; hours to be arranged. Credits to be arranged. Independent research by students in areas of systematics, environmental, developmental, behavioral, cellular and molecular biology, and comparative physiology.

Chemical Biology (CHEB)

CHEB 601. Chemical Biology I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of the structure and function of biological macromolecules from a chemical biology perspective. The course will be divided into three sections – nucleic acids, proteins and carbohydrates. Each section will initially focus on the thermodynamic properties of these macromolecules including the energetics of folding, thermodynamics of interactions and, for catalytic molecules, the kinetics of catalysis. Citing literature examples, the class will then focus on how small molecules have been used to uncover these properties.

CHEB 602. Chemical Biology II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on four broad areas of chemical biology: drug discovery (combinatorial chemistry, high throughput screening), natural product synthesis (combinatorial biochemistry), signal transduction (chemical genetics, pathway engineering) and protein translation (Phage display, in vitro translation/sections). Each area will begin with a brief overview followed by several examples based on the current literature.

CHEB 690. Research Seminars in Chemical Biology. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for credit. Seminars presented by students, staff and visiting lecturers where current problems and developments in chemical biology are discussed. Graded as P/R.

CHEB 697. Chemical Biology Research Rotations. 1,2 Hour.

A research rotation laboratory course that gives students different experiences and allows them to choose a research supervisor. Students will learn the theory and practice of advanced chemical biology research methods in a research lab setting. Students will be mentored by a postgraduate student, postdoctoral fellow or technician. At the end of each rotation, the students will give a presentation on the laboratory work done at that time. The lab hours are a minimum of three hours per week to achieve significant experience, but it is expected that students will put in appropriate time to achieve meaningful results in the laboratory setting. Graded as S/U/F.

Chemistry (CHEM)**CHEM 504. Advanced Organic Chemistry I. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. An integrated study of certain free radical and ionic reaction mechanisms with emphasis on electronic effects and stereochemical consequences of these reactions.

CHEM 506. Introduction to Spectroscopic Methods in Organic Chemistry. 1.5 Hour.

Half-semester course; 3 lecture hours. 1.5 credits. Introduction to mass spectrometry, infrared and ¹H and ¹³C NMR spectroscopy, theory and practice in the elucidation of organic structures.

CHEM 507. Introduction to Natural Products. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of the biosynthetic origins, isolation, structure elucidation and uses of naturally occurring organic compounds. Emphasis is placed upon three major classes of compounds, carboaromatics, terpenes and alkaloids.

CHEM 510. Atomic and Molecular Structure. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MATH 301 and PHYS 208. Survey of the pertinent aspects of quantum mechanics. Line spectra, atomic structure and molecular bonding.

CHEM 511. Chemical Thermodynamics and Kinetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The concepts and principles of thermodynamics and their application to chemical problems. The rates and mechanisms of chemical reactions including collision and transition state theories.

CHEM 512. Applied Molecular Modeling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Atomistic and coarse-grained force fields. Principles behind molecular simulations. Molecular dynamics and Monte Carlo approaches to problems in chemistry, molecular physics, biophysics and nanoscience. Thermodynamic and transport properties. Free energy calculations and rare event dynamics. Hands-on introduction to basic programming and operating systems. Suggested background: physical chemistry (CHEM 303) or thermodynamics with elements of statistical mechanics (PHYS 340, CHEM 511 or CHEM 612).

CHEM 520. Advanced Inorganic Chemistry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The application of modern physical techniques for the determination of the symmetry, molecular structure, bonding and reaction mechanisms of inorganic compounds.

CHEM 532. Advanced Analytical Chemistry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Theories and principles of thermodynamics and kinetics relevant to analytical methods, including acid-base, redox, and metal complexation equilibria, nonaqueous systems, kinetics and an introduction to surface chemistry.

CHEM 550. Introduction to Polymer Chemistry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of macromolecular compounds that includes classifications, methods of preparation, mechanisms, stereochemistry and applications. Physical characterizations, such as structure and property correlations, kinetics, thermodynamics, and molecular weight determinations are emphasized.

CHEM 580. Mechanical Properties of Plastics and Polymers. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course provides a link between the more practical aspects of plastics and the fundamental properties of the polymers from which they are made. Topics covered deal with the structure of polymers with emphasis on relationships with mechanical properties; rubber elasticity; the glass transition and other secondary transitions; time and temperature dependency; yield and fracture; crystallization and morphology; influence of polymer processing on mechanical properties.

CHEM 591. Topics in Chemistry. 1-6 Hours.

Semester course; variable hours. 1-6 credits per semester. Maximum total of 9 credits for all topics courses. An in-depth study of a selected topic in chemistry. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

CHEM 604. Advanced Organic Chemistry II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An integrated study of the mechanism and stereochemistry of organic reactions and their application to organic synthesis. Emphasis is placed on addition and condensation reactions, carbanions, carbocations, and other reactive intermediates.

CHEM 605. Physical Organic Chemistry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The theory and application of physical methods in the study of the behavior of organic compounds. Topics covered include homogeneous kinetics, equilibria, acid-base catalysis, and the quantitative correlation of structure and reactivity as they apply to the understanding of the mechanisms of organic reactions.

CHEM 606. Advanced Spectroscopic Methods in Organic Chemistry. 1.5 Hour.

Half-semester course; 3 lecture hours. 1.5 credits. Prerequisite: CHEM 506 or permission of instructor. Advanced spectroscopic techniques including 2-D, multinuclear and solid state NMR; theory and practice in the education of organic structures.

CHEM 610. Applied Quantum Chemistry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Quantum mechanics applied to chemical problems in UV, IR and NMR spectroscopy and the electronic structures of atoms and molecules; development of the self-consistent field equations. Suggested background: CHEM 510.

CHEM 611. Molecular Spectroscopy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course teaches the interaction of radiation and molecules; the rotation, vibration and electronic motion of molecules; molecular spectra and recent developments in laser spectroscopy. Suggested background: CHEM 510.

CHEM 612. Modern Statistical Mechanics: Fundamentals and Applications. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Fundamental topics in modern equilibrium and non-equilibrium statistical mechanics, with applications to selected chemical, physical and biological systems. Suggested background: CHEM 510 and 511.

CHEM 615. Chemical Thermodynamics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The study of the laws of thermodynamics and their application to pure phases, solutions and changes in state.

CHEM 616. Chemical Kinetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of the rates and mechanisms of chemical reactions, reaction rate theory, kinetic theory of gases and theories of catalysis.

CHEM 620. Advanced Inorganic Chemistry I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The application of modern physical techniques for the determination of the symmetry, molecular structure, bonding and reaction mechanisms of inorganic compounds.

CHEM 621. Advanced Inorganic Chemistry II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A coordinated study of synthetic methods, stereochemistry and reaction mechanisms including catalysis of inorganic, organometallic and bioinorganic compounds. Suggested background: CHEM 620.

CHEM 622. Solid State and Materials Chemistry. 1.5 Hour.

Semester course; 1.5 lecture hours. 1.5 credits. Prerequisite: CHEM 320. This course will present amorphous and crystalline solids, crystal structures, unit cells and packing, Miller indices, crystallographic directions and planes, crystal defects and non-stoichiometric compounds, phase diagrams and solid solutions, band structure and theory, sol-gel chemistry, powder X-ray diffraction, and X-ray crystallography.

CHEM 630. Electroanalytical Chemistry. 1.5 Hour.

Modular course; 3 lecture hours. 1.5 credits per module. Presents the theory and application of electroanalytical techniques including cyclic voltammetry, potential step methods and microelectrode voltammetry. Suggested background: CHEM 409 or equivalent experience.

CHEM 631. Separation Science. 1.5 Hour.

Modular course; 3 lecture hours. 1.5 credits per module. Students discuss theories and principles of separation science as applied to chemical problems with emphasis on current techniques, instrumentation and applications. Suggested background: CHEM 409 or equivalent experience.

CHEM 632. Chemometrics. 1.5 Hour.

Modular course; 3 lecture hours. 1.5 credits per module. Computer methods for experimental design and data analysis of spectroscopic, electrochemical and chromatograph data. Topics include sampling theory, detection limits, curve resolution, Fourier transform-based instruments and factor analysis. Suggested background: CHEM 409 or equivalent experience.

CHEM 633. Mass Spectrometry. 1.5 Hour.

Modular course; 3 lecture hours. 1.5 credits per module. Topics include mass spectrometry ionization methods, mass analyzers, theory and applications for ion structure determination. Suggested background: CHEM 409 or equivalent experience.

CHEM 634. Surface Science. 1.5 Hour.

Modular course; 3 lecture hours. 1.5 credits per module. Topics include types of surfaces requiring surface analysis, electron-surface scattering (AES, UPS, XPS, HREELS, LEED, STM, SEM), photon-surface scattering (IR, NMR, EXAFS), molecule/ion-surface scattering (ISS, RMBS), chemisorption techniques and work function measurements. Suggested background: CHEM 409 or equivalent experience.

CHEM 635. Spectrochemical Analysis. 1.5 Hour.

Modular course; 3 lecture hours. 1.5 credits per module. Topics include instrumental components, such as lasers, photomultipliers, array detectors, monochromators, lock-in and boxcar detection, waveguides and optical fibers, atomic spectroscopic methods, fluorescence, Raman and circular dichroism spectroscopies. Suggested background: CHEM 409 or equivalent experience.

CHEM 636. Chemical Sensors and Biosensors. 1.5 Hour.

Semester course; 1.5 lecture hours. 1.5 credits. Prerequisite: CHEM 409. The goal of this course is to teach "structure-function" relationships responsible for the analytical response of sensors and biosensors based on chemical transduction. The material covered is intended to provide a connection between the chemical structure of sensors and the transduction mechanisms that produce a response signal, as well as the physicochemical factors that affect performance. The content provided will be from different textbooks but complemented with illustrative examples from the research literature. Note: This is a half-semester course.

CHEM 637. Electrochemistry Applications. 1.5 Hour.

Semester course; 1.5 lecture hours. 1.5 credits. The goal of this course is to teach applications of electrochemistry in science and technology, thus complementing the principles covered in CHEM 630. The course content is intended to enhance understanding of the practical aspects of electrochemistry, so students can appreciate the impact of this field in the real world. General topics include energy conversion and storage, electrocatalysis, corrosion, electroplating, and concepts for simulating electrode processes. Note: This is a half-semester course.

CHEM 638. Scanning Electrochemical Microscopy. 3 Hours.

Semester course; 1 lecture and 3 laboratory hours. 3 credits. Prerequisite: CHEM 409. Scanning electrochemical microscopy is a scanning probe technique that generates topographic images of surfaces immersed in liquids. Besides imaging, SECM allows quantitative characterization of chemical processes between tip and the scanned surface including nonconducting ones, thus expanding its applicability to biological substrates. The course is structured around experiments that exemplify applications of SECM and allows experiential learning on the principles and measuring capabilities of SECM. Each lecture focuses on a particular experiment that can be performed in one or two lab sessions. The goal of the course is to provide an ecosystem of experimental methods that graduate students can directly apply in their research. The list of experiments covers topics in chemistry, biology and materials science.

CHEM 690. Research Seminar in Chemistry. 1 Hour.

Semester course; 2 lecture hours. 1 credit. May be repeated for credit. In addition to reports presented by students, staff and visiting lecturers, current problems and developments in nanoscience and nanotechnology are discussed. Graded S/U/F.

CHEM 691. Topics in Chemistry. 1-6 Hours.

Semester course; variable hours. 1-6 credits per semester. Maximum total of 9 credits for all topics courses. An advanced study of selected topic(s) in chemistry. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

CHEM 692. Chemistry Seminar Presentation. 1 Hour.

Semester course; 2 lecture hours. 1 credit. May be repeated for credit. In addition to reports presented by students, staff and visiting lecturers, current problems and developments in chemistry are discussed.

CHEM 693. Chemistry Perspectives and Ethics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. The objectives of this course are to prepare graduate students for a career in the physical sciences and develop graduate student competency in the responsible conduct of research from both ethical and safety standpoints. Graded as S/U/F.

CHEM 696. Professional Skill Development. 3 Hours.

Semester course; 1 lecture and 12 laboratory hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to students pursuing the M.S. in Chemistry. This course allows students to gain professional development skills through the process of identifying and securing an internship or an applied research program with a scientific professional in an industrial, government or academic laboratory. The research is completed under the guidance of a graduate faculty member in collaboration with another scientist in one of these settings. The course involves hands-on experience and skill development to enable students to connect with future employers and/or mentors in their chosen industry. A comprehensive written report and an oral presentation to the student's advisory committee is required. Students taking the course for the first time are required to participate in instructional sessions to clarify expectations, review roles and responsibilities and participate in activities related to professional skills development. Graded as satisfactory/unsatisfactory.

CHEM 697. Directed Research. 1-15 Hours.

Semester course; 1-15 credits. May be repeated for credit. Research leading to the M.S. and Ph.D. degree.

CHEM 698. Investigations in Current Chemistry Literature. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for credit; a maximum of two credit hours may be presented toward the didactic course graduation requirements to count as one course. Interactive course designed to engage graduate students in current research topics of chemistry while developing skills for critical analysis of primary chemistry literature through oral presentations, group discussions or other formats. Students are expected to enroll in this course at least once before their literature seminar presentation (CHEM 692).

CHEM 699. Scientific Writing in Chemistry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course focuses on building up competence to write research proposals commensurate to the oral candidacy exam requirement for the Ph.D., as well as writing research articles using standard templates of chemistry journals. Proposal topics and journal templates will be assigned by the instructor at the beginning of the course.

English (ENGL)**ENGL 500. Practicum in College English. 1-6 Hours.**

Semester course; 1-6 credits. May be repeated for credit. May not be applied toward degrees in English. Prerequisite: permission of director of graduate studies. Student participation in planned educational experience under the supervision of English department faculty. The practicum may include classroom teaching, Writing Center tutoring, or participation in research projects.

ENGL 501. Introduction to Graduate Studies in English. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Required of all new graduate students seeking the M.A. in English. An introduction to the theoretical and practical aspects of advanced English studies.

ENGL 528. Children's Literature II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of classic and current children's books from a variety of literary genres. Magazines and media-related reference resources and journals are reviewed. The creative use of literature, its sociocultural functions and its contribution to the development of the oral and written expression of children from nursery to grade eight are explored. A focus on children with special problems is included. May not be taken for credit toward undergraduate English major if student has taken ENGL 351/TEDU 351. May not be used to fulfill literature requirement for M.A. in English or M.F.A. in Creative Writing, but may be taken as elective credit. Crosslisted as: TEDU 528.

ENGL 532. Applied English Linguistics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. Prerequisite: ENGL 390. Application of linguistic theories and methods to selected teaching problems, such as teaching English grammar and usage, teaching English as a second or foreign language, or teaching standard English to students who speak different dialects.

ENGL 550. Studies in Linguistics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. Prerequisite: ENGL 390. A general introduction to one area of linguistic study, such as pronunciation, grammar, stylistics, dialects, usage standards, lexicography, onomastics or semantics.

ENGL 552. Methods for Teaching Multilingual Learners. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides students who plan to teach people whose native language is not English with a variety of instructional/learning strategies. Presents and explores current approaches and methodology, as these relate to linguistic features and pedagogy. Crosslisted as: TEDU 552/LING 552.

ENGL 560. Studies in British Literature and Culture. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers important topics in British literary and cultural studies including major literary periods, genres, major authors or literary movements. May be repeated for credit with permission of the instructor.

ENGL 570. Special Topics in American Literature and Culture. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers important topics in American literary and cultural studies including major literary periods, genres, authors and literary movements. May be repeated for credit with permission of instructor.

ENGL 601. Young Adult Literature. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Examination of literature written for young adults, literature appropriate for young people in middle schools and high schools. Focuses on the content, characteristics and teaching of such literature. Crosslisted as: ENED 601.

ENGL 605. Introduction to Scholarship in English Studies. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces the practice of research and scholarly discourse in English studies. Emphasizes scholarly resources (printed and electronic) and textual studies.

ENGL 606. Literary Criticism. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A comparative study of critical approaches to literary texts (reader-oriented, new critical and formalist, psychoanalytic, archetypal, feminist and gender-oriented, structuralist, poststructuralist, new historicist and postcolonial). These approaches will be evaluated in terms of their capacity to address major components of the literary process (author, text, reader, history, culture); they will also be tested on selected literary texts. Some attention is given to the historical development of criticism, but the primary focus is on its theoretical claims, methodologies and aims.

ENGL 611. Authors. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. A study of the relationships among authorship (in material or discursive form), texts and cultural contexts.

ENGL 614. Cultural Discourses. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. A study of contemporary literary and nonliterary texts produced within a designated period of time.

ENGL 620. Intertextuality. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. A study of texts, potentially of disparate genres and contexts, focused on similar theme, concern or issue. Will examine both foundational, originating texts and subsequent reactions.

ENGL 624. Texts and Contexts. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. A study of the ways in which texts shape, reflect and inform their cultural contexts.

ENGL 627. Genres. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. A sustained and detailed examination of one or more genres.

ENGL 629. Form and Theory of Genre: _____. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. Enrollment is restricted to students in the M.A. in English or M.F.A. in Creative Writing programs. Will address a number of key issues concerning the structure and theory of verse, fiction or creative nonfiction. Will provide readers and writers of these three literary genres an opportunity to study and practice a broad range of forms and techniques, as well as to explore various genre conventions and their thematic and rhetorical significance. Students may study work from various periods, with some focus on the contemporary, and apply to them the insights offered by major theorists of poetry, fiction and creative nonfiction.

ENGL 630. Form and Theory of Fiction. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated once for credit. Will address a number of key issues concerning the structure, conventions and function of narrative discourse and will seek to give readers and writers of fiction an opportunity to study a broad range of narrative forms, as well as to explore genre conventions and their thematic and rhetorical significance. Students will read stories and novels from various historical periods, with some focus on the contemporary, and apply to them the insights offered by major theorists of narrative. They also may write imitations, parodies and responses examining and demonstrating the aesthetics of fiction.

ENGL 631. Form and Theory of Creative Nonfiction. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated once for credit. Will address a number of key issues concerning the structure, conventions and function of varied types of creative nonfiction and will seek to give readers and writers an opportunity to study a broad range of forms in the genre, which may include magazine articles, research-based reportage, New Journalism, memoir, biography, autobiography, the meditative essay, the personal essay, the lyric essay and others, as well as to explore genre conventions and their thematic and rhetorical significance. Students will read across this range of forms, with some focus on contemporary writing, and apply to them insights offered by major theorists of the genre. They also may write imitations, parodies and responses examining and demonstrating the aesthetics of creative nonfiction writing.

ENGL 632. Community Writing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course teaches students how to use research in rhetoric and composition to design and deliver a community writing project that is mutually empowering, knowledge generating and publicly oriented – designed to inspire social change.

ENGL 636. Teaching Writing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines theories and practices of teaching writing, with emphasis on the connections between theory and practice.

ENGL 637. Theories of Rhetoric and Composition. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENGL 636. A study of theory and scholarship in rhetoric and writing.

ENGL 638. Responding to Writing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course studies theories and practices for responding to expository and persuasive nonfiction texts, both students' and professionals', academic and creative.

ENGL 652. Studies in Writing and Rhetoric: _____. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. A study of an area or specialized issue in rhetoric and/or writing such as the history of rhetoric, theories of invention, qualitative research methods in writing, or studies in style.

ENGL 661. Themes in Interdisciplinary Studies. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. A study in depth of a theme, topic, or concept involving two or more disciplines.

ENGL 666. Creative Writing: _____. 3 Hours.

Semester course; 3 workshop hours. 3 credits. May be repeated for credit. Enrollment is restricted to students in the M.F.A. program or with permission of the Creative Writing Committee. Students seeking to join the class who are not enrolled in the M.F.A. program must receive approval from the program director. Study of the art of one of the genres of creative writing, with the goal of producing professionally acceptable and publishable work. Workshop members shall produce a substantial amount of writing and in addition shall be able to evaluate and articulate the strengths of their own work. Graded as Pass/Fail.

ENGL 667. Creating Writing: Poetry. 3 Hours.

Semester course; 3 workshop hours. 3 credits. May be repeated for credit. Prerequisite: graduate standing in M.F.A. program or permission of the Creative Writing Committee. All students seeking to enroll must contact the creative writing M.F.A. director. Study of the art of poetry writing, with the goal of producing professionally acceptable and publishable poetry. Workshop members shall produce a substantial amount of poetry and in addition shall be able to evaluate and articulate the strengths of their own work. Graded as pass/fail.

ENGL 668. Creative Writing: Drama. 3 Hours.

Semester course; 3 workshop hours. 3 credits. May be repeated for credit. Prerequisite: graduate standing in M.F.A. program or permission of the Creative Writing Committee. All students seeking to enroll must contact the creative writing M.F.A. director. Study of the art of playwriting with the goal of creating plays that are suitable for production. Workshop members shall produce a substantial volume of writing, one-act plays, or a portion of a longer play, and, in addition, shall be able to evaluate and articulate the strengths of their own work. Graded as pass/fail.

ENGL 670. Literary Editing and Publishing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. A course in which the student learns to edit fiction, poetry, drama, or nonfiction. Genre covered will vary from semester to semester. Attention will be paid to the ways in which editors work with writers in all the technical aspects of editing, revising and publishing. Ethical responsibilities of editors to authors and their texts will be stressed. Questions considering the publishing world at large will be considered.

ENGL 671. Film and Television Scripts. 3 Hours.

Semester course; 3 workshop hours. 3 credits. Study of the theory and practice of producing shooting scripts for television and motion pictures. Emphasis will be placed on the various kinds of scripts most commonly used by directors and cinematographers (e.g., silent, narrated and dramatized). Attention will also be paid to the ways in which script writers adapt material to audiences, and the ways in which strict time frames are imposed on scripts. Students will write scripts of various kinds and lengths. Graded as pass/fail.

ENGL 672. Writing Nonfiction. 3 Hours.

Semester course; 3 workshop hours. 3 credits. May be repeated for credit. Enrollment requires permission of the instructor. Study and practice of writing one or more modes of nonfiction on the professional or preprofessional level under critical supervision. Emphasis will be placed on such matters as organization, style, revision and adaptation to particular audiences and publications. Possible kinds of writing could include reports; writing based on statistics; writing textbooks; writing separate chapters of books; and writing reviews, criticism and advocacy materials. Graded as pass/fail.

ENGL 673. Teaching Creative Writing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The course is intended for those who teach or plan to teach creative writing. A comparative analysis of different approaches to the teaching of creative writing. Attention will be paid to the different ways in which elements such as dialogue, sound pattern, scene development, line break, meter, voice and distance can be taught.

ENGL 692. Independent Study. 1-3 Hours.

1-3 hours. Variable credit. Maximum of 6 credits. Prerequisite: permission from department chair. For students in English/English education to pursue, in depth, a particular problem or topic about which an interest or talent has been demonstrated.

ENGL 694. Internship in Writing. 1-3 Hours.

Semester course; 1-3 field experience hours. 1-3 credits. May be repeated for credit. Enrollment requires permission of director of M.A. or M.F.A. program. Analyses and practices of professional writing and editing in settings such as business, government and industry.

ENGL 695. Directed Study/Major Project and Presentation. 1-3 Hours.

Semester course; variable hours. 1-3 credits. May not be repeated for credit. Students who choose not to write a thesis will complete a substantial project with a graduate faculty adviser and share the results of his or her research in a public presentation. This project may be an expansion or reworking of a seminar paper or group of seminar papers and must contain a statement of the theoretical, critical or methodological issues important to the project. An abstract of the research will be submitted three to four weeks before the presentation date scheduled for that semester and must be approved by the M.A. committee. The presentation will take place before the adviser, M.A. committee members, and interested faculty and students on the date designated by the M.A. director. Graded PR. Note: Students who present a paper at a national conference or publish in a reputable journal may be exempted from the presentation upon the approval of the M.A. committee.

ENGL 798. Thesis. 1-3 Hours.

Continuous courses; hours to be arranged. Credits to be arranged; 1-3 credits per course. Preparation of a thesis or project based on independent research or study and supervised by a graduate adviser.

ENGL 799. Thesis. 1-3 Hours.

Continuous courses; hours to be arranged. Credits to be arranged; 1-3 credits per course. Preparation of a thesis or project based on independent research or study and supervised by a graduate adviser.

Foreign Languages (FRLG)**FRLG 510. Language Learning and Technology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Introduces the variety of ways technology can be used to enhance language instruction and student learning. Targeted technologies include audio/visual media, language learning software, the Internet and multimedia resources. Attention also will be given to considerations of learning style, curricular integration and enhancement.

FRLG 575. Intercultural Communication. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). An experientially oriented seminar for persons preparing for or in careers necessitating intercultural communication among persons of differing cultural and/or national backgrounds. Special attention is given to teachers and other professionals who work with a clientele from Latin America, the Middle East, Asia, Africa and Eastern Europe. American cultural patterns broaden understanding of specific groups and engagement in intercultural communication. Crosslisted as: TEDU 575.

FRLG 591. Topics in Foreign Languages. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. A detailed study of selected topics in one or more of the foreign language or comparative courses offered by the department.

Forensic Science (FRSC)**FRSC 505. Forensic Entomology. 3 Hours.**

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Course focuses on proper collection, preservation and identification of entomological evidence. Students collect entomological evidence from a mock crime scene and utilize these specimens for estimation of minimum postmortem interval. There is a significant laboratory component.

FRSC 510. Developmental Osteology. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: FRSC 300; ANTH 307 and ANTZ 307; ANTH 310; graduate standing in forensic science; or permission of instructor. Examines the human musculoskeletal system and its development from an embryonic state to the adult form. Students learn the developmental course of each bone in the human skeleton and those of the associated soft tissue structures. Students are provided with training in the recognition of skeletal elements and bony landmarks, siding skeletal elements (and fragments thereof), knowledge of muscle structure and function and knowledge of nervous and venous structures associated with bony landmarks. Developmental defects and trauma associated with birth and child abuse are discussed. Juvenile age estimation from bones and radiographic images are emphasized.

FRSC 515. Forensic Anthropology Applications. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Focuses on estimation of the biological profile in human identification, the analysis of perimortem trauma and writing of case reports. The laboratory component will cover all aspects of the course including providing practice for age and race estimation.

FRSC 520. Forensic Fire Investigation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: FRSC 375 with a minimum grade of C (for undergraduate students), FRSC 670 or equivalent. Examines the specialized field of forensic fire investigation including on-scene investigation, fire theory, accelerant-assisted burn patterns and expert-witness testimony.

FRSC 525. Introduction to Digital Forensics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to forensic science or information systems majors. An in-depth study of digital forensics. Covers foundational concepts, evidentiary procedures, tools and software, current challenges, analysis techniques and report production, the legal system and expert testimony, standards and ethical considerations, as well as the vast community of practitioners and resources/opportunities in the field. The different disciplines within the field of digital forensics and the various modalities in which it is practiced will be reviewed.

FRSC 565. Scientific Crime Scene Investigation. 3 Hours.

Semester course; 3 lecture and/or laboratory hours. 3 credits. Presents the theory and techniques of scientific crime scene investigation including: recognition, documentation, collection and enhancement of physical evidence. A comprehensive introduction to the use of physical evidence for crime scene reconstruction is presented.

FRSC 566. Advanced Crime Scene Investigation. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: FRSC 309 with a minimum grade of C (for undergraduate students), FRSC 565 or equivalent. An advanced study of the methods and techniques of crime scene investigation with an emphasis on crime scene reconstruction by the use of physical evidence. Course will include extensive practical applications with mock crime scenes.

FRSC 570. Forensic Science Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for a maximum of 3 credits. A seminar course featuring presentations by faculty, crime laboratory staff, students and visiting lecturers. Instruction includes discussions of research and developments and current topics in various forensic science disciplines and related fields. Graded as S/U.

FRSC 580. Applied Statistics for Forensic Science. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 210, STAT 212 or equivalent statistics knowledge; or graduate standing in forensic science. The course will focus on the forensic applications of data visualization methods, hypothesis testing, analysis of variance, correlation measures, regression, multivariate analyses and concepts in database "matching" procedures. Techniques discussed will include ANOVA, MANOVA, principal component analysis, non-metric multidimensional scaling, discriminant function analysis and machine learning/neural network analysis.

FRSC 581. Forensic Analysis of Fire Debris and Explosive Evidence. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Prerequisites: CHEM 409, CHEZ 409 and FRSC 365; or FRSC 671, FRSZ 671, FRSC 673 and FRSZ 673. Presents the collection, analysis and interpretation of ignitable liquids and explosives as they are applied in forensic casework. Covers the theoretical and practical aspects. Laboratory exercises include hands-on instruction with appropriate instrumentation and techniques, including stereomicroscopy, gas and ion chromatography, GC-MS, thin layer chromatography, HPLC and FT-IR.

FRSC 582. Forensic Analysis of Paint and Fiber Evidence. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Prerequisites: CHEM 409, CHEZ 409 and FRSC 365; or FRSC 671, FRSZ 671, FRSC 673 and FRSZ 673. Covers topics in polymer analysis including collection, classification and analysis of paint and fiber evidence as applied to forensic casework. The course covers the theoretical and practical aspects, using lectures and laboratory exercises. Laboratory exercises include hands-on instruction with appropriate instrumentation and techniques, including stereomicroscopy, microchemical testing, microspectrophotometry, fluorescence microscopy, FT-IR and polarizing light microscopy.

FRSC 591. Topics in Forensic Science. 1-3 Hours.

Semester course; variable lecture hours. 1-3 credits; maximum of 6 credits for all forensic science topic courses may be applied to major. Prerequisite: graduate standing in the forensic science program or permission of instructor required for enrollment. A study in selected topics in forensic science. See the Schedule of Classes for specific topics to be offered each semester and additional prerequisites.

FRSC 607. Forensic Taphonomy. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Focuses on the process and sequence of human decomposition, as well as the burial, water disposal and surface dispersal of human remains. The course covers current issues in taphonomic research and practical application, including both domestic and international examples of mass disasters and mass graves. An understanding of the principles of archaeological stratigraphy is an integral part of the course. There is a significant field work and laboratory component.

FRSC 644. Analytical Considerations in Forensic Toxicology. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Lecture and laboratory will focus on the development and validation of advanced analytical methods in forensic toxicology. Data analysis and interpretation and the application of statistical tools will be discussed. Lectures will also provide the fundamentals of pharmacokinetics and toxicokinetics and dynamics as they pertain to forensically relevant chemicals and psychoactive substances.

FRSC 645. Applications in Forensic Toxicology. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Prerequisite: FRSC 644. Lecture and laboratory focused on the toxicokinetics and toxicodynamics of categories and specific chemicals and psychoactive substances. Sample preparation, instrumental analysis and professional practices relevant to post-mortem toxicology, surveillance drug testing and drug-facilitated crimes will be discussed.

FRSC 660. Toolmark Examinations. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Corequisites: FRSC 673 and FRSZ 673 or permission of instructor. Covers topics in toolmark examination and identification as applied to forensic casework. The course covers both the theoretical and practical aspects, using lectures and laboratory exercises.

FRSC 661. Analysis of Pattern Evidence. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Corequisites: FRSC 673 and FRSZ 673 or equivalents. Covers topics in pattern evidence analysis including analysis of latent prints and other patterned evidence as applied to forensic casework. The course covers both the theoretical and practical aspects, using lectures and laboratory exercises focusing on the collection, analysis and interpretation of pattern evidence.

FRSC 662. Firearm Identification. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Corequisites: FRSC 673 and FRSZ 673 or equivalents. Covers topics in firearm identification as applied to forensic casework. The course covers both the theoretical and practical aspects, using lectures and laboratory exercises.

FRSC 663. Forensic Medicine. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the fundamentals of forensic medicine including topics such as forensic death investigations, postmortem changes, time-of-death determinations, identification of unknown human remains and the forensic pathology of natural and traumatic deaths in adults and children. The characteristics and diagnosis of various types of trauma as well as the characteristics of common natural diseases that cause sudden death will be presented.

FRSC 670. Forensic Evidence and Criminal Procedure. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Presents the law of criminal procedure and rules of evidence as applied to forensic science. Explores issues of scientific versus legal burdens of proof, legal terminology and trial procedure.

FRSC 671. Instrumentation in Forensic Chemistry. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Corequisite: FRSZ 671. Enrollment is restricted to students in the forensic science program. Theory and applications of chromatography, mass spectrometry and spectroscopy as used in modern crime laboratories. Instruction will focus on instrumental analysis as applied to drug analysis, toxicology, fire debris identification and general trace evidence examination.

FRSC 672. Advanced Drug Analysis. 3 Hours.

Semester course; 3 lecture and/or laboratory hours. 3 credits. Isolation and identification of abused drugs emphasizing the analysis of unknowns, problems encountered in analysis and chain of custody issues.

FRSC 673. Forensic Microscopy. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Establishes the foundation for the theory of microscopy. The knowledge acquired in this course can be applied to forensic disciplines such as firearms examinations, forensic biology, controlled substances, questioned documents and trace evidence.

FRSC 675. Forensic Serology and DNA Analysis. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Presents the theory and methodology used for the examination and identification of body fluid stains and determination of species. Provides students an introduction to the theory and methodology of forensic DNA analysis as well as forensic DNA quality control issues. Instruction will focus on molecular biology techniques as they are applied in a forensic DNA crime laboratory setting.

FRSC 676. Advanced Forensic DNA Analysis. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Focuses on the specific principles and modern procedures used for analysis of forensic nuclear and mitochondrial DNA evidence. Other topics include current research and development for forensic DNA instrumentation and applications, statistical interpretation of results and case report writing. Students gain individualized, hands-on experience with DNA procedures and instrumentation in the laboratory exercises. Students will process mock forensic casework.

FRSC 677. Professional Practices and Expert Testimony. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: must have successfully completed a minimum of 18 credit hours in the forensic science master's degree program. Topics related to professional practices in the forensic science field will be covered, including ethics, bias, quality assurance, laboratory management and professional development. Individual and group activities relating to these topics will be completed. Additionally, this course will examine forensic expert testimony in the courtroom, communication of scientific findings to a general audience, trial preparation and cross-examination in moot court format.

FRSC 680. Forensic Psychology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Guilty mind requirements in criminal law. Competency to stand trial, insanity defense, mental disorder and crime. Behavioral profiling of serial murders and sex offenders. Issues in the use of clinical and statistical prediction methods in criminal justice. Crosslisted as: CRJS 680.

FRSC 686. Emerging Molecular Applications for Forensic Biology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: FRSC 676. Emerging forensic molecular technologies as well as molecular applications for nontraditional forensic needs will be covered. Emphasis will be given to current research and to technologies most likely to be implemented in forensic laboratories. Molecular applications may include those that involve analysis of DNA, RNA, protein, or other cell macromolecules and/or those that use advanced molecular tools for separation, detection, manipulation, identification, imaging and analysis. Students gain individualized experience in literature research, in summarization/simplification of technical information and in oral presentation.

FRSC 690. Scientific Writing. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment restricted to students in the M.S. in Forensic Science program. Focuses on scientific writing techniques, including abstracts, posters, review articles and research proposals. Emphasis will be placed on writing for scientific journals in forensic science and other peer-reviewed journals.

FRSC 692. Forensic Science Independent Study. 1-3 Hours.

Semester course; variable hours. 1-3 credits. Maximum credit for all independent study applicable to degree is 6 credits. The amount of credit must be determined, and written permission of instructor and program director must be obtained prior to registration. This course is designed to provide an opportunity for independent laboratory research in an area of forensic science or related scientific discipline. The end products of this experience will include an oral presentation at a campus seminar and a written report.

FRSC 693. Current Topics in Forensic Science. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for credit. A course designed to develop skills in reading journal manuscripts and delivering oral presentations in conjunction with an in-depth study of a current topic in forensic science. Student will conduct library research, present talks and lead discussions on the selected topic. See the Schedule of Classes for specific current topics course to be offered each semester and prerequisites.

FRSC 792. Research Techniques. 1 Hour.

Semester course; 3 laboratory hours. 1 credit. Enrollment restricted to students with graduate standing in forensic sciences and with permission of faculty mentor. Application of basic laboratory methods used in forensic science to the investigation of topics of interest. Emphasis on experimental design, data collection and analysis, communication skills, and critical thinking. Graded as Satisfactory/Unsatisfactory.

FRSC 793. Directed Research in Forensic Science. 1-3 Hours.

Semester course; 1-3 practicum hours. 1-3 credits. May be repeated for credit with up to 6 credits counted toward the degree requirements. Enrollment restricted to students in the forensic science master's degree program with permission of the instructor. A capstone course in which students will conduct independent, original laboratory research in a forensic specialization area of interest, while also gaining practical experience in crime laboratory practices and methods. A minimum of 300 hours of laboratory research and a minimum of three credits are required for graduation.

Forensic Science Lab (FRSZ)**FRSZ 671. Instrumentation in Forensic Chemistry Laboratory. 1 Hour.**

Semester course; 3 laboratory hours. 1 credit. Corequisite: FRSC 671. Enrollment is restricted to students in the forensic science program. Applications of chromatography, mass spectrometry and spectroscopy as used in modern crime laboratories. Instruction will focus on instrumental analysis as applied to drug analysis, toxicology, fire debris identification and general trace evidence examination. Laboratory exercises will focus on core instruments used across multiple subdisciplines in forensic chemistry.

FRSZ 673. Forensic Microscopy Laboratory. 1 Hour.

Semester course; 3 laboratory hours. 1 credit. Establishes the foundation for the application and methodology of microscopy. The knowledge acquired in this course can be applied to forensic disciplines such as firearms examinations, forensic biology, controlled substances, questioned documents and trace evidence. The course consists of laboratory exercises and demonstrations.

FRSZ 675. Forensic Serology and DNA Analysis Laboratory. 1 Hour.

Semester course; 3 laboratory hours. 1 credit. Presents the chemical, immunological and microscopic laboratory techniques commonly used for the examination and identification of body fluid stains and determination of species. Provides working knowledge and hands-on practice with basic forensic DNA procedures, including DNA extractions, quantitation, PCR amplification analysis/genotyping. Instruction focuses on molecular biology techniques as applied in a forensic DNA laboratory.

FRSZ 792. Research Techniques. 1 Hour.

Semester course; 3 laboratory hours. 1 credit. Enrollment restricted to students with graduate standing in forensic science and permission of faculty mentor. Application of basic laboratory methods used in forensic science to the investigation of topics of interest. Emphasis on experimental design, data collection and analysis, communication skills, and critical thinking. Graded as Pass/Fail.

French (FREN)**FREN 500. French for Graduate Students. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This course is designed to prepare graduate students for the reading knowledge examination for higher degrees. Each graduate department will determine the nature and form of certifying examination.

FREN 501. French Communication. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. An intensive study of communication in French. Variable credits; primarily oral, written and listening skills.

FREN 511. French Civilization. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. Prerequisite: functional fluency in French since the class will be taught in French. A comprehensive study of the civilization and culture of France and its global expressions.

Gender, Sexuality and Women's Studies (GSWS)**GSWS 501. Feminist Theory. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This seminar provides an overview of the theories of feminisms.

GSWS 602. Feminist Research Epistemology and Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course explores the implications of feminist theorizing across disciplinary and cultural contexts for both epistemology (theories of knowledge) and methods (theories and approaches in the research process). Students will examine how knowledge and power intersect, how gender theory and feminist politics influence research, how the knower influences knowledge production and how social location shapes inquiry. Students will experiment with feminist methods and approaches to researching issues related to gender, sexuality and women, and ethical considerations as these issues affect vulnerable populations.

GSWS 620. Theorizing Sexuality. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course examines and explores constructions of human sexuality (sexualities) and theorizes how these constructions operate within contemporary culture.

GSWS 622. Women and Public Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This seminar differentiates theories of feminisms and explores the effects of policies, or their absence, for women in the U.S., briefly examining theories of policymaking and the policy process in relation to feminist theories and the feminist project.

GSWS 624. Gender and Cultural Production. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This seminar takes as a starting point an understanding of culture as the expressive practice of meaning making that lies at the intersection of art, imagination, technology, space and politics.

GSWS 691. Topics in Gender, Sexuality and Women's Studies. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Course may be repeated with different topics as approved. Prerequisite: permission of instructor. An in-depth study of a selected topic in gender, sexuality and/or women's studies. See Schedule of Classes for specific topics to be offered each semester.

GSWS 692. Independent Study. 1-4 Hours.

Semester course; variable hours, variable credit. Maximum 4 credits per semester. Maximum total of 4 credits in all independent study courses. Prerequisites: completion of 6 credits in gender, sexuality and women's studies courses.

German (GRMN)**GRMN 500. German for Graduate Students. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This course is designed to prepare graduate students for the reading knowledge examination for higher degrees. Each graduate department will determine the nature and form of the certifying examination.

GRMN 502. German Communication. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. An intensive study of communication in German. The content of this course will emphasize primarily oral, written and listening skills.

GRMN 512. German Civilization. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. Prerequisite: functional fluency in German since the class will be taught in German. A comprehensive study of the civilization and culture of Germany and its global expressions.

Health and Movement Sciences (HEMS)**HEMS 500. Motor Development of Young Children. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Explores the development of small children, preschool, kindergarten and first-grade children through physical education. Emphasis will be on the construction of a program of motor development for each of these three groups. The programs will be based on the research findings in such areas as perceptual-motor development, motor learning, educational psychology and others. Those students and teachers in the fields of physical education, special education and elementary education should find this course useful in developing programs of motor development for their students.

HEMS 505. Contemporary Issues in Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on contemporary issues related to lifestyle and health behavior. Emphasizes the factors that influence health and the lifestyle changes that promote and maintain optimal health. Issues may include sexuality, nutrition, chronic and communicable diseases, aging, environmental health, policy, and health care systems.

HEMS 507. Teaching Health in Schools. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines health issues, family influences, teenage attitudes and signs of progress in health behavior. School health programs, including remedial, classroom instruction and environmental aspects of school life also are considered.

HEMS 514. Physical Activity for Special Populations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides fundamental information to students at the graduate level on physical activity programming for children with disabilities. Course content focuses on programming techniques and methods that are most effective in meeting the specific physical activity needs of the individual child. Emphasis is on Public Law 94-142 provisions currently affecting physical education programming for special populations; in particular, the development of specially designed physical education programs, individualized education programs and programming in the least restrictive environment.

HEMS 521. Pathomechanics of Sport Injuries. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Addresses musculoskeletal and sports injury mechanisms from a pathomechanical and pathophysiological perspective. Focuses on acute trauma and repetitive stress injuries to the musculoskeletal system. Emphasizes evaluation and diagnostic procedures and the pathophysiology and evaluation of mild head injuries commonly acquired as part of physical activity.

HEMS 550. Exercise, Nutrition and Weight Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an in-depth analysis of the scientific principles associated with weight management strategies. Emphasizes the separate and combined effects of exercise, nutrition and behavioral interventions relative to weight loss, weight gain and weight maintenance. Includes life cycle nutrition, childhood obesity, adult obesity and chronic disease, weight management intervention strategies, eating disordered behavior and the female athlete triad.

HEMS 591. Topical Seminar. 1-3 Hours.

Semester course; 1-3 seminar hours. 1-3 credits. May be repeated for a maximum of 6 credits. A seminar intended for group study by students interested in examining topics, issues or problems related to health, physical education, exercise science, recreation and sport. Crosslisted as: SPTL 591.

HEMS 600. Introduction to Research Design in Health and Movement Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an understanding of the basic knowledge and methodology of research in health and movement sciences. Develops the ability to critically read and evaluate research, acquire a conceptual understanding of statistics and develop an empirical study related to healthy and diseased populations.

HEMS 601. Movement Physiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HPEX 375 or equivalent. Investigates the physiological processes in relation to bodily exercises in everyday life and sports activities. Physiological changes in the human organism due to movement. Investigation and application of research to health and movement sciences. Students must design, conduct and write a pilot study.

HEMS 602. Statistical Applications in Health and Movement Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Presents theory and techniques involved in the analysis and interpretation of data pertinent to research in health and movement sciences. Includes statistics applied to data encountered in published health and movement sciences research.

HEMS 603. Applied Fitness and Nutrition for Health and Movement Science Professionals. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An in-depth study of applied fitness and nutrition principles and practices. Emphasizes the application of knowledge and fundamental fitness and nutrition principles.

HEMS 604. Nutrition for Health and Physical Activity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HPEX 350 or equivalent. Provides an in-depth examination of the basic nutrients and their effects on health, fitness and sport performance. Emphasizes an understanding of the biochemistry of metabolism and knowledge of the current research related to nutrition, health and exercise performance.

HEMS 605. Psychology of Physical Activity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Introductory psychology, personal health or equivalent. Examines psychological issues related to exercise and physical activity. Includes individual and group motivation theory and techniques, leadership effectiveness, mental health, mental skills training, injury rehabilitation, eating disorders, exercise adherence, addiction, over training and use of ergogenic aids. Emphasizes examining current research and applications of psychological principles and knowledge in a physical activity setting.

HEMS 606. Psychosocial Aspects of Sport and Physical Activity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines social and psychological issues in sport and physical activity, with emphasis on socialization and motivation for sport and physical activity; patterns of participation and opportunities related to race, gender and social class; mental skills training for performance enhancement; aggression and violence in sport and society; and the role of sport and physical activity in the educational system. Emphasizes examining current research and applied methods in addressing these issues.

HEMS 610. Laboratory Techniques in Rehabilitation Science. 3 Hours.

Semester course; 3 hours. 3 credits. Prerequisite: HPEX 375 or equivalent. Laboratory-based course examining the various procedures related to measurement and experimentation in human performance. Includes examination of instruments designed to assess cardiovascular, musculoskeletal and pulmonary performance. Emphasis is given to application of instrumentation to physical training in healthy and diseased populations and to treatment and rehabilitation in a clinical setting.

HEMS 612. Administration and Supervision of Physical Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Gives guidelines for administrative and supervisory policies and problems in physical education and explores observation techniques, standards for judging instruction, the supervisory conference and cooperative supervision. Emphasis is placed upon the common problems met by administrators and supervisors.

HEMS 613. General Motor Ability Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Investigates the theory of the construction of evaluative instruments in physical education with emphasis on a critical examination of existing measurement devices. Emphasis on the use of measurement as a tool for improving physical education programs.

HEMS 614. Motor Assessment for Special Populations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HEMS 514 or permission of instructor. Provides the student with basic information regarding motor tests and observational instruments that assess and evaluate special populations. Focuses on the analysis of these tests as to their 1) main components and items purporting to measure these components; 2) administration, i.e., time, administrator's experience, group size, validity and reliability and standardization; and 3) use in establishing and monitoring annual goals and short-term objectives for an individualized education program.

HEMS 615. Orthopaedics and Therapeutics in Sports Medicine. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides in-depth exposure to procedures used in orthopaedics and physical medicine. Includes lectures and presentations by physicians, surgeons and other health care personnel. Focuses on linking diagnostic and surgical techniques used in orthopaedics and physical medicine to the rehabilitative treatment plan. Emphasizes the diagnosis and treatment of neuromuscular diseases and adaptive technologies for disabled populations.

HEMS 620. Motor Learning and Performance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Analysis of early patterns of behavior and the development of physical skills in childhood, adolescence, and adulthood. Consideration of differences in motor proficiency and factors affecting the acquisition of motor skills and concepts of motor learning with reference to the improvement of instructional practices.

HEMS 621. Sports Medicine. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HEMS 521 or permission of instructor. Designed to give the student knowledge in the advanced principles of prevention and treatment of athletic injuries. The course includes advanced first aid techniques and the more sophisticated means of athletic care and prevention. Students are exposed to such modalities as mechanical therapies, thermal therapy, cryotherapy, hydrotherapy and electrotherapy. One major component of the course deals with therapeutic exercise and its use in the rehabilitation of the injured athlete.

HEMS 637. Advanced Technology in Teaching Health and Physical Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Designed to prepare students to apply knowledge and skills in using technology in the physical education setting. Emphasis is placed on creating lessons using pedometers, downloadable heart-rate monitors, flip cams, computerized observational systems and the pocket PC. Focus is also on the use of local county grade-reporting systems.

HEMS 640. Health Care Organization and Delivery in the U.S.. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Provides an overview of the U.S. health care system and its many diverse components. Within the context of the U.S. health system, the course also provides students a perspective on the growing role of health behavior coaches as part of the interdisciplinary health team, the variety of employment opportunities and the business development potential of the field.

HEMS 641. Human Disease Prevention, Prevalence and Lifestyle Risk Factors. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Examines major categories of diseases, i.e., infectious, noninfectious, acute and chronic, including significant examples in each category. Current modalities for the prevention, treatment and control of diseases will be studied. In addition, the course will provide learning experiences to prepare students to convey information as health behavior coaches to a variety of audiences, including individual patients/clients, groups, specific priority populations and the general public.

HEMS 642. Theoretical Foundations of Health Behavior Change. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Investigates the relationship between health and behavior, with emphasis on both theory and application. The course addresses the theoretical foundations of behavior change, including an overview of leading theories as well as critical evaluation of their utility in promoting health behavior change.

HEMS 643. Fundamentals of Motivational Interviewing. 1 Hour.

Semester course; 1 lecture hour (delivered online or face-to-face). 1 credit. Restricted to health behavior coaching certificate students only. Introduces students to the fundamentals of motivational interviewing, a state-of-the-art, evidence-based communication and counseling technique. MI is designed to build clients' and patients' inner motivation and self-efficacy for positive health behavior change and maintenance. This course will expose students to the theory, principles and skills of MI that can be utilized with individuals or with groups.

HEMS 644. Advanced Motivational Interviewing. 1 Hour.

Semester course; 1 lecture hour (delivered online or face-to-face). 1 credit. Prerequisite: HEMS 643. Expands the students' exposure, understanding and practice of motivational interviewing, a state-of-the-art, evidence-based communication and counseling technique. MI is designed to build clients' and patients' inner motivation and self-efficacy for positive health behavior change and maintenance. This course will reiterate the importance of the theoretical foundation underlying MI, examine applications of MI and provide opportunities for advancing students' skills through role-playing specific to health behavior change.

HEMS 645. Application of Motivational Interviewing in Clinical Settings. 1 Hour.

Semester course; 1 lecture hour (delivered online or face-to-face). 1 credit. Prerequisites: HEMS 644, HEMS 647 and HEMS 648. Expands the student's knowledge, skills and competencies in motivational interviewing by focusing on the utilization of this communication and counseling technique in clinical settings (i.e., health/medical care settings). Students will be exposed to applications of MI that can be employed with individual patients or clients who present with single disease processes or comorbidities.

HEMS 646. Application of Motivational Interviewing in Group and Community Settings. 1 Hour.

Semester course; 1 lecture hour (delivered online or face-to-face). 1 credit. Prerequisites: HEMS 644, HEMS 647, HEMS 649. Expands the student's knowledge, skills and competencies in motivational interviewing by focusing on the utilization of this communication and counseling technique in group or community settings (e.g., support groups, groups in community organizations, groups in faith-based organizations, etc.). Students will be exposed to applications of MI that can be employed with groups who present with common health challenges or groups who are concerned with health promotion and disease prevention.

HEMS 647. Concepts and Applications in Chronic Disease Self-management. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisites: HEMS 640, HEMS 641, HEMS 642 and HEMS 643. Evidence-based course designed to enhance the student's knowledge of lifestyle factors such as physical activity, nutrition, weight management, stress management, medication compliance and tobacco cessation, etc., as they relate to the self-management of the most prevalent chronic diseases that affect the U.S. Students will learn hands-on skills to assist patients/clients across the lifespan.

HEMS 648. Health Behavior Change Counseling Techniques for Clinical Interventions. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisites: HEMS 640, HEMS 641, HEMS 642, HEMS 643. Focuses on the development of knowledge and skills that are essential to effective interpersonal communication and counseling, which will lay the foundation for effective health behavior coaching. Emphasis will be placed on fundamental counseling techniques and motivational interviewing and their applications to individual level health behavior change.

HEMS 649. Planning, Implementing and Evaluating Group/Community Health Behavior Change Interventions. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisites: HEMS 640, HEMS641, HEMS 642 and HEMS 643. Addresses the fundamentals of planning, implementing and evaluating health behavior change interventions in a variety of group or community settings, including support groups, worksite health promotion groups, community groups, faith-based groups, etc. Students will operationalize and apply the knowledge and skills essential to the effective practice of certified health behavior coaches.

HEMS 675. Clinical Exercise Physiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Permission of instructor. Examines theoretical and functional techniques of graded exercise testing for functional and/or diagnostic assessment. Topics include pulmonary, cardiovascular, respiratory and myocardial physiology, and the principles and skills of exercise prescription based on metabolic calculations.

HEMS 690. Research Seminar in Health and Movement Sciences. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for a maximum of 3 credits. Provides opportunities for presentation and discussion of current research and topics of interest in health and movement sciences. Presents relevant research for discussion delivered by guest researchers, faculty and students.

HEMS 691. Topics in Health and Movement Sciences. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for 9 credits. Check with division head for specific prerequisites. Examines specialized issues, topics, readings or problems in health and movement sciences.

HEMS 692. Independent Study. 1-3 Hours.

Semester course; 1-3 independent study hours. 1-3 credits. May be repeated for 6 credits. Determination of the amount of credit and permission of the instructor and division head must be procured prior to registration. Cannot be used in place of existing courses. An individual study of a specialized issue or problem in health or movement sciences. Crosslisted as: REMS 692.

HEMS 695. Externship. 1-6 Hours.

Semester course; 1-6 credits. May be repeated for 6 credits. Prerequisite: Permission of instructor. Plan of work designed by extern with prior approval of the offering department. State certification or equivalent may be required for some externships. Off-campus planned experiences for advanced graduate students designed to extend professional competencies in health and movement sciences. Directed by university faculty in cooperation with clinical on-site supervisors.

HEMS 797. Directed Research Study. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for a maximum of 6 credits. A research study of a topic or problem approved by the student's adviser and completed in accordance with division policy regarding the directed research study.

HEMS 798. Thesis. 1-6 Hours.

Semester course; 1-6 credits. May be repeated for a maximum of 6 credits. A research study of a topic or problem approved by the student's supervisory committee and completed in accordance with acceptable standards for thesis writing.

History (HIST)**HIST 511. Studies in American History. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Study of a selected topic in American history, primarily through lectures and readings. See the Schedule of Classes for specific topics to be offered each semester.

HIST 515. Studies in European History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Study of a selected topic in European history, primarily through lectures and readings. See the Schedule of Classes for specific topics to be offered each semester.

HIST 519. Studies in Ethnic and Social History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Study of a selected topic in ethnic or social history, primarily through lectures and readings. See the Schedule of Classes for specific topics to be offered each semester.

HIST 523. Studies in Virginia and Southern History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Study of a selected topic in Virginia or Southern history, primarily through lectures and readings. See the Schedule of Classes for specific topics to be offered each semester.

HIST 527. Studies in African-American History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Study of a selected topic in African-American history, primarily through lectures and readings. See the Schedule of Classes for specific topics to be offered each semester.

HIST 591. Special Topics in History. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated with different topics for a maximum of 9 credits. An intensive study of a selected topic in history.

HIST 601. Historiography and Methodology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of the development of history as a discipline from ancient times to the present. The course examines the evolution of historical theory and philosophy, great historians, schools of interpretation, and problems of historical methodology. This course is a prerequisite for research seminars.

HIST 611. Readings in American History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of major studies and interpretative trends in a particular area of American history through readings and class discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 615. Readings in European History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of major studies and interpretative trends in a particular area of European history through readings and class discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 618. Readings in Transatlantic History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of major studies and interpretative trends in a particular area of transatlantic history through reading and class discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 619. Readings in Ethnic and Social History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of major studies and interpretative trends in a particular area of ethnic or social history through readings and class discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 623. Readings in Virginia and Southern History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of major studies and interpretative trends in a particular area of Virginia or Southern history through readings and class discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 627. Readings in African-American History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of major studies and interpretative trends in a particular area of African-American history through readings and class discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 631. Research in American History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of significant problems in a particular field of American history through research, writing, in-class presentations and discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 635. Research in European History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of significant problems in a particular field of European history through research, writing, in-class presentations and discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 638. Research in Transatlantic History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of significant problems in a particular field of transatlantic history through research, writing, in-class presentations and discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 639. Research in Ethnic and Social History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of significant problems in a particular field of ethnic or social history through research, writing, in-class presentations and discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 643. Research in Virginia and Southern History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of significant problems in a particular field of Virginia or Southern history through research, writing, in-class presentations and discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 647. Research in African-American History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 12 credits. Analysis of significant problems in a particular field of African-American history through research, writing, in-class presentations and discussions. See the Schedule of Classes for specific topics to be offered each semester.

HIST 651. Public History: Theory and Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An overview of the field of public history, intended to introduce students to the range of professional historical activities practiced outside the classroom. Explores methods and skills including archival work, documentary editing, historic preservation, museum studies and oral history. The course also involves a sustained consideration of the theoretical issues that arise from public history work, defined as history of, for, by and/or with the public.

HIST 652. Documentary Editing and Scholarly Publishing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An overview of the processes by which historical scholarship is disseminated by publication. Students will practice editing scholarly editions of historic documents and reviewing manuscripts for publication in academic media. Special consideration will be given to the digital humanities and new technology's relation to the traditional publishing trade.

HIST 653. American Material Culture. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Material culture is a term encompassing all things created or modified by people – such as clothing, tools, furniture, works of art, buildings and even landscapes. This course introduces students to the field of material culture studies and challenges them to study the American past through examination of its artifacts and architecture. Students will explore a range of disciplinary approaches and time periods, as well as the role of politics in the preservation and exhibition of material culture.

HIST 654. Oral History: Theory and Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An introduction to the practice and theories of oral history, a method employing interviews or sound recordings of people with personal knowledge of past events. Students will consider the benefits and limitations of the method as well as learn the general legal issues involved. Students will conduct their own interviews and practice the transcription of oral testimony.

HIST 655. Digital History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course explores the ways technology can change the way historians research, analyze, write, discuss and produce history. Beginning with the foundations of digital history, the course will consider a variety of media, platforms and projects, and will pay particular attention to the digital initiatives in the region. Students will experience hands-on training in web literacies and other skills, including sound editing, map editing and text mining, building toward presentations of final digital projects that employ at least one new skill. By the end of the course, students should gain a basic understanding of the field's advantages and challenges along with enough technical expertise to begin participating in it, given their own interests and needs. Above all, the course should enhance students' engagement with the past, not distract from it.

HIST 656. Museums, Cultures and Communities: Historical Perspectives. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on the changing theory and practice of museum and public display work within cultures and communities (primarily in the U.S. but some internationally) from the late 1800s forward. Provides a methodological understanding of historical and current issues in museum studies and how they relate to museum practice, as well as opportunities to gain practical experience in exhibit, grant and community engagement project proposals.

HIST 657. Controversy in Public History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. It is essential for practitioners of public history to feel comfortable addressing controversial or difficult topics, whether in teaching, writing or developing public history products. To offer such preparation, this course will focus on ways that history has been contested and the role of historians in mitigating these clashes in the broader political culture. Just as these battles may play out at the national level, they similarly unfold in communities, institutions and workplaces. Students will learn – through readings and class discussions, practical exercises, and meetings with professionals from the field – strategies for understanding and accommodating various perspectives and for interpreting controversial historical material. This course encourages disagreement and respectful dialogue.

HIST 691. Special Topics in History. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for a maximum of 9 credits. An intensive study of a selected topic in history.

HIST 692. Independent Study. 1-3 Hours.

Semester course; 1-3 credits. Maximum of 6 credits. Prerequisite: permission of department chair. Requires an analysis of a historical problem or topic in depth under faculty supervision.

HIST 693. Internship in History. 2-4 Hours.

Semester course; variable hours. 2-4 credits per semester. Maximum of 6 credits. Determination of the amount of credit and permission of departmental internship coordinator must be procured prior to registration for this course. Students receive credit for work on historical projects with approved agencies.

HIST 698. M.A. Thesis. 1-6 Hours.

1-6 credits. May be repeated for a maximum of 6 credits.

Humanities and Sciences (HUMS)**HUMS 591. Special Topics. 1-4 Hours.**

Semester course; variable hours. 1-4 credits. May be repeated with different content. Specialized topics in the liberal arts and sciences designed to provide an overview of a topic not provided by an existing course or program. May be multidisciplinary.

HUMS 701. Post-candidacy Doctoral Research. 9 Hours.

Semester course; 9 research hours. 9 credits. May be repeated for credit. Enrollment is restricted to students who have been admitted to doctoral candidacy in the College of Humanities and Sciences. Students will participate in supervised discipline-specific research related to their dissertation topic. Students must have approval from their current degree program coordinator to register. This course can be approved as a substitution for any post-candidacy degree requirement. Graded as satisfactory/unsatisfactory.

International Studies (INTL)

INTL 591. Topics in International Studies. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for a maximum of 12 credits. Open to undergraduate (junior or senior level) and graduate students. A detailed study of selected topics in one or more geographic areas or comparative studies of global phenomena. See the Schedule of Classes for specific topics to be offered each semester.

Linguistics (LING)

LING 552. Methods for Teaching Multilingual Learners. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides students who plan to teach people whose native language is not English with a variety of instructional/learning strategies. Presents and explores current approaches and methodology, as these relate to linguistic features and pedagogy. Crosslisted as: ENGL 552/ TEDU 552.

LING 650. Second Language Acquisition. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course is designed for those who plan to work with English language learners in diverse instructional settings. A major focus of the course is analyzing second language acquisition theories and how they apply in classroom settings. In-depth analysis of readings will enhance the students' understanding of SLA and the research related to this field. Students will observe classroom teaching, analyzing the application of SLA theories utilized in the instructional setting. Crosslisted as: TEDU 650.

Mass Communications (MASC)

MASC 591. Topics in Mass Communications. 1-3 Hours.

Semester course; variable lecture or laboratory hours (depending on topic). 1-3 credits. May be repeated for a maximum of 6 credits. Prerequisite: permission of instructor and director of graduate studies. An advanced study of a selected topic in mass communications. See the Schedule of Classes for specific topic(s) to be offered.

MASC 600. Managing Your Media Career. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Equips students for growth and leadership in media careers. Arms students with tools to plan, soft skills, time management, workplace relationships and other crucial issues for professional advancement.

MASC 602. Advertising Technology for Copywriters, Strategists and Media Planners. 2 Hours.

Semester course; 2 laboratory hours. 2 credits. Restricted to Brandcenter students only. This course covers a number of computer applications, tailored to the specific needs of copywriters, account managers, account planners and media planners. Students will learn how to create and format documents using Microsoft Word for the Macintosh, including placement of images and manipulation of text from various sources such as the Internet. Students will learn how to create computer presentations with Microsoft PowerPoint for Macintosh. This course will teach the basics of page layout, including formatting documents, placement of images and basic typography. Additionally, students will learn how to use a scanner to capture images into Adobe Photoshop, and basic image modification techniques, such as brightening and sharpening, silhouetting an image and saving the image. Additionally this course covers the appropriate applications designed to capture and edit digital video, and will include discussion of the use of the Brandcenter's digital video cameras, and other accessories such as external microphones and lights. Certain applications specific to the needs of media planners and account planners, such as Simmons, SRDS and MRI also will be covered in this course.

MASC 604. Media Stories. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students will identify, create and translate stories to the multiple screens of contemporary media with an emphasis on advertising, public relations and journalism. Students study contemporary storytelling cases and create original stories for professional communications.

MASC 605. Technology in the Classroom. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Beginning with a brief treatment of basic desktop publishing skills, students will learn layout and design using newspaper, magazine and yearbook models. They will master the functions of Photoshop, Illustrator, Adobe PageMaker and/or QuarkXpress and create promotional fliers/ brochures and advertisements for their journalism programs. They will set templates and a style palette for school publications.

MASC 611. Communication Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Introduces relevant communication theories and research methods. Both qualitative and quantitative data analysis techniques are examined.

MASC 612. Mass Communications Theory. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Nature, function and application of mass communications theory; structure, content and effects of media systems; social and technological events accounted for by a generalized theory of mass communications.

MASC 613. Mass Media and Society. 3 Hours.

Semester course; 3 seminar hours. 3 credits. A study of the mass media of the United States, with special attention to their historical development and their impact on other institutions. Consideration of ethical and legal aspects of the media, and problems such as access, control and accountability.

MASC 614. Media-governmental Relations. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Study of the interaction between the media and the government, and the role of the press in the governmental process as a disseminator, opinion-maker and adversary.

MASC 615. Depth Reporting. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Prerequisites: three undergraduate reporting courses or permission of instructor. A thorough examination of one or more issues in the forefront of the news, the environment, education, health care, science and others relevant to today's readers.

MASC 616. Mass Communication Law. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An intensive examination of media rights and restrictions, including libel, privacy, access to information, copyright, free-press fair-trial. Attention will be given to First Amendment theory, research techniques and administrative regulation of broadcasting and advertising.

MASC 617. Advanced Research Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MASC 611. An examination of a mass medium through design and execution of a research project using one of the traditional research techniques of the field. Students will have major and minor projects for systematic study of a medium.

MASC 618. Media Economics and Management. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. In-depth study of media economics, management and finance based on an examination of major contemporary issues and challenges. Students will interact with faculty, media managers and each other to gain major problem-solving skills for media economics, management and finance.

MASC 619. Media and Public Opinion. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of the role of the mass media in the formation and change of beliefs and attitudes, the involvement of the media with policy makers in shaping public opinion and public policy, and the interaction of media and public opinion polling.

MASC 620. Seminar in Mass Communications History. 3 Hours.

Semester course; 3 credits. An examination of historical methodology and content as related to the investigation and writing of mass communication history in the United States. Special attention is placed on the adaptation and the use of historical method by mass communications historians.

MASC 621. Advanced Public Relations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students will explore a variety of case studies, decision-making analyses and advanced public relations programming in relation to private and public policy-making at the senior levels of management.

MASC 626. Critical Thinking in Media. 2 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Focuses on the application of critical and creative thinking to solve communication problems. Provides students with opportunities to explore and expand their creative abilities through brainstorming sessions, creative techniques and team-oriented activities dealing with contemporary advertising, public relations and media cases.

MASC 642. Online Journalism I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Exploration and production of various means of journalistic communication using online resources. Various multimedia projects will be reviewed and discussed, as well as the best use and application of media types based on the information being communicated. Students will research news stories and examine the effectiveness of online presentations while exploring how online journalism can work with more traditional forms of communication.

MASC 643. Digital Management and Analytics. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Students will learn how to use metrics to test ideas, offer audience insights and, ultimately, build relationships with the public they serve. This course will help students master the latest tools and techniques to collect information about news audiences and integrate metric insights into a digital media strategy.

MASC 644. Computational Journalism. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Computational journalism incorporates elements of computer-assisted reporting and data journalism while expanding on these approaches. Students will explore how the combination of algorithms, data and knowledge from the social sciences can supplement the accountability function of journalism and change how stories are discovered, presented, aggregated and monetized.

MASC 645. Digital Production. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Examines innovative approaches and technologies used in multimedia storytelling. Specific focus on the technical skills necessary to produce and edit messages using photography, videography, graphic design and more. Students gain hands-on experience with state-of-the-art tools.

MASC 646. Convergence Law and Ethics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MASC 611, 642 and 685. Explores the delicate balance that exists between freedom and control of the mass media (print, broadcast and new media). Focuses on judicial decisions and reasoning, given the impact the courts have on interpreting the First Amendment. Will also focus on new legal and ethical concerns created by the Internet and digital newsgathering and presentation technologies. Students will be immersed in the ethical decision-making process through the case-study approach.

MASC 654. Persuasion. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Study of communication practices influencing attitudes, opinions, belief systems and behavior change. Establishes the theories and practices used by brands to persuade within the boundaries of truth, diversity, commerce and law.

MASC 658. Account Leadership. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Restricted to Brandcenter students only. Students will learn first-hand general leadership skills crucial to developing successful relationships with agency personnel and clients. Emphasis will be given to exploring ways students can contribute to accounts not only strategically but creatively as well. Students will learn presentation and communication skills as well as effective ways to manage accounts. Students will sharpen previously prepared strategies as well as interviewing skills.

MASC 660. Advertising Account Research and Planning. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: MASC 650 and MASC 651. Develops student's ability to choose the most effective research methods for determining both the correct target market for a product and specific issues most pertinent to that market, in regards to positioning the product. Research work with consumer groups will demonstrate student's ability to develop thoughtful questions that will deliver valuable insight.

MASC 665. Building Global Brands. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MASC 650 and MASC 651. Restricted to Brandcenter students only. Provides thorough coverage of an approach and framework for designing a comprehensive marketing plan suitable for implementations in an international setting, with particular focus on identifying and analyzing the important cultural and environmental uniqueness of single nations or global regions. We also will look at specific examples of cases that will better inform our planning efforts and will spend time examining various cultures in order to respectfully and appropriately engage them in our marketing plan.

MASC 671. Strategic PR in a Digital Environment. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. An introduction to the thinking and actions required to communicate strategically in today's dynamic socioeconomic environment. Focus is on the skills and information to handle strategic public relations. Introduces cutting-edge technology and using the Internet as a strategic communications tool. Professional responsibilities emphasized.

MASC 672. Strategic PR Research and Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Introduces the basic theories and practices of strategic public relations research and evaluation. Both qualitative and quantitative techniques are examined.

MASC 675. Leadership in Action. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Discusses dynamic leadership challenges on both a knowledge and skill basis, including results-driven decision-making in executive communication and overall management. Examines 21st-century topics such as fostering a diverse, equitable and inclusive workplace.

MASC 676. Media Law and Ethics. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Study of legal issues affecting the media industries. Analyzes contemporary issues and problems in conventional and new media. Discusses critical and unresolved issues within the legal and ethical framework of modern mass media practice.

MASC 679. Writing Across Modern Media. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Student will learn to take ideas and bring words to life across a number of media platforms. The writing will range from writing succinct professional emails to writing with AP style in a journalistic way.

MASC 682. Media Mechanics. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Focus on newsworthiness, the evolving media landscape, determining relevant and innovative outlets for the message and shaping a message for maximum impact. Includes techniques to effectively reach the media in order to amplify and leverage an organization's story.

MASC 683. Strategic Communications in the Global Environment. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Examines the phenomenon of global strategic communications, including the enabling environmental factors. How to develop an integrated, holistic global communications program and how to manage such a program. Students experience one region of the world with an in-depth study tour.

MASC 684. Multimedia Storytelling. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Students will learn how to create digital content that resonates with diverse audiences across varying mediums. They will learn how to best showcase and report multimedia stories across visual and audio platforms. News-driven projects will use new trends in technology in addition to photography, video, audio and data visualization.

MASC 685. Strategy. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Explores creative approaches to the strategic thinking process. Discusses best practices used to conceptualize high-level campaigns. Creates a framework for outcome-focused messaging. Students gain a mixed-methods approach to planning and problem solving at all levels of communication.

MASC 686. International Journalism. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Students will learn about trends in journalism practices around the world and examine the power and impact of global news media. They will gain a deeper understanding of the political, social, cultural, religious and other contextual factors that impact the operation of the press. Additional topics will include the structures of media ownership, the ethical and legal dimensions of international reporting and the role of technology in international journalism.

MASC 687. Entrepreneurial Media Management. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. This course explores entrepreneurial processes for communication professionals to develop startups, corporations or nonprofits. The material introduces communication professionals to the skills leaders need in developing entrepreneurial ventures including idea generation, business models, revenue sources, marketing and inclusive management of media businesses.

MASC 688. Converged Media Applications. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MASC 644 and 684. Graduate-level research and production focused on multimedia. Students will complete a significant multimedia project that draws on their experiences and the skills learned in other graduate courses.

MASC 691. Topics in Mass Communications. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. May be taken for a maximum total of six credits. An advanced study of a selected topic in mass communications. See the Schedule of Classes for specific topic(s) to be offered each semester.

MASC 692. Independent Study. 1-3 Hours.

Semester course; 1-3 credits. A maximum of 3 credits may be submitted toward the master's degree. Prerequisite: permission of instructor and director of graduate studies.

MASC 693. Practicum in Mass Communications. 1-6 Hours.

Semester course; variable hours. 1-6 credits. May be repeated for credit. Prerequisite: permission of director of graduate studies. Student participation in planned research or internship experience under the supervision of mass communications faculty. Graded as pass/fail.

MASC 694. Capstone. 3 Hours.

Semester course; 3 practicum hours (delivered online). 3 credits. Enrollment is restricted to students with a minimum of 21 graduate-level MASC credits completed. Students complete an experiential capstone project that allows them to demonstrate the skills they have learned in their previous course work.

MASC 695. Fieldwork/Internship. 1-3 Hours.

Semester course; variable hours. 1, 2 or 3 credits per semester. Maximum total of 3 credits toward graduation. Prerequisite: permission of director of graduate studies. Selected students will receive on-the-job training under the supervision of an instructor and the employer. Internships are available in newspapers, magazines, public relations, advertising, radio and television. Graded S/U/F.

MASC 697. Portfolio Development for Strategists. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MASC 653. Continues the development and demonstration of critical thinking skills, insights and creative abilities in a variety of areas sought by agency planning directors, media planning directors, management supervisors and recruiters. Development of concepts and materials necessary for the creation of mini-books and individual portfolios will be one of the main focal points. Independent projects pursued specifically for portfolio development also will be conducted.

MASC 699. Thesis. 1-3 Hours.

1-3 credits. May be repeated. A maximum of 3 credits may be submitted toward the master's degree.

Mathematics (MATH)**MATH 502. Abstract Algebra I. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: MATH 401 with a minimum grade of a C, or permission of instructor. A study of groups, subgroups, quotient groups and homomorphisms, group actions, sylow theorems, direct and semi-direct products, rings, integrals domains, and polynomial rings.

MATH 505. Modern Geometry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MATH 300; and MATH 307 or MATH 310, each with a minimum grade of C, or permission of instructor. Topics in Euclidean and non-Euclidean geometries from a modern viewpoint. A course geared toward students intending to teach secondary mathematics.

MATH 507. Bridge to Modern Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to student with graduate standing. Metric spaces, normed vector spaces, inner-product spaces and orthogonality, sequences and series of functions, convergence, compactness, completeness, continuity, contraction mapping theorem, and inverse and implicit function theorems.

MATH 511. Applied Linear Algebra. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 310 or permission of instructor. The algebra of matrices, the theory of finite dimensional vector spaces and the basic results concerning eigenvectors and eigenvalues, with particular attention to applications.

MATH 515. Numerical Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to student with graduate standing. Knowledge of a programming language or mathematical software package recommended. Theoretical derivation and implementation of numerical methods. Topics to include direct methods, data fitting, differentiation, integration and solutions to ordinary differential equations.

MATH 535. Introduction to Dynamical Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing. Theoretical and computational introduction to continuous and discrete dynamical systems with applications. Topics include existence and uniqueness of solutions, stability and bifurcations.

MATH 550. Combinatorics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MATH 211 or MATH 300; and MATH 350, both with a minimum grade of C; or permission of instructor. Topics include basic counting, binomial theorems, combinations and permutations, recurrence relations, generating functions, and basic graph theory with emphasis to applications.

MATH 553. Linear Optimization. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students in mathematical sciences or systems modeling and analysis programs or by permission of the instructor. Introduction to linear optimization and mathematical programming. Course addresses the simplex algorithm, duality, the primal-dual relationship, complementary slackness and optimality certificates. Other topics may include integer linear programming, relaxations, cutting planes and related applications, including matching theory and other classical combinatorial problems.

MATH 555. Dynamics and Multivariable Control I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 301 and 310 or the equivalent. Systems of differential equations with controls, linear control systems, controllability, observability, introduction to feedback control and stabilization. Crosslisted as: EGRE 555.

MATH 556. Graph Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MATH 211 or MATH 300; MATH 310; and MATH 356, each with a minimum grade of C; or permission of instructor. Introduction to graph classes, graph invariants, graph algorithms, graph theoretic proof techniques and applications.

MATH 585. Biomathematics Seminar. _____. 1 Hour.

Semester course; 2 lecture hours. 1 credit. Prerequisite: MATH 301 or permission of instructor. May be repeated with different thematic content. Opportunity for students to develop their understanding of the connection between mathematics and the areas of biology and medicine. Activities include reading of classical and contemporary research literature, attending seminar talks and class discussions.

MATH 591. Topics in Mathematics. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for credit with different topics. Prerequisite: permission of the instructor. Open to qualified undergraduates. A study of selected topics in mathematical sciences. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

MATH 592. Teaching and Communicating Mathematics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to graduate or professional students. This course focuses on the art and science of teaching and communicating mathematics in both higher education and nonacademic settings. Throughout the course students will explore and critically examine research on evidence-based teaching practices. In addition, the course will focus on how the skills students are developing as teaching assistants can transfer to nonacademic careers. This course will not count toward degree requirements for any program. Graded as S/U/F.

MATH 593. Internship in Mathematical Sciences. 3,6 Hours.

Semester course; variable hours. 1-6 credits. May be repeated for credit. Student participation in a planned educational experience under the supervision of a mathematical sciences faculty member. The internship may include supervised teaching, statistical consulting or participation in theoretical or applied research projects. A grade of P may be assigned students in this course. May be applied toward the degree in mathematical sciences only with the permission of the graduate affairs committee.

MATH 602. Abstract Algebra II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 502. A study of modules, vector spaces, field extensions and Galois theory.

MATH 607. Measure and Integration Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Math 507. Measurable sets and functions, sets of measure zero, Borel sets, Lebesgue measure and integral, fundamental convergence theorems, L_p spaces, and foundations of probability theory.

MATH 610. Advanced Linear Algebra. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Vector spaces, bases and dimension, change of basis. Linear transformations, linear functionals. Simultaneous triangularization and diagonalization. Rational and Jordan canonical forms.

MATH 615. Iterative Numerical Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 515. Theoretical development of solutions to large linear and nonlinear systems by iterative methods with consideration given to optimal implementation.

MATH 632. Ordinary Differential Equations I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MATH 507 and MATH 535. Linear systems theory; existence, uniqueness and continuous dependence for nonlinear systems; invariant manifolds; stable manifold theorem; Hartman-Grobman theorem; Lyapunov stability theory; Hamiltonian and gradient systems.

MATH 633. Partial Differential Equations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 507. Classification of partial differential equations, initial and boundary value problems, well-posedness; first-order equations and methods of characteristics; wave equation; heat equation, transform methods, maximum principle, energy methods; Laplace's equation. Other topics may vary depending on the interest of the students and the instructor.

MATH 640. Mathematical Biology I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 535. Mathematical modeling in the biological and medical sciences. Topics will include continuous and discrete dynamical systems describing interacting and structured populations, resource management, biological control, reaction kinetics, biological oscillators and switches, and the dynamics of infectious diseases.

MATH 650. Advanced Combinatorics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 550. Topics include advanced applications of the pigeonhole principle and inclusion-exclusion principle, recurrence relations, generating functions, special counting sequences, Ramsey theory, and combinatorial designs and codes.

MATH 656. Advanced Graph Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 556. This course lays a rigorous theoretical foundation for further advanced study in graph theory. Topics may include connectivity, matching, planarity, coloring, Hamiltonian cycles and topological graph theory, as well as further advanced material.

MATH 661. Number and Operations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Ways of representing numbers, relationships between numbers, number systems, the meanings of operations and how they relate to one another, and computation within the number system as a foundation for algebra; episodes in history and development of the number system; and examination of the developmental sequence and learning trajectory as children learn number concepts. A core course for preparation as a K-8 mathematics specialist. Not applicable to M.S. in Mathematical Sciences.

MATH 662. Geometry and Measurement. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explorations of the foundations of informal measurement and geometry in one, two and three dimensions. The van Hiele model for geometric learning is used as a framework for how children build their understanding of length, area, volume, angles and geometric relationships. Visualization, spatial reasoning and geometric modeling are stressed. As appropriate, transformational geometry, congruence, similarity and geometric constructions will be discussed. A core course of preparation as a K-8 mathematics specialist. Not applicable to M.S. in Mathematical Sciences.

MATH 663. Functions and Algebra. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examination of representation and analysis of mathematical situations and structures using generalization and algebraic symbols and reasoning. Attention will be given to the transition from arithmetic to algebra, working with quantitative change, and the description of and prediction of change. A core course for preparation as a K-8 mathematics specialist. Not applicable to M.S. in Mathematical Sciences.

MATH 664. Statistics and Probability. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An introduction to probability, descriptive statistics and data analysis; exploration of randomness, data representation and modeling. Descriptive statistics will include measures of central tendency, dispersion, distributions and regression. Analysis of experiments requiring hypothesizing, experimental design and data gathering. A core course for preparation as a K-8 mathematics specialist. Not applicable to M.S. in Mathematical Sciences.

MATH 665. Rational Numbers and Proportional Reasoning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Basic number strands in fractions and rational numbers, decimals and percents; ratios and proportions in the school curriculum. Interpretations, computations and estimation with a coordinated program of activities that develop both rational number concepts and skills and proportional reasoning. A core course for preparation as a K-8 mathematics specialist. Not applicable to M.S. in Mathematical Sciences.

MATH 667. Functions and Algebra II. 3 Hours.

Semester course; 3 lecture hours, 3 credits. Prerequisite: Math 663 or equivalent. Examination of the K-8 strands related to algebra. A study of linear, exponential and quadratic functions. Use of number lines, coordinate axes, tables, graphing calculators and manipulatives to understand core algebraic ideas and real-world contexts. Course provides preparation for K-8 mathematics specialists. Not applicable to M.S. in Mathematical Sciences.

MATH 668. Modeling With Mathematics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MATH 662, MATH 663 and MATH 665, or permission of the instructor. An in-depth study of mathematical modeling for K-8 mathematics, including an examination of the history and development of modeling real-world situations, different types of and purposes for mathematical models, modeling for various STEM contexts, designing modeling tasks, teaching and assessing with mathematical modeling. A core course for preparation as a K-8 mathematics specialist. Not applicable to M.S. in Mathematical Sciences.

MATH 690. Research Seminar. 2 Hours.

Semester course; 2 lecture hours; 2 credits. Enrollment is restricted to students with graduate standing. Discussion of topics in the mathematical sciences stimulated by independent reading in selected area. Each student will give at least one oral presentation and complete an expository writing assignment.

MATH 691. Special Topics in Mathematics. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for credit. Prerequisite: permission of instructor. A detailed study of selected topics in mathematics. Possible topics include commutative rings and algebras, topological groups, special functions, Fourier analysis, abstract harmonic analysis, operator theory, functional analysis, differential geometry, Banach algebras and control theory.

MATH 697. Directed Research. 1-3 Hours.

Semester course; variable hours. 1-3 credits per semester. May be repeated for credit. Prerequisite: graduate standing. Supervised individual research and study in an area not covered in the present curriculum or in one which significantly extends present coverage. Research culminates with an oral presentation and submission of a written version of this presentation to the supervising faculty member.

MATH 698. Thesis. 1-3 Hours.

Hours to be arranged. 1-3 credits. A total of 3 or 6 credits may be applied to the M.S. in Mathematical Sciences/Applied Mathematics or to the M.S. in Mathematical Sciences/Mathematics. May be repeated for credit. Prerequisite: graduate standing. Independent research culminating in the writing of the required thesis as described in this bulletin. Grade of S/U/F may be assigned in this course.

MATH 707. Functional Analysis I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 507. Banach and Hilbert spaces, bounded linear maps, Hahn-Banach theorem, open mapping theorem, dual spaces, weak topologies, Banach-Alaoglu theorem, reflexive spaces, compact operators, spectral theory in Hilbert spaces.

MATH 715. Numerical Solutions for Differential Equations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 515 or MATH 615. Students will use the finite difference method and the finite element method to solve ordinary and partial differential equations. Course will explore the theoretical underpinnings of the techniques and implement the methods to solve a variety of equations.

MATH 727. Topics in Analysis: _____. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit with different topics. A detailed study of selected topics, which may include complex analysis, geometric analysis, harmonic analysis, mathematical logic, nonlinear functional analysis, nonstandard analysis and variational analysis.

MATH 732. Ordinary Differential Equations II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 632. Center manifold theory; normal form theory; oscillations in nonlinear systems; local bifurcation theory of equilibria and periodic orbits.

MATH 750. Topics in Combinatorics: _____. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated with different topics for credit. Prerequisite: MATH 650. A detailed study of selected topics, which may include probabilistic methods, linear algebra methods, extremal problems, partially ordered sets and symmetric functions.

MATH 756. Topics in Graph Theory: _____. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated with different topics for credit. Prerequisite: MATH 656. A detailed study of selected topics, which may include extremal graph theory, spectral graph theory, infinite graphs, random graphs and graph minors.

MATH 769. Topics in Applied Mathematics: _____. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated with different topics for credit. A detailed study of selected topics, which may include advanced partial differential equations, discrete dynamical systems, fluid dynamics, computational physiology, disease dynamics, kinetic theory, optimal transportation, numerical optimization and population dynamics.

Media, Art, and Text (MATX)**MATX 601. Texts and Textuality. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Explores theories of texts and textuality as they relate to the study of media, the arts and discourse of any kind.

MATX 602. History of Media, Art, and Text. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the history of communication technologies in their social and cultural contexts, with an emphasis on the development of contemporary digital technology and new media. Students will explore how the interactions between communication practices and technologies are related to institutions, identity formation, cultural values, social practices and economic conditions.

MATX 603. Mass Media. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the history of mass media and the leading theories, concepts and methods for mass media research.

MATX 604. Interdisciplinary Workshop. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to first-year MATX students. Students gain an understanding of current interdisciplinary theory and practice across media, art, and text. Examination of real-world examples provides a foundation for academic and professional careers in today's interdisciplinary digital environment. Workshopping of students' preliminary dissertation ideas, conference abstracts, teaching portfolios and professional websites develops content and skills needed for the MATX e-portfolio. Graded as pass/fail.

MATX 690. Seminar in Media, Art, and Text. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Graduate-level research and reading centered on interdisciplinary study.

MATX 696. Internship. 1-3 Hours.

Semester course; variable hours. 1-3 credits; may be repeated for a maximum of 6 credits. Planned experiences approved by student's adviser under the supervision of professionals and evaluated by university faculty.

MATX 791. Directed Study. 1-3 Hours.

Semester course; variable hours. 1-3 credits; may be repeated for credit. Focuses on a selected topic chosen by student and approved by student's adviser.

MATX 897. Dissertation Project. 1-12 Hours.

Semester course; variable hours. 1-12 credits; may be repeated for credit. Research and work leading to the completion of the dissertation project.

Nanoscience and Nanotechnology (NANO)**NANO 530. Nanomaterials Characterization Techniques. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This course will explore a select number of fundamental topics that are essential to nanoscience and nanotechnology. Topics will be developed to a basic understanding of the scientific principles and technological methods that are employed in research in experimental nanoscience. Theoretical concepts are only briefly introduced when they are needed. The following topics will be examined: ultra-high vacuum system and techniques, surface structure and characterization techniques, surface electronic properties, elements of crystallography, theory of electronic lenses, interactions of electrons with solids, elements of image processing techniques.

NANO 570. Nanoscale Physics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course builds a fundamental understanding of the unique properties of materials with nanoscale dimensions and emphasizes the physics and thermodynamics underlying several phenomena encountered in nanotechnology. The course starts from a general description of size effects and then moves to describe the fundamental aspects of nanocluster physics such as magic numbers, and concludes with a description of the theory and fabrication of nanoscale devices. Suggested background: PHYS 380.

NANO 571. Nanoscale Chemistry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course builds a fundamental understanding of the unique chemical properties of materials with nanoscale dimensions and emphasizes the synthetic chemistry encountered in nanotechnology. The course starts from a description of crystallization and growth models and concludes with discussion of several different synthetic approaches of nanoscale systems. Suggested background: PHYS 380.

NANO 630. Experimental Techniques in Nanoscience. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will explore a select number of fundamental topics that are essential to nanoscience and nanotechnology. Topics will be developed to a basic understanding of the scientific principles and technological methods that are employed in research in experimental nanoscience. Theoretical concepts are only briefly introduced when they are needed. The following topics will be examined: ultra-high vacuum system and techniques, surface structure and characterization techniques, surface electronic properties, atomic motion and vibration on solid surface, semiconductor surfaces and interfaces, nanofabrication techniques.

NANO 650. Experimental Techniques in Nanoscience I. 1.5 Hour.

Semester course; 1.5 lecture hours. 1.5 credits. The course will focus on a variety of instrumental methods and techniques commonly applied to the characterization of nanomaterials. Particular attention will be placed on the theory behind the measurements, instrument safety, sample preparation and data analysis/interpretation. Topics will focus on X-ray, optical and electron characterization techniques. Suggested background: CHEM 409 or PHYS 450.

NANO 651. Experimental Techniques in Nanoscience II. 1.5 Hour.

Semester course; 1.5 lecture hours. 1.5 credits. The course will focus on a variety of instrumental methods and techniques commonly applied to the characterization of nanomaterials. Particular attention will be placed on the theory behind the measurements, instrument safety, sample preparation and data analysis/interpretation. Topics will cover morphological and physical properties characterization tools. Suggested background: CHEM 409 or PHYS 450.

NANO 660. Theoretical Studies of Nanostructures. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CHEM 660 or PHYS 580. Introduction to theoretical techniques needed to study electronic and magnetic properties of nanostructures. Covers theoretical first-principles approaches to study electronic structure of molecules, clusters, nanostructure materials and condensed matter, including determination of geometry and electronic states. Will also cover magnetic properties in reduced sizes, including quantum effects and the model Hamiltonians. A brief discussion of effective interatomic molecular potentials and their application in monte-carlo and molecular dynamics methods will be included, as well as a discussion of application of nanomaterials to medical areas. Suggested background: CHEM 660 or PHYS 580.

NANO 661. Computational Nanoscience. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CHEM 511, CHEM 512 or CHEM 612. Open only to students admitted to the Nanoscience and Nanotechnology Ph.D. program. Introduction to computational methods used to model true nanostructures containing more than 10^5 atoms and whose assembly, morphology and properties are governed by noncovalent interactions. Structural and dynamic aspects of the computational methods will be covered throughout the course. Applications to nanotechnology and environmental cleanup will be covered through special topics assignments during the semester and discussed by the end of the course.

NANO 690. Research Seminar in Nanoscience and Nanotechnology. 1 Hour.

Semester course; 2 lecture hours. 1 credit. May be repeated for credit. In addition to reports presented by staff and visiting lecturers, current problems and developments in nanoscience and nanotechnology are discussed. Graded S/U/F.

NANO 692. Nanoscience Seminar Presentation. 1 Hour.

Semester course; 2 lecture hours. 1 credit. May be repeated for credit. In addition to reports presented by students, staff and visiting lecturers, current problems and developments in chemistry are discussed.

Operations Research (OPER)**OPER 527. Optimization I. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: graduate status in mathematical sciences or systems modeling and analysis, or permission of the instructor. Introduction to optimization and mathematical programming. Course addresses fundamental concepts of optimization (such as optimality conditions and duality) as well as the construction, solution, analysis and application of linear programming and network models. Emphasis is placed on using software to solve problems as well as on understanding its underlying methodology. Integer programming models will be introduced. Students may not receive degree credit for both OPER 427 and OPER 527.

OPER 528. Stochastic Simulation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: graduate status in mathematical sciences, systems modeling and analysis, or decision sciences and business analytics, or permission of the instructor. An introduction to stochastic discrete-event simulation. The course covers simulation modeling and programming in general-purpose languages (e.g., VBA for Excel) and (briefly) in specialized simulation environments (e.g., Arena, @Risk). The probability foundations of stochastic simulation of stochastic processes, random number and variate generation, variance reduction techniques, and proper design and analysis of the simulation experiment are emphasized. Applications are drawn from manufacturing, finance, logistics and service systems. Students may not receive degree credit for both OPER 428 and OPER 528.

OPER 591. Topics in Operations Research. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be taken more than once for credit. Prerequisite: permission of the instructor. A detailed study of selected topics in operations research.

OPER 627. Optimization II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: OPER 527. This course will address basic theory and algorithms for nonlinear optimization (unconstrained and constrained). Both theoretical foundations and practical implementations of optimization algorithms will be covered.

OPER 635. Network Models and Graph Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: OPER 527 or permission of the instructor. This course will focus on optimization models for network problems, as well as on the underlying graph theoretic structure for such models. Emphasis will be on solution procedures and applications with some discussion of related implementation issues. The course will concentrate on the study of polynomial-time algorithms for well-solved problems. May also include treatment of solution techniques for NP-hard network problems. Possible topics for the course include, but are not limited to, maximum flows/minimum cuts in networks, minimum spanning trees, minimum cost flows, matching and assignment, shortest path problems, traveling salesman problems and multicommodity flows.

OPER 636. Machine Learning Algorithms. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate status in mathematical sciences, systems modeling and analysis, decision sciences and business analytics, or computer science, or by permission of the instructor. Includes an in-depth analysis of machine learning algorithms for data mining, equipping students with skills necessary for the design of new algorithms. Analyses will include framing algorithms as optimization problems and a probabilistic analysis of algorithms. Students will be exposed to current areas of research in the construction of data mining algorithms. Crosslisted as: STAT 636.

OPER 639. Practical Optimization. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: OPER 527. The application of optimization theory toward the solution of practical problems in operations research. The use and analysis of computer programs available to solve such problems. The algorithms used in these programs will be discussed from a practical and theoretical point of view.

OPER 641. Stochastic Simulation and Monte Carlo Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 513 and either STAT 503 or STAT 613. Addresses the methodological foundation of applying stochastic modeling and simulation with a focus on introducing simulation concepts through examples, algorithms and experiments. Topics include simulation output analysis, input modeling, simulation optimization, steady-state simulation, variance reduction techniques, sensitivity analysis and Monte Carlo optimization.

OPER 643. Decision and Risk Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: graduate status in mathematical sciences, systems modeling and analysis, or decision sciences and business analytics, or permission of the instructor. This course presents the decision and risk analysis theory and methodology. Decision analysis applies to hard problems involving sequential decisions, major uncertainties, significant outcomes and complex values. The course includes: decision structuring with influence diagrams and decision trees; modeling uncertainty with subjective probabilities; sensitivity analysis and the value of information; and modeling preferences with utility functions. Decision and risk analysis applications in business and government are considered.

OPER 645. Queuing Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate status in mathematical sciences or systems modeling and analysis, or permission of the instructor. This operations research course provides a development of some basic queuing systems. Such systems will include birth-death queues, as well as the M/G/1 and GI/M/S queuing systems. Other topics may include the GI/G/1 queues, overflow queues and some basic queuing networks.

OPER 647. Multiobjective Decision Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate status in mathematical sciences, systems modeling and analysis, or decision sciences and business analytics, or permission of the instructor. Introduction to the mathematical foundations of multiattribute utility theory. Topics covered include: structuring objectives; tradeoffs under certainty; unidimensional utility theory; multiattribute preferences under uncertainty; preferences over time; and aggregation of individual preferences. Real world applications will be discussed throughout.

OPER 648. Systems Reliability Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate status in mathematical sciences or systems modeling and analysis, or permission of the instructor. An introduction to engineering reliability and risk analysis, specifically failure data analysis, maintenance problems, system reliability and probabilistic risk assessment. Applications in computer science and engineering will include stochastic characterization of wear in hardware systems and the development of failure models for software systems. Decision problems such as the optimal maintenance of repairable systems and optimal testing policies for hardware and software systems will be examined. The analysis of risk through fault trees, event trees and accident precursor analysis also will be discussed. Crosslisted as: STAT 648.

OPER 649. Statistical Quality Control. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate status in mathematical sciences or systems modeling and analysis, or permission of the instructor. Demonstrates how statistics and data analysis can be applied effectively to process control and management. Topics include the definition of quality, its measurement through statistical techniques, variable and attribute control charts, CUSUM charts, multivariate control charts, process capability analysis, design of experiments, and classical and Bayesian acceptance sampling. Statistical software will be used to apply the techniques to real-life case studies from manufacturing and service industries. Crosslisted as: STAT 649.

OPER 691. Special Topics in Operations Research. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be taken more than once for credit. Prerequisite: permission of the instructor. A detailed study of selected topics in operations research.

OPER 696. Applied Project. 1-3 Hours.

Semester course; 1-3 lecture hours (to be arranged). 1-3 credits. Up to three credits will be applied to the M.S. in Mathematical Sciences (operations research or statistics concentration) per section. Can be repeated for credit. Prerequisite: SSOR 690 or permission of the faculty adviser. Designed to allow students to apply concepts and theories learned in other courses to a practical situation. Includes the selection, written description, completion and written report of the project and a presentation of the findings. Students may not receive credit for both OPER/STAT 696 and OPER/STAT 698. Graded as Satisfactory/Unsatisfactory. Crosslisted as: STAT 696.

OPER 697. Directed Research. 1-3 Hours.

Semester course; variable hours. 1-3 credits. May be taken more than once for credit. Prerequisite: graduate standing. Supervised individual research and study in an area not covered in the present curriculum or in one which significantly extends present coverage. Research culminates with an oral presentation and submission of a written version of this presentation to the supervising faculty member.

OPER 698. Thesis. 1-3 Hours.

Hours to be arranged. 1-3 credits. A total of 3 or 6 credits may be applied to the M.S. in Mathematical Sciences/Operations Research. (A total of 3 credits for an expository thesis or a total of 6 credits for a research thesis.) May be taken more than once for credit. Prerequisite: graduate standing. Independent research culminating in the writing of the required thesis as described in this bulletin. Grade of S/U/F may be assigned in this course.

OPER 731. Discrete Optimization. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: OPER 527. Provides the theoretical background necessary to design and evaluate advanced solution techniques for discrete optimization problems. Topics include theory of polyhedra and valid inequalities for integer programming models, matchings, computational complexity, and sufficient conditions for integer programs to be polynomially solvable. Scheduling, packing, covering and routing models will also be examined.

OPER 732. Stochastic Optimization. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: OPER 527 and STAT 613 or equivalent courses; or permission of the instructor. Enrollment is restricted to students with graduate standing in mathematical sciences or systems modeling and analysis. This course introduces modern methodologies in stochastic optimization with a focus on combining statistical learning and optimization. Topics include learning policies, sequential learning, adaptive learning, stochastic approximation, Bayesian learning, simulation optimization, information policies, uncertainty analysis, and ranking and selection. Real-world applications will be discussed throughout with use of computer software.

OPER 736. Mathematics of Knowledge and Search Engines. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: STAT 636 or equivalent. Investigates the mathematics, methods and algorithms for searching for and extracting structures of interest (knowledge) from large and possibly high-dimensional datasets. The motivation is the rapid and phenomenal growth of the search engine (as demonstrated by Google) as a major tool for search on the Internet, which has impacted commerce, education and the study of social, financial and scientific datasets. The development of the mathematical and statistical learning algorithms behind these search engines has led to advances in how large, high-dimensional datasets can be effectively analyzed for the extraction of knowledge. Crosslisted as: STAT 736.

OPER 741. Advanced Stochastic Simulation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: STAT 513, OPER 528 and either OPER 503 or 613, or permission of the instructor. This is an advanced-level course on stochastic modeling and simulation. State-of-the-art topics on simulation theory and methodology will be taught through lectures and guided literature review. Tentative topics include advanced simulation output analysis, simulation optimization, steady-state simulation, nested simulation, metamodeling, variance reduction (stratification, importance sampling, quasi-Monte Carlo, etc.).

OPER 743. Decision Analysis II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: OPER 643 or OPER 647. Introduces the current areas of research in the field of decision analysis, which applies to hard problems involving sequential decisions, major uncertainties, significant outcomes and complex values. Includes current research in decision structuring and representation, modeling uncertainty with subjective probabilities, modeling preferences with utility functions and modeling multiattribute preferences.

OPER 791. Special Topics in Operations Research. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for credit. Prerequisite: permission of instructor. A detailed study of selected advanced topics in operations research.

Philosophy (PHIL)**PHIL 521. Aesthetics. 3 Hours.**

Semester courses; 3 lecture hours. 3, 3 credits. A critical survey of aesthetics from antiquity to the 20th century. First semester: antiquity to the Renaissance; Second semester: the Renaissance to the present. Topics to be considered include the nature of art, aesthetic experience, the aesthetic analysis in the arts of painting, music, architecture and the motion picture.

PHIL 522. Aesthetics. 3 Hours.

Semester courses; 3 lecture hours. 3, 3 credits. A critical survey of aesthetics from antiquity to the 20th century. First semester: antiquity to the Renaissance; Second semester: the Renaissance to the present. Topics to be considered include the nature of art, aesthetic experience, the aesthetic analysis in the arts of painting, music, architecture and the motion picture.

PHIL 591. Topics in Philosophy. 1-4 Hours.

Semester course; variable hours. 1-4 credits. Prerequisite: written permission of instructor or graduate standing. A graduate-level, in-department study of an individual philosopher, a particular philosophical problem or a narrowly defined period or school. See the Schedule of Classes for specific topics to be offered each semester.

PHIL 592. Independent Study. 1-4 Hours.

Semester course; 1-4 credits. An independent study course to allow graduate students to do research, under the direction of a professor qualified in that field, in an area of major interest.

PHIL 601. Principles of Ethics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing. An examination of major ethical theories and their application to contemporary issues in medicine, science and public policy.

PHIL 602. Biomedical Ethics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An examination of ethical theory and its application to moral problems in medicine and biotechnology.

PHIL 635. Philosophy of the Social Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A philosophical study of the nature of science and scientific explanation, with emphasis upon the social sciences. Topics include the philosophical analysis of objectivity in the social sciences, theories of human action and the relation of social sciences to the physical sciences.

PHIL 683. Administrative Ethics. 2,3 Hours.

Semester course; 2 or 3 lecture hours. 2 or 3 credits. A philosophical investigation into the problems of making ethical decisions, focusing on issues likely to confront the public administrator. Examples of such issues are equity in social services delivery, affirmative action, loyalty to the bureaucracy vs. "whistle blowing," and conflicts of interest between personal and public interest. Crosslisted as: PADM 683/GVPA 683.

PHIL 691. Topics in Philosophy. 1-4 Hours.

Semester course; variable hours. 1-4 credits. Prerequisite: written permission of instructor or graduate standing. A graduate-level, in-depth study of an individual philosopher, a particular philosophical problem, or a narrowly defined period or school. See the Schedule of Classes for specific topics to be offered each semester.

PHIL 692. Independent Study. 1-4 Hours.

Semester course; variable hours. 1-4 credits. Open to graduate students only. An independent study course to allow graduate students to do research, under the direction of a professor qualified in that field, in an area of major interest.

PHIL 713. Ethics and Public Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Doctoral students only. An examination of the main theories of morality and justice. These theories' implications for public policy will be discussed.

Physics (PHYS)**PHYS 508. The Physical Science of Space for Teachers. 3 Hours.**

Semester course; 3 credits. Prerequisites: B.S. or B.A. degree with at least two mathematics and two science courses or permission of instructor. The course is designed for the secondary physical science and physics teachers. The physical science phenomena of the solar system and the universe: mechanics, electromagnetism, optics and energy are presented for the teacher. The course curriculum closely follows the Virginia Science Standards of Learning for Physics and Physical Science. The course makes use of the Virginia Science Museum's interactive physical science exhibit galleries (aerospace, force and motion, waves and patterns, light and vision matter, crystals and electromagnetism as well as the Digistar planetarium and telescopes).

PHYS 509. Experiencing Science for Teachers. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: B.S. or B.A. degree with at least two mathematics and two science courses or permission of instructor. Designed to give physical science and physics teachers an understanding of the methods and processes actually used by scientists in different disciplines. Students repeat classic experiments, read from original works, keep detailed research journals, participate in laboratory experiments, engage in the peer review process and present results of projects in colloquium format. The course meets at the Science Museum of Virginia and uses the interactive science exhibits; visits to science sites in the area.

PHYS 510. Physical Science Demonstrations. 3 Hours.

Semester course; 3 credits. Prerequisite: PHYS 509 or permission of instructor. The course is designed to give the working secondary physical science and physics teacher a depth of experience in designing and effectively using experiments to interpret phenomena for students. Participants learn the essentials of developing effective apparatus for investigations, interactive exhibits and demonstrations in the physical sciences. Students will undertake and present a major project as part of the course.

PHYS 514. Modeling Biocomplexity. 3 Hours.

Semester course; 2.5 lecture and .5 laboratory hours. 3 credits. Prerequisite: one year of calculus. Introduction to the modeling and simulation of the behavior of complex biological systems, including models in both continuous and discrete time. Numerical methods using mathematica, analytical methods using calculus and laboratory experiments using computer interfaces will be used to study population dynamics and the behavior of physiological systems exhibiting such properties as oscillations and chaotic biological dynamics. Crosslisted as: BNFO 514.

PHYS 522. Optics and Laser Physics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHYS 376 or permission of instructor. The purpose of this course is to introduce a range of topics from optics and the principles of laser operation. Topics include waves, physical optics, geometric optics, superposition, interference, polarization, diffraction, Fourier optics, coherence, lasers, second quantization.

PHYS 550. Techniques in Material Research. 3 Hours.

Semester course; 4 laboratory and 2 lecture hours. 3 credits. Prerequisite: PHYS 450 or graduate standing. This course focuses on the application of modern characterization techniques in materials research. Techniques to be studied include high-resolution X-ray diffraction, low-energy electron diffraction, light-energy electron diffraction, scanning-tunneling microscopy, molecular beam epitaxy, Auger electron spectroscopy and X-ray photoemission spectroscopy.

PHYS 560. Fundamentals of Semiconductor Nanostructures. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course provides an introduction to the fundamentals in physics of semiconductors with emphasis on low-dimensional structures such as quantum wells, quantum dots, nanorods, etc. Particular attention is placed on the effects of the surface and small sizes on electrical and optical properties of semiconductor materials and devices.

PHYS 571. Theoretical Mechanics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PHYS 376 and PHYS 380, or graduate standing. An introduction to advanced dynamics involving the Lagrangian and Hamiltonian formalisms.

PHYS 573. Analytical Methods in Physics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PHYS 376 and PHYS 380, or graduate standing. Theoretical and numerical techniques in solving differential equations in condensed matter. Classification of electronic states in solids and clusters using groups, infinite series approximations, calculus of residues and causality.

PHYS 576. Electromagnetic Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHYS 571. Maxwell's equations of electromagnetism, vector and scalar potentials, electromagnetic waves and radiation theory.

PHYS 580. Quantum Mechanics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHYS 571. Theoretical quantum descriptions with emphasis upon mathematical techniques. Schrodinger equation, hydrogen atom, eigenfunctions and eigenvalues, angular momentum and spin and perturbation theory.

PHYS 583. Geometrical Methods of Physics and Gravitation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PHYS 571 and PHYS 573 or permission of instructor. Introduction to the language of differential geometry that is needed for research in gravitation and cosmology. Topics include tensors, connections on manifolds, gauge-invariant field theories and Einstein's theory of general relativity. Examples include black holes and cosmological solutions of Einstein's field equations.

PHYS 591. Topics in Physics. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Open to graduate students and to undergraduate students with advanced standing. An in-depth study of a selected topic in advanced physics. See the Schedule of Classes for specific topics to be offered each semester and prerequisites. Applicable toward physics major requirements.

PHYS 640. Equilibrium Statistical Physics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PHYS 571 and PHYS 580. Fundamentals of equilibrium statistical physics. Topics include review of thermodynamics, canonical and grand canonical partition functions, mean-field theories, Ising and Bragg-Williams models, Landau theory, fluctuations about the mean field, critical phenomena, exact solution to the one-dimensional Ising model, two-dimensional Ising model and the renormalization group.

PHYS 641. Solid State Physics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PHYS 571 and PHYS 580. Study of structure and electronic properties of materials in the solid phase.

PHYS 650. Subatomic Physics I. 3 Hours.

Semester course; 3 credits. Prerequisites: PHYS 576, PHYS 580 and CHEM 510. Studies of nuclei and elementary particles, reaction dynamics, particle accelerators, detection devices, particle classification, symmetries and conservation laws, quantum electrodynamics, the weak interaction, quantum chromodynamics, unified theories, the nuclear shell model and collective model, and nuclear reactions. Offered in cooperation with Virginia State University.

PHYS 651. Subatomic Physics II. 3 Hours.

Semester course; 3 credits. Prerequisite: PHYS 650. A continuation of PHYS 650. Offered in cooperation with Virginia State University.

PHYS 661. Surface and Materials Physics. 3 Hours.

Semester course; 3 credits. Prerequisites: PHYS 641, CHEM 510 or permission of instructor. This course will focus on the physics of surface, interfacial and other nanostructured material systems, and the experimental techniques used to assay their geometric and electronic properties. Topics include ultra-high vacuum techniques and design, surface geometric and electronic structure, adsorbates on surfaces and interface formation, thin film growth, and layered systems. Characterization techniques to be discussed include geometric probes (STM, AFM, RHEED, LEED, AFM, XRD) and synchrotron radiation-based electronic structure probes (PES, SXF, NEXAFS).

PHYS 663. Studies in Nuclear Physics. 3 Hours.

Semester course; 3 credits. Credits for only two televised courses will count toward degree requirements. Courses televised by the Virginia Cooperative Graduate Engineering Program. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

PHYS 670. Conceptual Physics for Teachers I. 3 Hours.

Semester course; 4 studio hours. 3 credits. Prerequisites: PHYS 508, PHYS 509 and PHYS 510, or permission of instructor. First of the sequence 670-672. Development of the methodology for the experimental design at middle and high school level, concentrating on the science of measurement, materials structure and characterization, and light and optical properties of matter. The 670-672 sequence uses and develops computer-based experiments and interactive multimedia materials for use in the classroom. The course contains examples of vertical integration of technological applications of physical principles across disciplines.

PHYS 671. Conceptual Physics for Teachers II. 3 Hours.

Semester course; 4 studio hours. 3 credits. Prerequisite: PHYS 670 or permission of instructor. Second of the sequence PHYS 670-672. Development of the methodology for experimental design at middle and high school level, concentrating on sound and acoustics, electromagnetism and classical mechanics.

PHYS 672. Conceptual Physics for Teachers III. 3 Hours.

Semester course; 4 studio hours. 3 credits. Prerequisite: PHYS 671 or permission of instructor. Third of the sequence PHYS 670-672. Development of the methodology for the experimental design at middle and high school level, concentrating on heat, thermodynamics and modern physics.

PHYS 680. High Bandwidth Nanoscale Control, Positioning and Dynamics. 2 Hours.

Semester course; 1 lecture and 2 laboratory hours. 2 credits. This course introduces students to key concepts for nanoscale measurement and guides them through the process of developing instrumentation for the measurement, fabrication and characterization of nanoscale features and structures. Key skills learning will include programming, data analysis, instrument control and automation.

PHYS 690. Research Seminar. 1 Hour.

Semester course; 1 credit. May be repeated for a maximum of 4 credits. Examines current problems and developments in physics.

PHYS 691. Special Topics. 3 Hours.

Semester course; 3 credits. Prerequisites: at least one graduate-level physics course and permission of instructor. Selected topics in physics from such areas as statistical physics, quantum field theory, semiconductor device physics, general relativity, electronic structure of solids, thin-film fabrication techniques, superconductivity, nuclear magnetic resonance techniques, crystallography and nuclear physics.

PHYS 697. Directed Research. 1-15 Hours.

Semester course; 1-15 credits. May be repeated for credit. Prerequisites: at least one graduate-level physics course and permission of instructor. Research leading to the M.S. or Ph.D. degree.

Political Science (POLI)**POLI 591. Topics in Political Science. 3 Hours.**

Semester course; 3 credits. An in-depth study of a selected topic in political science in a seminar environment. Intended for small groups of students interested in examining issues and problems related to aspects of the political processes.

Psychology (PSYC)**PSYC 601. Foundations of Applied Developmental Psychology. 3 Hours.**

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: graduate standing in the psychology program or permission of instructor. An introduction to developmental research and theory on applied research topics. Topics include ethical issues in applied developmental science, culture, ethnicity and child development, poverty, child abuse, nontraditional families, childcare, family instability, early childhood intervention and parenting.

PSYC 602. Psychology of Aging. 3 Hours.

Semester course; 3 seminar hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment requires permission of instructor. Students must complete social sciences research methods before taking this course. Psychological adjustment in late life; special emphasis on personality, cognitive and emotional development; life crises associated with the aging process. Crosslisted as: GRTY 602.

PSYC 603. Developmental Processes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Cognitive, social, personality and behavioral development across the life span is considered, with special attention to theories of development.

PSYC 604. Social Psychology of Business and Industry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PSYC 630 or permission of instructor. The theme is the influence of organizational structure on behavior. Topics will include motivation, attitudes, job satisfaction, morale, leadership and supervision.

PSYC 605. Social Development. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: PSYC 603 or permission of instructor. The development of social relations, focusing primarily on infancy and childhood, but also considering adulthood and aging. Attachment, parent-child interaction, peers, siblings, aggression, sex-roles, cultural determinants, deprivation and remediation, social cognition, adulthood changes, parenthood. Critical evaluation of theory and current research.

PSYC 606. Development in Middle Childhood. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Prerequisite: graduate standing in the psychology program or permission of instructor. An introduction to theory and research on children during middle childhood. Topics include language, intelligence, early education, schooling, social cognition, theory of mind, attachment, social competence, emotions and socialization.

PSYC 608. Research in Counseling Psychology. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: Graduate standing in the counseling psychology program or permission of counseling committee. An introduction to the theoretical, procedural, methodological and ethical issues encountered during the conduct of empirical research in counseling psychology. Topics include the empirical analysis of such mainstream counseling research activities as assessment, interventions, consultation, supervision, training, psychosocial factors in health and prevention, career development, the study of diversity and underrepresented populations, and professional issues in counseling psychology.

PSYC 609. Contemporary Issues in Clinical Psychology. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: first-year graduate standing in clinical psychology or permission of the instructor. Informs first-year doctoral students of the philosophy behind the training model and the requirements of the doctoral program in clinical psychology in the context of the current status of contemporary issues in the field. Includes coverage of traditional and innovative training models, research issues, the role of assessment and psychotherapy in clinical psychology, the medical vs. the behavioral model of psychopathology, relations with other mental health professions, professional issues such as licensure and credentialing, and malpractice.

PSYC 610. Attitude Theory and Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Theory and research in attitudes. Attitude formation and change, including cognitive consistency, learning and reinforcement, social judgment, and functional theories.

PSYC 611. Contemporary Issues, Supervision and Leadership in Counseling Psychology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Contemporary issues, problems and research related to the practice of counseling psychology; their importance in developing a professional identity and sensitivity to major developments in the field; history, present status and future directions in the field of counseling psychology.

PSYC 612. Seminar in Motivation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A survey of some theoretical views of motivation. Biological, cultural personality and learning theories of motivation will be covered. Theoretical positions will be related to current empirical findings.

PSYC 613. Cognitive Development. 3 Hours.

Semester course; 3 lecture/discussion hours. 3 credits. Prerequisite: graduate standing in psychology or permission of instructor. The development of the intellectual processes, including reasoning, memory, imagery and knowledge. Special attention will be given to theories of cognitive growth. Although the focus will be on child cognitive developments, consideration of life-span issues will be included.

PSYC 614. Development in Infancy and Early Childhood. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Prerequisite: PSYC 603 or permission of instructor. An introduction to theory and research on children from birth to early childhood, including sensory and behavioral capacities; cognitive, social and emotional development; and contexts of development (especially the family). Emphasis on stage 1 salient tasks of development and the effects of early experience on function later in life. Consideration of the challenges associated with research and intervention with these age groups.

PSYC 615. Aging and Mental Disorders. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The course deals with common psychological disorders and problems of late life, their etiology, methods of evaluating psychological status and intervention strategies that have been used successfully with older persons. Topics include epidemiology of psychological disorders and mental health service utilization; late-life stressors and crises; psychology of health, illness and disability; techniques and procedures in the evaluation of the older adult; functional and organic disorders; institutionalization; individual, group and family therapy; behavioral techniques; peer counseling and crisis intervention; and drugs and the elderly. Crosslisted as: GRTY 615.

PSYC 616. Psychopathology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of the instructor. Clinical and experimental contributions to the field of psychopathology, with particular attention to the roles of learning and motivation in the development of behavior disorders.

PSYC 617. Sensation and Perception. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The major phenomena of vision, audition, olfaction, gustation and the skin senses. Psychophysics and the effects of sensory deficits. The relationship of variations in environmental energy to the psychological reactions of sensing and perceiving.

PSYC 618. Seminar in Personality. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. A detailed exploration of various approaches in personality. Contemporary issues in personality theory.

PSYC 619. Learning and Cognition. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing in psychology or permission of instructor. Covers principles and theories of learning and cognitive psychology from simple associative learning through memory, comprehension, thinking and social behavior.

PSYC 620. Design and Analysis of Psychological Research. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: undergraduate course in basic statistics or permission of instructor. An introduction to research design in psychology (e.g., logic behind various research designs, typical research problems). Review of principles of hypothesis testing, general linear model, analysis of variance including factorial designs with special emphasis on prior and post-hoc comparisons, repeated-measures designs and mixed designs.

PSYC 622. Physiological Correlates of Emotion. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Research and theories of emotion emphasizing physiological bases, with special attention to neurological and endocrine systems. Applications to psychological functioning.

PSYC 623. Counseling Theories and Personality. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment requires permission of instructor. Overview of major trends in personality theory, techniques and current research in psychotherapies as they apply to counseling psychology. Includes descriptions of some brief psychoeducation and preventive interventions and stresses accountability in outcome of all interventions.

PSYC 624. Group Counseling and Psychotherapy. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: permission of instructor. Historical perspective. Basic dynamics and processes of therapeutic groups. Role and technique of the group facilitator. Examination of different theoretical approaches.

PSYC 625. Career Development and Occupational Health. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: permission of instructor. A review of major theories and current research in career development and topics in occupational health are presented. Theory, research and techniques associated with vocational assessment and intervention are reviewed. Emphasis on late adolescent and adult populations.

PSYC 626. Single-case Experimental Design for the Clinical Research Practitioner. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: permission of instructor. Review of single-case design models that have utility for clinicians in evaluating their practice. Emphasis will be placed on the historical development of the field and on the main experimental design issues that are relevant to the conduct of single-case research.

PSYC 627. Research Methods in Clinical Psychology. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: PSYC 680 and graduate standing in clinical or counseling psychology, or permission of instructor. Examines the role of research in clinical psychology and experimental design issues in psychotherapy research.

PSYC 628. Psychology of Adolescence. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing in psychology or permission of instructor. Theories and research on the social, personality and cognitive development of adolescents. Emphasis is placed on the development of identity and relationships with family and peers, within the contexts of home, school, work and community. Variations in development related to cultural differences will also be the focus, but atypical behavior will be explored. Normal adolescent behavior will also be addressed. Current research ideas will be examined.

PSYC 629. Biological Basis of Behavior. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: an undergraduate course in physiological psychology or permission of instructor. Theory and current experimental research on the physiological and neurological concomitants of behavioral variables.

PSYC 630. Social Psychology. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Topics include attitudes, social influence processes, person perception, affiliation and attraction, group processes, cultural influences on behavior and conformity.

PSYC 631. Evaluation Research: Psychological Perspectives. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides the student with knowledge of and skills in evaluation research. Additionally, students will learn how to apply psychological theories and applied research methods in evaluating psychological interventions and treatment programs. The class covers several key aspects of evaluation: 1) use of psychological theory in evaluations, 2) defining the problem, 3) contextual issues surrounding the evaluation, 4) selecting the appropriate type and design of evaluation, 5) methodological issues and 6) steps involved in conducting an evaluation of process and outcome. Course will attend to: a) theoretical, b) political, social and contextual factors that impact an evaluation, c) cultural considerations when conducting an evaluation, d) practical and logistical considerations and e) effective collaboration with community partners. Course examples and materials will be drawn from the professor's experiences with evaluating community-based psychological interventions and prevention programs and the experiences of guest presenters.

PSYC 632. Research Methods in Social Psychology. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisites: PSYC 680 and PSYC 630. Epistemological, methodological, technical and ethical problems encountered during the scientific study of social psychological phenomena. Emphasizes practical experience in theory development, hypothesis derivation, research planning, data collection, reduction and analysis, and dissemination strategies.

PSYC 633. Group Dynamics. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: PSYC 630 or permission of instructor. Theoretical explanations and empirical research related to group formation, development, performance and dissolution. Topics include obedience, conformity, group productivity and leadership.

PSYC 634. Social Cognition. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: PSYC 630. Theoretical explanations and empirical research related to social thought. Topics include social memory, impression formation and attribution, culture and cognition, automaticity, judgment and decision-making, cognitive biases, stereotypes and prejudice, and moral psychology.

PSYC 635. Psychology of Health and Health Care in the Elderly. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Presents health psychology models, theories and issues relating to the etiology, course and treatment of illness in the elderly. Covers older patient-practitioner interaction, compliance, late-life stress and illness, and psychosocial issues in terminal care.

PSYC 636. Research Methods in Developmental Psychology. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: PSYC 680. Research designs, methods, ethical issues and problems specific to developmental psychology. Cross-sectional, longitudinal and sequential strategies. Statistical issues, multivariate statistics and choice of statistical designs appropriate for developmental research questions. Computer skills in organizing and analyzing data. Grant writing and scientific reporting.

PSYC 637. Operant Behavior. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: graduate standing in psychology or permission of instructor. Presents an overview of the methodology, terminology and phenomena unique to the experimental analysis of behavior. Topics include operant methodology, schedules of reinforcement, stimulus control, acquisition of behavior, conditioned reinforcement, punishment, scheduled-induced behaviors and use of operant techniques in drug research.

PSYC 638. The Evolution of Psychological Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: core course in student's area of specialization or permission of instructor. A survey of the development and present state of various psychological systems. Current meta-theoretical and systematic issues in psychology.

PSYC 639. Research Methods in Biopsychology. 3 Hours.

Semester course; 1 lecture and 4 laboratory hours. 3 credits. Prerequisite: permission of instructor. Methodological, technical and ethical problems in biopsychology. Examples are design and use of circuits in behavioral sciences, stereotaxic surgery, histology, drug procedures, research design, data collection procedures and data analysis.

PSYC 640. Parenting. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is about parenting. Students review and discuss theories and literature on human parenting, including the history of parenting, contextual issues in parenting, parenting at different stages of children's lives (from pregnancy and infancy through having adult children) and parenting children with special needs (including disabilities and behavior problems). Also covers parent training and education, the journey to becoming a parent through adoption, parenting contributions to social, emotional and cognitive competence, child maltreatment and public policy around parenting. Students review parenting in different family structures including married, never married, divorced and separated families. This is not a course on how to parent, but practical issues in the lives of parents are discussed.

PSYC 641. Survey of Psychological Assessment and Treatment of the Older Adult. 3 Hours.

3 lecture hours. 3 credits. A combination didactic and skills training course; review of major treatment strategies and techniques for utilization with the older adult client with emphasis on group, individual and paraprofessional delivery systems; evaluation of crisis intervention and consultation team approaches; lectures, demonstration and classroom practice of actual treatment techniques. Crosslisted as: GRTY 641.

PSYC 642. Practicum in Clinical Geropsychology. 3 Hours.

3 practicum hours. 3 credits. An initial practicum geared as an entry to the team practicum experience; focus on familiarizing the student with mental health service delivery systems for the elderly in the Richmond community; rotation through a limited number of facilities such as nursing homes, retirement centers, nutrition sites, emergency hotline services for the elderly and various agencies involved in deinstitutionalization; possible extended placement in a particular facility. Crosslisted as: GRTY 642.

PSYC 643. Principles of Psychological Measurement. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: graduate standing in psychology or permission of instructor. Basic psychometric concepts to prepare the student for subsequent evaluation instruments. Origins and logic of testing, criteria for judging tests, standardization and reliability, and validity and principles of test development and construction.

PSYC 644. Individual Tests of Intelligence. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students with graduate standing in clinical or counseling psychology or with permission of the counseling or clinical psychology program. Examines the administration, scoring, interpretation and research foundations of the major individual tests of intelligence. Emphasizes the Wechsler scales and the measurement of adult and child intelligence. Develops psychological report writing skills.

PSYC 645. Assessment of Personality. 2,3 Hours.

Semester course; variable hours. 2 or 3 credits. Prerequisite: graduate standing in clinical or counseling psychology, or permission of clinical or counseling psychology program and instructor. Examines use of objective and projective tests in assessment of personality. Emphasizes clinical interpretation of the Minnesota Multiphasic Personality Inventory (MMPI), and the administration and clinical interpretation of the Rorschach and Thematic Apperception Test (TAT). Stresses integrative report writing.

PSYC 646. Projective Techniques. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing in clinical or counseling psychology or permission of counseling and clinical program committee. Projective devices for the assessment of personality. Supervised administration, scoring, interpretation and written reports of individually administered projective personality tests.

PSYC 647. Neuropsychological Assessment. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: graduate standing in psychology and permission of instructor. Psychological assessment of brain-behavior relationships in the context of neurological or neurosurgical problems. Emphasis is on current modifications of Halstead's tests and on the Reitan-Indiana Neuropsychological Battery for younger children. Laboratory requires supervised administration, scoring and interpretations of neuropsychological test batteries.

PSYC 648. Behavioral Assessment of Clinical Problems. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: graduate standing in psychology and permission of instructor. Development, evaluation, use and interpretation of behavioral approaches to the assessment of clinical problems, including self-monitoring, behavioral ratings and direct observational assessment procedures. Both existing instruments and procedures for designing new instruments will be discussed.

PSYC 649. Clinical Assessment of Child Disorders. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: PSYC 643 and graduate standing in clinical psychology, or permission of clinical program committee and instructor. Administration and interpretation of intellectual and personality assessment instruments for children. Laboratory requires supervised administration, scoring, interpretation and written reports of these assessment instruments.

PSYC 650. Advanced Child Psychopathology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Principal childhood emotional and behavioral difficulties: intellectual disability and learning disabilities, psychosis, eating disorders, substance use disorders, non-suicidal self-injury and suicidality. Genetic, epigenetic, prenatal, social and psychological factors related to the etiology of childhood psychopathology.

PSYC 651. Theories of Counseling and Interviewing. 1-3 Hours.

Semester course; variable hours. 1, 2 or 3 credits. Prerequisites: graduate standing in counseling or clinical psychology, and permission of instructor. Introduces basic principles of interviewing as they apply to theories and practice of psychotherapy and counseling. Laboratory requires videotaping of simulated counseling/psychotherapy session, modeled and role-played interviewing situation, skill development and demonstration, and evaluative interpersonal feedback.

PSYC 652. Child and Adolescent Psychotherapy. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: graduate standing in psychology and permission of the instructor. Presents the major approaches to psychological interventions for children's and adolescents' behavioral and emotional disorders. Includes a review of empirical research evaluating the effectiveness of contemporary psychological interventions for specific disorders.

PSYC 653. Family Counseling and Therapy. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisites: PSYC 616, and PSYC 693 or PSYC 694, and PSYC 645; or permission of instructor. Emphasizes an applied approach to family assessment and therapy. Presents theories and concepts of major approaches to family therapy and general systems issues. Emphasizes techniques of family therapy. Involves participants in role playing, demonstration, films and case discussion.

PSYC 654. Marriage Counseling and Therapy: Theory, Practice and Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing in clinical or counseling psychology, or permission of instructor. Surveys major theories of marital interaction and counseling (as distinct from family counseling). Students perform assessment batteries and interviews and practice selected techniques of marital counseling. Participation in a research project, either library, field, or experimental research, is required.

PSYC 655. Community Interventions: Development, Implementation and Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Provides an understanding of the concepts community, prevention and promotion and how interventions that adopt such a perspective differ from traditional psychotherapeutic interventions in their goals and targets. Explores how to critically evaluate research related to community and preventive interventions. Emphasizes consideration of issues in designing, implementing and evaluating community intervention projects. Provides opportunities to conduct part of the intervention in a community setting.

PSYC 656. Structured Training Groups. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: permission of instructor. This course presents an introduction to the historical roots and basic assumptions of group training methods. The specific focus is on those structured, behavioral interventions that are designed to be time limited and emphasize staff development or training needs of clients. Needs assessment, screening, program development and evaluation, consultation methods and ethics are included as topics. Leadership styles and the composition of training grant proposals are developed and critiqued in the laboratory/experiential component of this course.

PSYC 657. Advanced Educational Psychology for Secondary Teachers. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Application of the principles of psychology to the teaching-learning process in the secondary classroom. Discussion will focus on the comprehensive development of individual learning experiences and educational programs from the point of view of the educator and administrator. Crosslisted as: EDUS 617.

PSYC 658. Motivational Interviewing. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students with graduate standing in psychology or by permission of instructor. The course will provide an overview of motivational interviewing and how it can be used to elicit behavior change in the treatment of individuals with substance use disorders. Stages of change will be discussed, as students learn and practice basic MI skills. The course will also provide an opportunity for students to explore how MI skills can be tailored to assist in the treatment of other mental health disorders. Course components include readings, lectures and videotape demonstrations. A substantive amount of time will be focused on MI basic skill development.

PSYC 659. Seminar in Consultation Psychology. 3 Hours.

Semester course; 3 credits. Prerequisite: graduate standing in psychology or permission of instructor. Explores theory and practice of psychological consultation using case materials, readings and individualized projects. Covers conceptual models and role choices available to the consulting psychologist, common phases, principles and practices found in the consultation process and program evaluation and consultation research methods and issues.

PSYC 660. Health Psychology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PSYC 629 and graduate standing in psychology, or permission of instructor. Provides an overview of research in and applications of the principles of behavioral psychology with respect to the fields of medicine, health maintenance and illness. Emphasizes the integration of theoretical research and applied issues in these areas. Surveys major topics in behavioral medicine, including psychophysiological disorders, compliance and adherence with health care regimens, psychological adjustment to illness and pain, behavioral dentistry, pediatric psychology, cardiovascular risk reduction, eating and sleeping disorders, behavioral pharmacology and biofeedback. Explores roles of psychologists.

PSYC 661. Clinical Applications of Health Psychology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Clinical health psychology has emerged as a distinct practice area within professional psychology. It is best defined as the application of psychological assessment and intervention methods to various specialty areas within medicine. These areas include rehabilitation medicine, neurology, geriatrics, transplant medicine, bariatrics, oncology, cardiology, pain management, sleep medicine, reproductive health, pediatrics, gastroenterology and primary care. The course will survey the clinical roles of and intervention and assessment tools used within each of these specialty areas, and will include guest lectures provided by clinicians who work in these specialty areas from the VCU Health System or the larger community. In addition, students will conduct information-gathering telephone interviews with clinicians from around the nation and present their findings in a discussion format. Course evaluation will be based primarily on class discussion, student presentations of interviews and two take-home exams.

PSYC 662. Diagnostic and Behavioral Assessment. 2,3 Hours.

Semester course; variable hours. 2 or 3 credits. Designed to introduce students to the theory and practice of diagnostic and behavioral assessment. The course primarily focuses on the conceptual underpinnings and major methods associated with the diagnostic and behavioral assessment traditions. Emphasis is placed on how these assessment traditions can be used together to guide case conceptualization, monitor treatment progress and outcome, treatment planning, and treatment selection. The course covers psychometric theory, classics assessment controversies and the psychometric strengths and weaknesses of the diagnostic and behavioral assessment approaches. The course ends with a review of risk assessment. The goal of the course is to provide students with the knowledge and skills to critically apply the appropriate assessment strategies to guide clinical work from intake to termination.

PSYC 664. Psychological Needs of Military Service Members and Their Families. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Provides opportunities to understand the psychological needs of both service members and their families – from pre-deployment through post-deployment – through presentations by professionals from the Department of Defense, National Guard, VA Medical Center and other military organizations. Explores the impact of psychological trauma and physical injuries on service members' well-being. Emphasizes a review of different interventions and other sources of help available for returning service members and their families. Provides an opportunity to prepare an integrative review of a topic related to a military issue.

PSYC 665. Psychodynamic Approaches to Psychological Treatment. 3 Hours.

Semester course; 3 credits. Prerequisite: permission of instructor. Examines basic principles in conceptualizing and treating clients from a psychodynamic perspective. Theoretical and clinical readings and case materials are used as a basis for an in-depth analysis of psychodynamic theories and practices within a seminar format.

PSYC 666. Crisis Intervention: Theory, Research and Practice. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: graduate standing in psychology or permission of instructor. Review of the development of the concept of psychological crisis and of intervention programs in a range of areas such as sexual assault, natural disasters, telephone hotlines and medical emergencies. Relevant theory and data from community psychology, laboratory and applied research, sociology and psychiatry will be considered.

PSYC 667. Behavior Therapy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing in the psychology program or permission of instructor. Emphasizes group and individual approaches to the following general areas: observational techniques; counterconditioning and extinction procedures; techniques of positive and negative control; self-control procedures; use of modeling and role playing as change techniques; behavioral feedback and cueing procedures.

PSYC 668. Interpersonal Psychotherapy: Social Psychological Analysis. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: permission of instructor. Analysis of counseling and psychotherapy as interpersonal influence processes. Applications of social psychological theories and research to the process of therapeutic change; identification of key aspects of the change process and of how these aspects are embodied in current approaches and techniques of counseling and psychotherapy. Emphasis on experimental methods of studying change processes.

PSYC 669. Interpersonal Psychotherapy: Communication Analysis. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Prerequisite: permission of instructor. Theory and research in nonverbal communication. Communication theories of psychotherapy and a communication analysis of key concepts in psychotherapy.

PSYC 670. Seminar in Gestalt Therapy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Philosophical basis, historical background, theoretical formulation, techniques and application of Gestalt therapy. Students will have the opportunity to practice and observe the techniques.

PSYC 671. Readings and Research. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for a maximum of 9 credits. Prerequisite: written permission of instructor. Individual study leading to the investigation of a particular problem in a systematic fashion under the supervision of a member of the faculty.

PSYC 673. Diversity Dialogues. 2 Hours.

Semester course; 2 seminar hours. 2 credits. Seminar is designed to provide students with a foundation for understanding, discussing and addressing issues of diversity across multiple contexts in their academic and personal lives. The seminar involves process-oriented discussions, exercises, readings and videos on issues pertinent to diversity and inclusion in research, clinical work, service and professional development as a graduate student. Graded as pass/fail.

PSYC 675. Ethical Principles of Psychology. 2 Hours.

Semester course; 2 lecture hours. 2 credits. A discussion of some of the current problems of interest to psychologists. Particular emphasis on the ethical principles of psychology, and the dilemmas encountered in the teaching, research and applied practice of psychology.

PSYC 676. Personal Awareness in Multicultural Counseling. 3 Hours.

Semester course; 2 seminar hours and 1 hour skills-building component. 3 credits. Prerequisite: graduate standing in the counseling psychology doctoral program or permission of the instructor. Focus on (1) self-awareness regarding cultural issues, (2) knowledge of cultural differences and (3) counseling skills with culturally different clients. This course will provide the theoretical and research knowledge base to complement students' experiential training in multicultural issues. Building on the students' knowledge of Western and non-Western psychology theories and practices, the course will help students in developing a theory of cross-cultural and multicultural counseling. The course will further focus on historical development of multiculturalism and examine existing research in this area.

PSYC 677. Minority Issues in Mental Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students with graduate standing in psychology or permission of the instructor. This course examines the roles and influences of cultural and other individual differences in mental health that are important to understanding and working with diverse populations in research and clinical settings. Students will learn about cultural and individual influences on mental health; gain a fundamental understanding of the primary racial/ethnic groups in the U.S.; explore issues related to sexual-based, age, ability/disability and gender differences in mental health; examine the impact of immigration and acculturation on well-being; learn about how culture affects the expression of distress and the resulting diagnostic implications; gain an understanding of patterns and barriers to help-seeking; and learn how to be more culturally humble and sensitive when providing mental health care or working in research settings.

PSYC 678. African American Children and Families. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students with graduate standing in psychology or by permission of instructor. This course examines African American children's physical, cognitive, social and emotional development, as shaped by familial, societal, cultural, historical and contextual influences. The course explores several core theories, perspectives and methodological approaches that have been used to understand African American families and children. Particular attention is paid to integrity-based approaches that explain the developmental competencies of African American children in response to environmental risks that exceed normative expectations.

PSYC 679. Culture, Ethnicity and Health. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Enrollment restricted to graduate students in health psychology or by permission of instructor. This course is designed to provide students with a foundation for understanding and addressing health disparities from a psychological perspective. The class will focus on: (a) health disparities from a historical, political, economic, social and environmental perspective; (b) the intersection of race, ethnicity, gender, socio-economic status, sexual orientation and other social factors that may exacerbate disparities; (c) challenges in the measurement of minority health and health disparities; (d) the role of cultural competence in health promotion and disease prevention; and (e) barriers to health care that contribute to disparities.

PSYC 680. Statistics in Psychological Research I. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: an undergraduate psychological statistics course or equivalent within the past three years or successful passage (80 percent or greater) of an undergraduate psychological statistics equivalency test to be completed at VCU. Extensive coverage of multiple regression/correlation analysis with applications in psychology. Survey of applications of multivariate statistical analyses in psychology.

PSYC 681. Statistics in Psychological Research II. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: PSYC 680 or permission of instructor. Will build on PSYC 680 and provide extensive coverage of multiple regression/correlation analysis with applications in psychology. Will provide a survey of applications of multivariate statistical analyses in psychology and will introduce students to recent statistical developments in the field.

PSYC 682. Advanced Multivariate Methods in Psychology. 3 Hours.

Semester course; 2 lecture and 1 laboratory hours. 3 credits. Prerequisites: PSYC 680 and PSYC 681. The course examines the application of multivariate methods to the analyses of psychological, behavioral and health data. Major emphasis will be given to multivariate analysis of variance and its extensions (analysis of covariance, repeated measures analysis of variance); hierarchical mixed effects models; and factor analysis in its various forms (principal components, exploratory factor analysis, confirmatory factor analysis, path analysis, structural equation modeling).

PSYC 683. Multilevel Modeling. 3 Hours.

Semester course; 2 lecture and 1 laboratory hours. 3 credits. Prerequisites: PSYC 680 and PSYC 681; or two semesters of graduate-level statistics courses. Course introduces a number of expressions of multilevel modeling that are now in common use in all the major branches of psychology, as well as in education and other sciences. The course balances conceptual understanding of MLM with practical application.

PSYC 684. Research Methods in Psychology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course provides instruction in methodological approaches, design issues and ethical considerations when conducting research in psychology. The course covers a variety of methods and designs and considers issues that affect many subdisciplines within psychology, including threats to validity, reliability and validity of measurement, and ethics in human research.

PSYC 688. The Self and Identity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PSYC 630 and 680 or permission of instructor. Our sense of self provides meaning and coherence to our lives; it is the lens through which we interpret the world. This seminar will take a research-based approach, and almost all readings will be psychology journal articles. Class will focus on key topics in recent self research (e.g., self-regulation, self-esteem, the self and relationships, different cultural conceptions of self) as well as debate controversial issues in the literature (e.g., the cultural universality of self-enhancement, whether positive illusions are healthy). Students may choose some of the topics covered in the latter part of the semester. Evaluation will be based primarily on class discussion, student-led debates and discussions, and a research proposal and presentation at the end of the semester.

PSYC 690. Research Practicum. 1-3 Hours.

Semester course; 4 hours per credit. 1-3 credits. Available to graduate students in the psychology department with approval by their program committee. Provides the graduate student in psychology the opportunity to design and apply research skills under close faculty supervision. Involves research projects that progressively become more sophisticated as students increase their research skills.

PSYC 691. Special Topics. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for credit. Prerequisite: permission of instructor. Theory, research and techniques in specialized topics of current interest are presented.

PSYC 693. Counseling Practicum. 1-3 Hours.

Semester course; one-half day per credit. 1-3 credits. May be repeated for a maximum of 12 credits. Available only to graduate students in counseling psychology approved by the counseling program committee. A series of training experiences designed to facilitate progressively greater degrees of skill development in counseling psychology.

PSYC 694. Clinical Practicum. 1-3 Hours.

Semester course; one-half day per credit. 1-3 credits. May be repeated for a maximum of 12 credits. Available only to graduate students in clinical psychology approved by the clinical program committee. The graduate student in clinical psychology is given an opportunity to apply and practice interviews and diagnostic and therapeutic skills with clients requiring psychological services. Careful supervision and evaluation of the student is provided. The practicum may be located at a clinic on campus or in a hospital or other agency off campus.

PSYC 695. Practicum in Clinical or Counseling Supervision. 2 Hours.

Semester course; 4 supervisory hours. 2 credits. May be repeated for a maximum of 6 credits. Credits earned do not count as course credits toward the degree. Prerequisites: permission of instructor, enrollment in graduate program in clinical or counseling psychology, completion of 12 hours of clinical (PSYC 694) or counseling (PSYC 693) practicum. This course is an opportunity to develop, apply and practice psychotherapy supervision skills under the direct supervision of clinical or counseling faculty members.

PSYC 696. Internship. 0.5 Hours.

0.5 credit. Prerequisite: approval of the director of the program involved. The internship is one-year, full-time assignment, under supervision, to an agency approved by the student's program committee. Graded S/U/F.

PSYC 700. Grant Writing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: two graduate courses in statistics or permission of instructor. Students are expected to enter course with a pre-approved topic identified and substantial background reading completed. Focuses on preparing an NIH grant application, using F31-F32 mechanism (predoctoral or postdoctoral National Research Service Award) as a model. Course covers elements of a grant application, details of the grant review process and key features of successful applications. Students prepare a research plan for their own application based upon their current work.

PSYC 702. Causal Analysis for Organizational Studies. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: two graduate courses in statistics or permission of instructor. Focuses on conceptual and statistical issues involved with causal analysis with nonexperimental and experimental data. Course covers basic and advanced confirmatory factor analysis and structural equation techniques, with an emphasis on organizational and psychological applications. Crosslisted as: MGMT 702.

PSYC 791. Advanced Topics in Psychology. 1-6 Hours.

Semester course; 1-6 seminar hours. 1-6 credits. May be repeated with different topics for a total of 12 credits toward graduation. A seminar course for the examination of specialized issues, topics, readings, problems or areas of interest for the field of psychology. This course is open to all doctoral students in psychology. Graded as pass/fail.

PSYC 795. Practicum in the Teaching of College Psychology. 3 Hours.

Semester course; 3 credits. May be repeated. Prerequisites: appointment as a graduate teaching assistant in psychology or permission of instructor. Students develop skills in the design and conduct of undergraduate courses in psychology through observation and supervised experiences: acquaints students with university, college, and department policies and resources in support of instruction; familiarizes students with disciplinary resources; assists students in evaluating personal strengths and weaknesses.

PSYC 798. M.S. Thesis. 1-6 Hours.

1-6 credits. May be repeated.

PSYC 898. Doctoral Dissertation. 1-12 Hours.

1-12 credits. May be repeated.

Rehabilitation and Movement Science (REMS)**REMS 540. Cardiovascular Pathophysiology and Pharmacology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: HPEX 375 and HPEX 440 or equivalents. Presents theoretical principles of electrocardiography and the effects of pharmacological intervention in the treatment of cardiovascular disease. Specific emphasis placed on myocardial ischemia, myocardial infarction and their treatment through exercise rehabilitation protocols. The impact of pharmacological agents on the ECG and on exercise are explored.

REMS 608. Advanced Musculoskeletal Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students registered in the REMS program or by permission of instructor. Examines the structure and function of tissues of the musculoskeletal system. Investigates mechanisms of healing of these tissues and explores the affects of various modalities, altered use and disease on the structure and function of musculoskeletal tissues.

REMS 611. Biomechanics of Human Motion. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Enrollment restricted to students registered in the REMS program or by permission of instructor. Applies knowledge and methods of mechanics in the study of the structure and function of the human body as applied to sport, physical activity and rehabilitation. Topics include kinematics, kinetics and methods of biomechanical analysis.

REMS 612. Advanced Biomechanics. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: REMS 611 or permission of instructor. Enrollment restricted to students registered in the REMS program or with permission of instructor. Applies advanced biomechanics techniques to the evaluation and quantification of human performance. Encourages scientific thought with practical applications.

REMS 660. Neuromuscular Performance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students registered in the REMS program or by permission of instructor. Examines the interrelationships between the musculoskeletal and neuromuscular systems. Includes examination of normal and abnormal biomechanics of the musculoskeletal system, biomechanical factors related to human performance, as well as acute and chronic adaptations of the neuromuscular system. Emphasizes how these principles can be applied to physical training in healthy and diseased populations and treatment and rehabilitation in the sports medicine setting.

REMS 665. Instrumentation in Motion Analysis. 3 Hours.

2 lecture and 2 laboratory hours. 3 credits. Designed for students in the interdisciplinary Ph.D. in Rehabilitation and Movement Science Program. Examines theories, principles, and applications of systems used to qualify and characterize movement.

REMS 690. Research Seminar in Rehabilitation and Movement Science. 0.5 Hours.

Seminar course; 0.5 credit. Seminar course designed for students in the interdisciplinary Ph.D. in Rehabilitation and Movement Science Program. Presentation and discussion of research reports and topics of interest. Advances skills in critical analysis and discussion leadership. Topics and research presentations vary from semester to semester and are coordinated by the instructor of record. May be repeated. Graded as pass/fail.

REMS 692. Independent Study. 1-3 Hours.

Semester course; 1-3 independent study hours. 1-3 credits. May be repeated for 6 credits. Determination of the amount of credit and permission of the instructor and division head must be procured prior to registration. Cannot be used in place of existing courses. An individual study of a specialized issue or problem in health or movement sciences. Crosslisted as: HEMS 692.

REMS 701. Advanced Exercise Physiology I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501 or other graduate-level mammalian physiology course or permission of instructor. Investigates the effect of acute and chronic exercise stimuli on human performance and select disease states. Topics to be addressed include exercise bioenergetics, metabolic responses to exercise, contributions to substrate selection and utilization during exercise, muscular performance and adaptations to exercise training, cardiovascular adaptation to exercise, aerobic and anaerobic training programs, and effects of training on fitness and performance.

REMS 702. Advanced Exercise Physiology II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PHIS 501 or other graduate-level mammalian physiology course or permission of instructor, and REMS 701. Investigates the effect of physiological stressors on human performance and health through lecture and article discussion. Topics to be addressed include exercise in the heat and cold, effects of altitude on physical performance, acute and chronic endocrine responses to exercise, role of adipokines in chronic disease conditions, the use of ergogenic aids in sport.

REMS 703. Cardiovascular Exercise Physiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. Investigates the structural, functional and cellular principles of human cardiovascular physiology as applied to health and human performance. Emphasis will be placed on the metabolic, contractile and hemodynamic adaptations to acute and chronic exercise training.

REMS 704. Psychobiology of Physical Activity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. "Psychobiology" is defined as the integrative study of behavior from the social, cognitive and biological levels of analysis. This course will include an examination of the research that encompasses psychophysiology, psychoneuroendocrinology, psychoneuroimmunology, neuroscience, physiological psychology and behavioral genetics applied to exercise.

REMS 705. Metabolic Aspects of Physical Activity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. This course is designed to explore the thermic effects of physical activity in apparently healthy individuals, as well as those with increased risk for cardiovascular, metabolic or other inflammatory diseases. Additionally, the relationship between physical activity and food intake, resting metabolic rate and dietary-induced thermogenesis will be reviewed. The examination of gastrointestinal function during dietary manipulation will also be assessed to address performance enhancement in several types of physical activities. This course will emphasize the metabolic control of ATP synthesis, which includes carbohydrate, lipid and protein metabolism and their interaction with one another in response to biological needs during rest and physical activity.

REMS 706. Development and Motor Control. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students admitted to the REMS program or by permission of instructor. Explores theories of developmental motor control and examines theoretical influences on development of infants and young children who are typically developing as well as those with developmental disabilities. Engages students in critical literature review relevant to motor development and rehabilitation and in the application of theory to practice and research design.

REMS 707. Programing for Rehabilitation Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: REMS 611 or equivalent. Enrollment is restricted to students in the rehabilitation and movement sciences program or with permission of the instructor. Develops proficiency in processing and analyses of kinematic, kinetic and electrophysiological data (e.g. EMG) typically associated with biomechanical labs. Focuses on coding in common packages to achieve the goals of reading in data from various sources, construction of multidimensional arrays, filtering, data visualization and extraction. Upon completion of this course, students will be able to independently import time series data, process and extract variables of interest, and write the output variables of interest to a format suitable for statistical analyses packages (e.g., SPSS, SAS, R).

REMS 710. Research Techniques in Rehabilitation and Movement Science. 1-3 Hours.

50 hours of laboratory times per credit hour. 1-3 credits. Prerequisite: Permission of instructor required. Examines and explores laboratory techniques used in rehabilitation and movement science research. Provides opportunity to begin transitioning clinical problems to research questions. Opportunities in laboratories of the rehabilitation and movement science program or other laboratories approved by the adviser or program directors. Focuses on individual student learning needs. Graded as pass/fail.

REMS 793. Teaching Practicum in Higher Education. 1 Hour.

50 hours of contact/preparation time for each credit. 1 credit. Practicum designed for students in the interdisciplinary Ph.D. in Rehabilitation and Movement Science degree program. Develops skills necessary for classroom teaching including preparing and presenting selected topic (s), writing test questions, and grading examinations. May be repeated for additional teaching experience. Graded as pass/fail.

REMS 794. Research Presentation Seminar. 1 Hour.

1 lecture hour. 1 credit. Seminar course designed for students in the interdisciplinary Ph.D. in Rehabilitation and Movement Science Program. Develops presentation skills. Requires preparation and presentation of research at a public research forum scheduled by the instructor of record. Students are expected to submit their research for presentation at a selected regional, national or international conference in a related field. Graded as pass/fail.

REMS 798. Research in Rehabilitation and Movement Science. 1-12 Hours.

Semester course; 1-12 credits. Research leading to the Ph.D. degree and elective research projects for students in the Rehabilitation and Movement Science doctoral program. May be repeated. Graded as "S," "U" or "F".

Religious Studies (RELS)**RELS 592. Independent Study. 1-4 Hours.**

Semester course; 1-4 credits. Determination of the amount of credit and permission of the instructor and department chair must be procured prior to registration for the course. Open only to graduate students. An independent study course to allow qualified graduate students to do research in an area of major interest.

Sociology (SOCY)**SOCY 500. Advanced Principles of Sociology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. A comprehensive analysis of the concepts and techniques useful for understanding society and culture as well as the social processes and structures operant within these spheres.

SOCY 501. The Foundations of Sociological Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The foundations of theoretical explanation of the social world is addressed from an historical and philosophical perspective. The emergence of contemporary sociological theory in the 19th and 20th centuries is reviewed.

SOCY 502. Contemporary Sociological Theory. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. A critical assessment is given of such contemporary theoretical orientations as functionalism, conflict theory, exchange theory, symbolic interactionism and phenomenology.

SOCY 508. Introduction to Social Statistics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Introduction to statistical methods applicable in a variety of settings, with emphasis on nonexperimental data. Data description and analysis including chi-square and t-tests, using a statistical computing package. Not applicable toward M.S. in Mathematical Sciences or Computer Science. Crosslisted as: STAT 508.

SOCY 510. Domestic and Sexual Violence in Social Context. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students will learn about the experiences of and responses to sexual and domestic violence in specific social contexts, with a focus on less visible contexts and underserved populations. Examines violence within various family structures and intimate relationships including racial/ethnic minority and immigrant groups and gay/lesbian/bisexual/transgender relationships, in various community settings including college campuses and the military, and among people with disabilities. Guest lectures provided by community experts in these areas.

SOCY 515. Globalization and Transformation: Concepts and Realities. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Examines how globalization significantly affects cultural processes at both local and national levels. Transformations of cultural understandings and practices under such circumstances will be explored. Virtual course components will bring causes, processes and consequences of the transformations of Western, Eastern and developing countries into focus.

SOCY 524. Aging and the Minority Community. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. An analysis of the relationship between the aging process and American minority communities. In addition to the sociological factors, the course will examine demographic, physiological and psychological aspects of minority aging. Attention will also focus on dominant social problems and federal policies toward the aged.

SOCY 525. Digital Social Problems. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The study of sociological concepts and methods in the analysis of current social problems in the digital environment, including topics such as privacy, obscurity, hacking, danger, crime and war; interpersonal conflicts and harassment; stress, information overload and FOMO, among others. This course explores how individual online behaviors have the effect of reproducing inequality.

SOCY 593. Internship in Sexual and Domestic Violence Practice and Research. 3 Hours.

Semester course; 12 hours per week. 3 credits. Provides students practical experiences working in settings that address sexual and domestic violence. Students will focus on various areas including but not limited to service provision, intervention, research and program evaluation. Students will work closely with organizations/agency staff and follow their instructions.

SOCY 601. Sociological Research Methods. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Review of sociological research methodologies, including research design, ethical issues, measurement, data collection techniques, sampling and the basic logic of qualitative and quantitative analysis.. The focus is on developing the student's abilities to critically evaluate uses of methodologies in the research literature and justify methodological choices.

SOCY 602. Applications of Sociological Research Methods. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: SOCY/STAT 508 or equivalent and SOCY 601. Emphasis on applying methods for developing and executing a sociological research project, including the problem statement, theoretical framework, literature review, research design, ethics, sampling, data collection procedures, data analysis and presentation of results.

SOCY 603. Seminar in Population Studies. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Analysis of fertility, mortality and migration from a sociodemographic perspective. Special attention will be paid to sociological determinants of demographic processes and their interrelationships.

SOCY 604. Sociology of Work in Industry. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Analyses of work relations and the social structures and mechanisms that govern and arise out of them and examination of the social problems that are inherent in the characteristics that make a society an industrial society.

SOCY 605. Survey Research Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SOCY 601, SOCY 602 and SOCY/STAT 608, or permission of instructor. Examines all major areas of survey research methodology including sampling, design, data collection methods, questionnaire design, data analysis and data processing. Addresses problems specific to survey research, such as telephone interviewing, constructing large representative samples and nonresponse rates. Crosslisted as: PADM 605.

SOCY 607. Seminar in Racial and Ethnic Relations in America. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. A study of intergroup relations in such areas as busing and school desegregation, racism, minority and athletics, the emergence of white ethnic groups in the political systems, and the position of minorities in legal, economic and medical institutions.

SOCY 608. Statistics for Social Research. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: STAT/SOCY 508 or SOCY 214 or permission of instructor. Statistical methods applied in social research. Topics include analysis of variance, correlation and regression, including stepwise methods, and the analysis of discrete data. Study of a statistical package, emphasizing manipulation of survey data sets. Not applicable toward M.S. in Mathematical Sciences or Computer Science. Crosslisted as: STAT 608.

SOCY 609. Seminar in the Family. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Analysis of contemporary family life with an emphasis on the influence of social change. Consideration of current family crises and problems.

SOCY 610. Complex Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of complex organizations in society with emphasis on the determinants and effects of organizational structure and process.

SOCY 611. Studies in the Community. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The organization of the community with emphasis on major trends in urban development and growth. The interdependence of political, social and economic geographic units. The need for cooperative planning and control.

SOCY 612. Seminar in the Sociology of Deviant Behavior. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The nature and functions of deviance. Theories and problems of social control.

SOCY 613. Social Stratification. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. An in-depth analysis of status differentials in society (e.g., social class, prestige and power).

SOCY 614. Seminar in the Sociology of Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. A sociological analysis of education as a social institution with an emphasis on methodological issues and policy implications.

SOCY 615. Seminar in Mass Communications. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Some theoretical background in sociology is recommended. A sociological analysis of contemporary media and their interrelationships with social systems, media and national development. Special emphasis on media as instruments of social and cultural change.

SOCY 616. Digital Sociology. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course covers the sociological underpinnings of apps, likes, shares, profiles and swipes. Many of the digital tools used in society have become critical points of access for education, health care, government and work. Not all groups have the same access to, experience of and returns to using these tools. Digital sociology is emerging from classic social theory and methods to consider these new technologies and how groups interact with them.

SOCY 620. Seminar in Criminology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examination and analysis of social, psychological, and economic theories and correlates of criminal behavior. Typologies of offenders. Crosslisted as: CRJS 620.

SOCY 622. Theory Construction. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A consideration of recent social theorists in which emphasis is placed on the logic of theory construction.

SOCY 624. Community and Community Services for the Elderly. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. A conceptual/theoretical overview of community focusing on the ecological, psychological and social dimensions of community and on communities of the aged. Crosslisted as: GRTY 624.

SOCY 625. Urban Sociology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing. A detailed analysis and examination of the social and ecological structures and processes of the modern city with primary emphasis on the macro-level organization of urban life.

SOCY 630. Social Psychology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Discussion and investigation of selected social psychological issues in sociology, as well as traditional and innovative methodology applied to these issues.

SOCY 631. Battered Women in the Criminal Justice System. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides students with an understanding of (1) the major developments and trends in the law related to battered women in the criminal justice system; (2) the role of the various players in the criminal justice system; (3) how child abuse and sexual abuse are treated in the criminal justice system; and (4) battered women who kill and the defense of battered woman syndrome. Introduces the stages of the criminal justice system as it relates to battered women and their children.

SOCY 632. Intimate Partner and Sexual Violence: Medical Practice and Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of the sociological perspective on intimate partner and sexual violence as it relates to women's health. Also covers practical responses to violence such as screening, assessment, treatment and referral behaviors of medical providers, as well as policy in the health care setting.

SOCY 633. Application of the Policy Process to Issues of Violence. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Offers an interdisciplinary approach to understanding different models of decision-making and the policy process found at all levels of American government. The focus is on the public sector with application to private and nonprofit settings. A six-stage model of policy initiation, selection, implementation, evaluation and termination is presented and explored through the use of case studies and examples of policy initiatives related to domestic violence, sexual assault and youth violence. Prepares students to recognize and understand the key stages of and influences on the policy process and apply them in their current and future work settings.

SOCY 634. Social Contexts of Childhood and Violence. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Course will increase awareness and knowledge of children and adolescents as victims of violence, "absorbers" of violence and perpetrators of violence, as well as the victim-perpetrator dichotomy. Course is informed by an interdisciplinary framework to include neuroscience, trauma-informed practice, socioecological model, child development and resiliency. Topics include children and adolescents' experience with domestic violence, sexual violence, physical abuse, neglect, human trafficking, teen-dating violence, violence against LGBTQ youth, school violence, neighborhood/community violence and violence in the media. This highly interactive course will also consider innovative intervention and prevention strategies and discuss relevant policy issues.

SOCY 635. Theorizing Gender Violence. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Teaches students to think sociologically and structurally about gender and violence. Familiarizes students with sociological and feminist scholarship and explanatory theories related to preventing and responding to gender violence. Students will learn about the experiences of and responses to sexual and domestic violence in specific social contexts, with a focus on less visible and underserved populations. Guest lectures provided by community experts in these areas. Also examines social policy and research implications of various approaches.

SOCY 640. Seminar in Political Sociology. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Analysis of structures and processes of political organization. Examination of the creation and management of power, diffusion and regulation of conflict, and the politics of modernization and bureaucratization.

SOCY 645. The Sociology of Health and Illness. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. An examination of sociocultural factors in health and illness and the influence of social factors on recovery and rehabilitation. Special attention will be paid to the methodology found in current studies.

SOCY 646. Seminar in the Sociology of Mental Health and Disorder. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Seminar in social organizational causes of clinical depression, schizophrenia, neurosis and personality disorders. Focus is on prevention through social engineering and social policy. Impact of social change, sex roles and socialization processes on rates of mental disorder emphasized.

SOCY 650. Theories of Social and Institutional Change. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of social change with emphasis on institutional settings. Topics examined include alternative theoretical perspectives on change, structural sources of change, approaches to planned change, and the role and function of change agents.

SOCY 652. Environmental Sociology. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Exploration of the social and political dimensions of human-environment relationships through the lens of environmental sociology and human geography. The course focuses on large-scale, planetary transformations often referred to as climate change, a diverse range of effects that are becoming increasingly salient parts of our everyday lives.

SOCY 654. Political Economy. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. A rigorous introduction to historical and theoretical modes of inquiry that are foundational to a wide range of critical sociology. An exploration of the major sociological paradigms for analyzing relations among state, economy and society. Topical focus will vary each term, but will include a critical evaluation of liberal political economy, an investigation of 20th century capitalism and the rise of neoliberalism, and the intersections of race, gender and class in the modern world-system.

SOCY 656. Social Network Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to graduate students or with permission of the instructor. Provides a solid introduction to the theoretical foundations, basic measures and common applications of Social Network Analysis. Begins with overview of what it means to practice SNA and discusses the implications and use of SNA as social science methodology. Using online discussions and standard SNA methodological tools, students will engage in peer discussions and complete a series of practica designed to introduce the SNA methodology. Course will also take a broad look at how SNA has been used in understanding social mobility, interpersonal violence and terrorism/gangs. By course end, students will have an understanding of the theories and basic measures and methods of SNA.

SOCY 660. Seminar in the Sociology of Gender. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. An analysis of the social construction of gender, the social forces that create and maintain gender hierarchy, and how the gender hierarchy intersects with other systems of inequality such as race, class and sexuality.

SOCY 673. Public Sociology. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides students an opportunity to reflect on public sociology and develop skills in disseminating their sociological insights to a broader public. Some of the major questions addressed include: What is public sociology? What/who is the sociological audience? What is the relationship between academia and public intellectual life? How does the internet influence the availability of publics? How does style of writing determine our relationship to different publics?.

SOCY 676. Digital Research Methods and Design. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. To engage with both the possibilities and the critiques of digital data, this course speaks two languages – sociology and data science. The course introduces the tools needed for analyzing "native-born" data in order to explain how human behavior both shapes and is shaped by digital data. Methods taught in this course are digital ethnography, digital content analysis, data sampling from social media and Twitter hashtag sampling. Students should be prepared to learn basic Python programming language in order to evaluate the science behind the internet.

SOCY 677. Digital Data Visualization and Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course is specifically designed for students using digital data to understand and explain social phenomena. The goal of the course is to introduce students to data visualization including both the principles and techniques. Students will learn how to present information in an understandable, effective and aesthetic manner for the purposes of explaining insights and messages found in the data. While the emphasis of this course is on the motivation for the visualization method chosen, students will also explore common visualization tools.

SOCY 681. Equity, Diversity and Social Justice. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course is designed to increase students' awareness, knowledge and critical skills related to diversity, equity and social justice (health, economic, housing, education, etc.) in research and practice. The interdisciplinary approach to diversity and equity will cover the intersections of disability, race, gender, sexual orientation, social class, age, poverty and other social statuses and will draw on interdisciplinary research across multiple fields. The topics of this course include developing a framework for engaging diversity, equity and social justice in research and advancing human rights and social justice. Students will explore the knowledge base that underlies skills needed to work toward justice, including types and sources of power, multiple social locations, social constructions, social processes, social identities, conflicts, and how all these interact. Students will explore the nature of diversity and power relations and how social norms shape individual identity. A major emphasis is on developing skills in critical contextual thinking, research and analyses, and in praxis, learning to use knowledge and theory to recognize and critique underlying assumptions and paradigms, and inform working for change. Multiple kinds of boundaries are especially important – across groups, between organizations and system levels, and within and between people, related to intersecting social locations.

SOCY 690. Practicum in the Teaching of College Sociology. 1 Hour.

Semester course; 1 credit. Enables students to develop skills in the design and conduct of undergraduate courses in sociology through observation and supervised experiences. Credits not applicable toward the B.S. in Sociology.

SOCY 691. Special Topics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Seminars on current specialized areas of sociological and anthropological interest.

SOCY 692. Independent Study. 1-6 Hours.

Semester course; 1-3 credits. A maximum of 6 credits may be submitted toward the master's degree. Prerequisites: permission of instructor and graduate program committee.

SOCY 693. Internship. 1-6 Hours.

Semester course; variable hours (50 contact hours per credit). 1-6 credits. May be repeated for a maximum of 6 credits. Permission of the internship coordinator and graduate director required for enrollment. A graduate-level internship that allows students to explore professional opportunities as related to the discipline of sociology. Students will be required to write a professional paper applying sociological concepts and methodologies to their experiences in the setting, as appropriate.

SOCY 694. Practicum in Sociology. 1-6 Hours.

Semester course; variable hours. 1-6 credits. May be repeated for a maximum of 6 credits. Provides opportunities for training experiences in sociological applications under faculty supervision leading to progressively greater degrees of skill development. Specific experiences offered vary from semester to semester.

SOCY 698. M.S. Thesis. 1-6 Hours.

1-6 credits. May be repeated.

SOCY 699. Seminar in Sociological Practice. 1-3 Hours.

Semester course; 1-3 lecture hours (delivered online, face-to-face or hybrid). 1-3 credits. May be repeated for a maximum of six credits. Enrollment is restricted to graduate students in the M.S. in Sociology program who have completed 18 credit hours in graduate-level (500 and above) sociology courses. The purpose of this course is to professionalize students pursuing multiple forms of sociological practice through interactions with the course instructor and student peers who are undertaking thesis, practicum and internship projects. Students will meet regularly with the course instructor to discuss progress/issues/insights with regard to their projects and topics relevant to sociological practice. Students will make progress on their individual projects in a structured format and present their work at the end of each semester. Graded as S/U/F.

Spanish (SPAN)**SPAN 533. Spanish for the Professions. 1-4 Hours.**

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated for a maximum of 8 credits. Prerequisites: SPAN 301; SPAN 305 or 307 or 311; SPAN 320 or 321; SPAN 330 or 331; SPAN 404. An intensive study of specialized communication in Spanish. The content of this course will emphasize the knowledge and language skills for particular professions, which may include business, education, health sciences and translation. See the Schedule of Classes for specific topic offered each semester.

SPAN 543. Texts and Contexts in Spain and Latin America. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated for a maximum of 8 credits. Prerequisites: SPAN 301; SPAN 305 or 307 or 311; SPAN 320 or 321; SPAN 330 or 331. Restricted to seniors in Spanish concentration with at least 85 credit hours taken toward the degree. An exploration of themes concerning Spain, Latin America and/or Latinos in the U.S. as reflected in a variety of textual genres, including film.

Statistical Sciences (STAT)**STAT 508. Introduction to Social Statistics. 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Introduction to statistical methods applicable in a variety of settings, with emphasis on nonexperimental data. Data description and analysis including chi-square and t-tests, using a statistical computing package. Not applicable toward M.S. in Mathematical Sciences or Computer Science. Crosslisted as: SOCY 508.

STAT 513. Mathematical Statistics I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrolling students should have completed both univariate and multivariate calculus. Probability, random variables and their properties, expectations, moment generating functions, common families of distributions, multiple random variables, and sample statistics and properties. Crosslisted as: BIOS 513.

STAT 514. Mathematical Statistics II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 513/BIOS 513. Sufficient statistics, completeness, likelihood functions, point estimators and their properties, hypothesis tests, confidence intervals, and limit theorems. Crosslisted as: BIOS 514.

STAT 534. Statistical Data Science I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of the instructor or graduate director. Familiarity with computer programming is strongly recommended. Topics include processing data from multiple sources and of different types; presentation of complex data; programming statistical and machine learning algorithms, such as maximum likelihood, least squares, etc.; design, implementation and analysis of simulation studies. Other topics will be covered that reflect the current needs of data scientists.

STAT 543. Statistical Methods I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing, or those with one course in statistics and permission of instructor. Basic concepts and techniques of statistical methods, including the collection and display of information, data analysis and statistical measures; variation, sampling and sampling distributions; point estimation, confidence intervals and tests of hypotheses for one and two sample problems; principles of one-factor experimental design, one-way analysis of variance and multiple comparisons; correlation and simple linear regression analysis; contingency tables and tests for goodness of fit. Students may receive degree credit for only one of BIOS 543, STAT 441, STAT 541, STAT 543 or STAT 641. Neither STAT 543 nor BIOS 543 is applicable toward the M.S. degree in mathematical sciences or the M.S. degree in computer science.

STAT 544. Statistical Methods II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 305, STAT 314, STAT 441, STAT 541 or STAT 543, or an equivalent. Advanced treatment of the design of experiments and the statistical analysis of experimental data using analysis of variance and multiple-regression. Includes the use of a statistical software package for data analysis. Students may receive degree credit for only one of BIOS 544 or STAT 544.

STAT 545. Applied Bayesian Statistics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. Students should be familiar with statistical techniques such as multiple linear regression and multi-way ANOVA. Basic probability theory, prior distributions, prior distribution elicitation, likelihood principle, conjugate prior distributions, posterior probability distributions, Bayesian inference. Analysis of typical types of experiments such as single sample experiments, two sample experiments, regression analysis, ANOVA, hierarchical models, structural equation modeling and other topics. Software such as R, Python, JAGS or STAN will be used to perform computations.

STAT 546. Linear Models. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: STAT 513 and one applied course in statistics, or permission of instructor. A study of the theory underlying the general linear model and general linear hypothesis. Topics include the general linear model for quantitative responses (including multiple regression, analysis of variance and analysis of covariance), binomial regression models for binary data (including logistic regression and probit models) and Poisson regression models for count data (including log-linear models for contingency tables and hazard models for survival data).

STAT 591. Topics in Statistics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for credit. Prerequisite: Permission of the instructor. Course open to qualified undergraduates. Selected topics in statistics.

STAT 608. Statistics for Social Research. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: STAT/SOCY 508 or SOCY 214 or permission of instructor. Statistical methods applied in social research. Topics include analysis of variance, correlation and regression, including stepwise methods, and the analysis of discrete data. Study of a statistical package, emphasizing manipulation of survey data sets. Not applicable toward M.S. in Mathematical Sciences or Computer Science. Crosslisted as: SOCY 608.

STAT 613. Stochastic Processes. 3 Hours.

Continuous courses; 3 lecture hours. 3-3 credits. Prerequisite: graduate status in mathematical sciences or systems modeling and analysis, or permission of instructor. Introduction to the theory and applications of stochastic processes. Random walks, Markov processes, queuing theory, renewal theory, birth-death and diffusion processes. Time series, spectral analysis, filter, autocorrelation.

STAT 614. Stochastic Processes. 3 Hours.

Continuous courses; 3 lecture hours. 3-3 credits. Prerequisite: graduate status in mathematical sciences or systems modeling and analysis, or permission of instructor. Introduction to the theory and applications of stochastic processes. Random walks, Markov processes, queuing theory, renewal theory, birth-death and diffusion processes. Time series, spectral analysis, filter, autocorrelation.

STAT 621. Nonparametric Statistical Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: any two courses of statistics or permission of instructor. Estimation and hypothesis testing when the form of the underlying distribution is unknown. One-, two- and k-sample problems. Tests of randomness, Kolmogorov-Smirnov tests, analysis of contingency tables and coefficients of association. Crosslisted as: BIOS 621.

STAT 623. Discrete Multivariate Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate status in mathematical sciences or systems modeling and analysis, or permission of the instructor. Methods for the analysis of categorical data, including logistic regression and the general log-linear model. Emphasis on social and biomedical applications of these techniques using SPSS and SAS software.

STAT 625. Applied Multivariate Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate status in mathematical sciences or systems modeling and analysis, or permission of instructor. Multivariate statistics is a study of dependent random variables. This course covers methods for analyzing continuous multivariate data, such as numerical and graphical summary of multivariate observations, principal component analysis, factor analysis, classification and discrimination, canonical correlation analysis, and cluster analysis. Students will learn the motivation behind these methods, how to implement them in statistical software packages and how to interpret the results.

STAT 626. Complex Sampling Designs and Variance Estimation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: STAT 544 and 514. The analysis of data from surveys that use multistage samples, and connections to the analysis of observational studies and experiments with missing data. Computer intensive methodologies such as the jackknife and bootstrap will be introduced and applied to the problem of variance estimation in these diverse settings.

STAT 636. Machine Learning Algorithms. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate status in mathematical sciences, systems modeling and analysis, decision sciences and business analytics, or computer science, or by permission of the instructor. Includes an in-depth analysis of machine learning algorithms for data mining, equipping students with skills necessary for the design of new algorithms. Analyses will include framing algorithms as optimization problems and a probabilistic analysis of algorithms. Students will be exposed to current areas of research in the construction of data mining algorithms. Crosslisted as: OPER 636.

STAT 641. Applied Data Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Experience with mathematics or statistics software is strongly recommended. Introduction to applied data analysis intended primarily for graduate students in mathematical sciences and engineering. Topics include the fundamental ideas of descriptive statistics, elementary probability theory, statistical inference including tests of hypotheses and confidence intervals, ANOVA, principles of experimental design, correlation and linear regression analysis, categorical data analysis, and quality control. Focus is on the practical side of implementing these techniques using statistical software packages. Students may receive degree credit for only one of BIOS 543, STAT 441, STAT 541, STAT 543 or STAT 641.

STAT 642. Design and Analysis of Experiments I. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate status in mathematical sciences or systems modeling and analysis or by permission of instructor. An introduction to the design and analysis of experiments. Topics include the design and analysis of completely randomized designs, one variable block designs, the family of Latin square designs and split-plot designs. Introductions are also given to multiple comparison procedures and contrasts, analysis of covariance and factorial experiments. Applications involve the use of a statistical software package.

STAT 643. Applied Linear Regression. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Knowledge of calculus and linear algebra recommended. An introduction to the concepts and methods of linear regression analysis. Topics include simple linear regression, multiple linear regression, the impact of model misspecification, model selection criteria, residual analysis, influence diagnostics, diagnostic plots, multicollinearity, transformations and response surface methodology. Applications involve the use of a statistical software package.

STAT 645. Bayesian Decision Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 514 or equivalent. Presents statistical decision theory and Bayesian analysis, with discussions of loss functions, risk, utility, prior information; conjugate families; posterior distributions, estimation, hypothesis testing; empirical and hierarchical Bayes analysis; and robustness.

STAT 648. Systems Reliability Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate status in mathematical sciences or systems modeling and analysis, or permission of the instructor. An introduction to engineering reliability and risk analysis, specifically failure data analysis, maintenance problems, system reliability and probabilistic risk assessment. Applications in computer science and engineering will include stochastic characterization of wear in hardware systems and the development of failure models for software systems. Decision problems such as the optimal maintenance of repairable systems and optimal testing policies for hardware and software systems will be examined. The analysis of risk through fault trees, event trees and accident precursor analysis also will be discussed. Crosslisted as: OPER 648.

STAT 649. Statistical Quality Control. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate status in mathematical sciences or systems modeling and analysis, or permission of the instructor. Demonstrates how statistics and data analysis can be applied effectively to process control and management. Topics include the definition of quality, its measurement through statistical techniques, variable and attribute control charts, CUSUM charts, multivariate control charts, process capability analysis, design of experiments, and classical and Bayesian acceptance sampling. Statistical software will be used to apply the techniques to real-life case studies from manufacturing and service industries. Crosslisted as: OPER 649.

STAT 650. Design and Analysis of Response Surface Experiments. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate status in mathematical sciences or systems modeling and analysis, or by permission of the instructor. Philosophy, terminology and nomenclature for response surface methodology, analysis in the vicinity of the stationary point, canonical analysis, description of the response surface, rotatability, uniform information designs, central composite designs and design optimality. Crosslisted as: BIOS 650.

STAT 675. Time Series Analysis I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate status in mathematical sciences or systems modeling and analysis, or permission of instructor. Analysis of data when observations are not mutually independent, stationary and nonstationary time series, ARIMA modeling, trend elimination, seasonal models, intervention analysis, transfer function analysis, prediction and applications in economics and engineering.

STAT 691. Special Topics in Statistics. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for credit. Prerequisite: Permission of instructor. A detailed study of selected topics in statistics.

STAT 696. Applied Project. 1-3 Hours.

Semester course; 1-3 lecture hours (to be arranged). 1-3 credits. Up to three credits will be applied to the M.S. in Mathematical Sciences (operations research or statistics concentration) per section. Can be repeated for credit. Prerequisite: SSOR 690 or permission of the faculty adviser. Designed to allow students to apply concepts and theories learned in other courses to a practical situation. Includes the selection, written description, completion and written report of the project and a presentation of the findings. Students may not receive credit for both OPER/STAT 696 and OPER/STAT 698. Graded as Satisfactory/Unsatisfactory. Crosslisted as: OPER 696.

STAT 697. Directed Research. 1-3 Hours.

Semester course; variable hours. 1-3 credits per semester. May be repeated for credit. Prerequisite: Graduate standing. Supervised individual research and study in an area not covered in the present curriculum or in one that significantly extends present coverage. Research culminates with an oral presentation and submission of a written version of this presentation to the supervising faculty member.

STAT 698. Thesis. 1-3 Hours.

Hours to be arranged. 1-3 credits. A total of 3 or 6 credits may be applied to the M.S. in Mathematical Sciences/Statistics. (A total of 3 credits for an expository thesis or a total of 6 credits for a research thesis.) May be repeated for credit. Prerequisite: Graduate standing. Independent research culminating in the writing of the required thesis as described in this bulletin. Grade of "S," "U" or "F" may be assigned in this course.

STAT 725. Advanced Multivariate Statistical Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: STAT 625 and STAT 643. This course emphasizes statistical analysis, methodology and theory in modern statistical learning. A variety of multivariate statistical methods, algorithms and software tools will be introduced, with emphasis on conceptual, theoretical and computational aspects. Topics include regularized regression (linear/nonlinear), classification, clustering, sufficient dimension reduction and high dimensional data analysis. Applications involve the use of a statistical software package.

STAT 736. Mathematics of Knowledge and Search Engines. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: STAT 636 or equivalent. Investigates the mathematics, methods and algorithms for searching for and extracting structures of interest (knowledge) from large and possibly high-dimensional datasets. The motivation is the rapid and phenomenal growth of the search engine (as demonstrated by Google) as a major tool for search on the Internet, which has impacted commerce, education and the study of social, financial and scientific datasets. The development of the mathematical and statistical learning algorithms behind these search engines has led to advances in how large, high-dimensional datasets can be effectively analyzed for the extraction of knowledge. Crosslisted as: OPER 736.

STAT 742. Design and Analysis of Experiments II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 642. Advanced study of the design and analysis of experiments. Topics include the design and analysis of incomplete block designs, factorial designs, fractional factorial designs, asymmetric factorial designs, blocking in fractional factorial designs, nested designs and response surface designs. Applications involve the use of a statistical software package.

STAT 744. Regression II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 643 or equivalent. Knowledge of calculus and linear algebra required. Theoretical development and advanced applications of the general linear regression model and nonlinear regression models. Topics include an overview of multiple linear regression, generalized least squares and weighted regression, procedures for diagnosing and combating multicollinearity, advanced model selection criteria, influence diagnostics including multiple observation diagnostics and singular value decomposition, nonlinear regression, Poisson regression, logistic regression, generalized linear models and the exponential family, variance modeling and nonparametric regression. Applications involve the use of a statistical software package.

STAT 745. Advanced Bayesian Statistics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: STAT 546 and STAT 645 or permission of instructor. Introduces modern aspects of Bayesian methodology. Numerical and sampling techniques such as the Gibbs sampler, importance sampling resampling, Monte Carlo integration, Metropolis-Hastings sampling and adaptive sampling methods. Inferential methods including model selection, highest probability models, Bayesian model averaging, Markov chain Monte Carlo model composition. A large portion of the course will survey the current literature in the areas listed above as well as applications of the methods.

STAT 746. Spatial Data Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: STAT 513 and STAT 643 or permission of instructor. The course will introduce graphical and quantitative analysis for spatial data. Topics include data on fixed-grids, point-referenced data, lattice data, point-pattern data and experimental design for spatial data collection. Students will be expected learn how to program in appropriate software packages.

STAT 775. Time Series Analysis II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 513 and STAT 675, or permission of instructor. Advanced study of time series analysis. Topics include multivariate time series, state-space models and GARCH models. Applications involve the use of a statistical software package.

STAT 791. Special Topics in Statistics. 1-3 Hours.

Semester course; 1-3 lecture hours (delivered online, face-to-face or hybrid). 1-3 credits. May be repeated for credit. Enrollment requires permission of the instructor. A detailed study of selected advanced topics in statistics.

Statistical Sciences and Operations Research (SSOR)**SSOR 690. Research and Communications Seminar. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with nine graduate credits in OPER and/or STAT courses and with permission of the instructor. Designed to help students attain proficiency in professional and academic communication and research in the context of statistics and operations research. The course focuses on the discipline-specific communication and research skills necessary to excel in careers or graduate studies in these disciplines.

Systems Modeling and Analysis (SYSM)

SYSM 681. Research Exploration. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to graduate students in mathematical sciences or systems modeling and analysis. Designed to help students attain knowledge of the various research opportunities in the systems modeling and analysis Ph.D. program. Students are exposed to the discipline-specific communication and research skills necessary to excel in graduate studies in these disciplines.

SYSM 682. Systems Seminar II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: graduate standing in mathematical sciences or systems modeling and analysis. Designed to help students attain proficiency in professional communication and research in the context of mathematics, operations research and statistics. Focuses on the discipline-specific communication and research skills necessary to excel in professional careers in these disciplines.

SYSM 683. Systems Seminar III. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: graduate standing in mathematical sciences or systems modeling and analysis. Designed to help students attain proficiency in literature review and research in the context of mathematics, operations research and statistics. Focuses on the discipline-specific literature review and research skills necessary to write an applied project, thesis or dissertation.

SYSM 697. Systems Research. 2 Hours.

Semester course; 2 research hours. 2 credits. May be repeated for a maximum of six credits. Enrollment is restricted to graduate students in systems modeling and analysis Ph.D. program. Supervised individual research and study. Research culminates with submission of a written report to the supervising faculty member. Graded as S/U/F.

SYSM 780. Stochastic Methods in Mathematical Biology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: STAT 513 or STAT 613; and MATH 535. Covers commonly used stochastic methods in mathematical biology, including cellular physiology and related areas. Topics covered include stochastic differential equation models, applications of first passage time (escape time) and applications of density or master equations, diffusion in cells, stochastic ion channel dynamics, and cellular communication. Students will be expected to learn how to program in appropriate software packages.

SYSM 798. Dissertation Research. 1-12 Hours.

Semester course; variable hours. 1-12 credits. May be repeated for credit. Research and work leading to the completion of the Ph.D. dissertation in systems modeling and analysis. Graded S/U/F.

World Studies (WRLD)

WRLD 530. Concepts in World Cinema. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Can be repeated for credit with different themes. Prerequisites: permission of instructor and/or graduate standing. Exploration of aspects of film theory combined with a study of cinema across national traditions and movements. Each semester a different thematic focus is engaged to illuminate issues in film composition and reception. Themes will include: the Holocaust, film and screen theory in the digital era, decolonizing the gaze: Black African and Caribbean cinema.

WRLD 535. World Filmmakers. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Can be repeated for credit with different themes. Prerequisites: permission of instructor and/or graduate standing. Centers on the distinct yet interrelated roles of directors (as individual "authors" or as part of a movement or tradition), studios, audiences, national film industries, etc. in the production, development and interpretation of screen media. Each semester a different vantage point, i.e. gender, is used to open new perspectives on film, a critical evaluation of national film traditions and the elements of cinematographic style. Topics include: women filmmakers in world cinema, Spanish and Latin American filmmakers, filmmakers of the "New German Cinema".

WRLD 593. Internship With French Film Festival. 3 Hours.

Semester course; 8 hours per week in festival office during semester and 8 hours per day during festival in Byrd Theatre. 3 credits. Provides students practical hands-on experience working in the French Film Festival office. Students will research and write questions to ask French actors, directors and cinematographers during the festival. The students edit a final audiovisual project of their actor/director interviews. Students work closely with the founders/directors of the French Film Festival.

School of the Arts

Applied Music (APPM)

APPM 585. Opera Theatre. 2 Hours.

Semester course; 1 lecture and 4 studio hours. 2 credits. May be repeated up to four times for credit. Prerequisite: Permission of instructor. Explores aspects of opera through study, written research and fully staged public performances of operatic scenes and/or one-act operas.

Art Education (ARTE)

ARTE 501. Art Education Elementary Materials and Practicum. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: admission to the art teacher preparation program. A preparatory experience with observation and participation in art programs in elementary grades prior to student teaching. This course explores art materials, techniques and teaching methods suitable for this level and analyzes evaluation strategies appropriate for art.

ARTE 502. Art Education Secondary Materials and Practicum. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: admission to the art teacher preparation program. A preparatory experience with observation and participation in art programs in middle school, high school or nontraditional settings prior to student teaching. This course explores art materials and techniques suitable for these levels, examines developmental performance levels and analyzes evaluation methods appropriate for art.

ARTE 508. Two-dimensional Art Experiences. 3 Hours.

Semester course; 2 seminar and 3 studio hours. 3 credits. Not offered for credit for studio art majors. The course explores the media, techniques and concepts of drawing, painting and printmaking.

ARTE 509. Three-dimensional Art Experiences. 3 Hours.

Semester course; 2 seminar and 3 studio hours. 3 credits. Not offered for credit for studio art majors. Exploration of sculptural concepts with three-dimensional materials such as wood, metal, clay, fiber, plaster, plastic and glass.

ARTE 510. Studio Pedagogies. 3 Hours.

Semester course; 1 lecture and 4 studio hours. 3 credits. Students will explore two-dimensional and three-dimensional traditional and emerging media and investigate related teaching innovations. The focus will be contemporary methods and conceptual approaches to visual meaning-making.

ARTE 550. Art for the Exceptional Learner. 3 Hours.

Semester course; 2 lecture and 3 laboratory hours. 3 credits. A study of exceptional learners including handicapped, gifted, talented, aged and others, and their participation in and appreciation for the visual arts. Courses may include practicum and field experiences.

ARTE 570. Community-based Art Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students will spend two hours per week for 10 weeks (20 hours) at a community site engaged in studio-based service-learning activities. In this transdisciplinary course, students study theories of socially engaged art, community-based art education, service-learning and transformative learning as it applies to multigenerational, multicultural community settings. Using art as a call to action, a language that transcends, transgresses and transforms, students and community participants engage in arts-based narrative co-inquiry to co-create place-based oral, visual, written and performed narratives that express their personal voice, lived experiences, social, moral, cultural and political concerns toward the creation of healthy communities.

ARTE 592. Independent Study in Art Education. 1-6 Hours.

Semester course; 1-6 credits. Prerequisite: Approval from department chair. Art education majors only. An in-depth study of a selected art education topic.

ARTE 600. Seminar: Issues in Art Education. 3-6 Hours.

Semester course; 3-6 lecture hours. 3-6 credits. The course investigates contemporary issues and identifies problems in art education. Students prepare oral and written reports that explore new directions and discuss the implications for teachers and art programs.

ARTE 611. Theory and Literature in Art Education. 3 Hours.

Semester courses; 3,3 seminar hours. 3, 3 credits. An introduction to the body of literature and key issues within the field of art education. Students will also develop an overview of the history of art education as well as an understanding of the major roles that theory plays in the crafting of literature within the field, including the roles of conceptual and theoretical frameworks in conducting and consuming research.

ARTE 612. Theory and Literature in Art Education. 3 Hours.

Semester courses; 3,3 seminar hours. 3, 3 credits. An introduction to the body of literature and key issues within the field of art education. Students will also develop an overview of the history of art education as well as an understanding of the major roles that theory plays in the crafting of literature within the field, including the roles of conceptual and theoretical frameworks in conducting and consuming research.

ARTE 665. Curriculum Development and Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 6 credits. A review of curriculum development including: needs assessment, determination of goals and objectives, curriculum writing, evaluation, and feedback processes. Theoretical approaches in the visual arts will be studied and curriculum models designed, developed and analyzed.

ARTE 670. Technology in Art Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The students examine diverse aspects of new technologies in relation to art programs. These aspects include media and computer-assisted learning, and applications of computer graphics and other technology to artistic expression.

ARTE 690. Issues and Methods of Inquiry in Art Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Readings and discussions of studies in art education and related research emphasizing possibilities for implementation by art teachers. Methods of research in the field will be reviewed and sample research proposals will be developed by the students.

ARTE 691. Topics in Art Education. 1-3 Hours.

Semester course; variable hours. 1-3 credits. May be repeated for a maximum of 9 credits with different content. The course will explore selected topics of current interests or needs relative to art education. See Schedule of Classes for specific topic to be offered each semester.

ARTE 692. Independent Study in Art Education. 1-6 Hours.

Semester course; 1-6 credits. Prerequisite: Approval from department chair. Art education majors only. An in-depth study of a selected art education topic.

ARTE 701. Issues in Art Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Readings and discussions of current issues in art education, art and education. This course emphasizes contemporary issues and research in the field and makes connections between theory and practice.

ARTE 702. History of Art Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is a survey of the history of art education, its major theories and influences. The emphasis is on the influence of education, art, society and politics on the shaping of art education. While the history of art education from Plato to the present is surveyed, the emphasis is on the past 50 years.

ARTE 703. Contemporary Philosophies and Art Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Readings and discussions of philosophical writings that affect contemporary art education, art and education.

ARTE 704. Research in Art Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Advanced readings and discussions of studies in art education. Advanced methods of research in the field will be reviewed and students will develop a beginning dissertation proposal.

ARTE 780. Cultural Diversity in Art and Society. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Recognizing the complex intersections of art, culture and social issues, this course explores the diverse social and cultural landscape in which art is produced. Students will consider recent and historical examples of how policies and social issues have shaped art production in both U.S. and global contexts.

ARTE 799. Thesis. 1,3 Hour.

Semester course; 1 or 3 credits. May be repeated. Prerequisite: completion of all formal course work, candidacy and approval of the department chair. Preparation of a thesis is based upon independent research.

ARTE 800. Advanced Seminar in Art Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum total of 9 credits. The course investigates contemporary issues and identifies problems in art education. Students prepare oral and written reports to explore new directions and discuss the implications for teachers and art programs.

Art History (ARTH)

ARTH 591. Special Topics in Art History. 1-6 Hours.

Semester course; variable hours. 1-6 credits. May be repeated for a maximum of 9 credits. An in-depth study of a particular aspect of art history or art made in a particular time or place, or by a specific artist or group of artists. Course may include extended off-campus trips to sites and collections throughout the United States or abroad. See the Schedule of Classes for specific topics to be offered each semester.

ARTH 598. German for Art Historical Research. 3 Hours.

Semester course. 3 practicum hours. 3 credits. A sustained and progressively complex sequence of exercises in reading and translating art historical research that is written and published in German. Graded P/F.

ARTH 621. Historical Preservation and Architectural History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An introduction to the methods or research, record keeping and reporting used in architectural history, and to the evolution of the discipline, especially in relation to historic preservation.

ARTH 622. Studies in Architectural History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 9 credits. An advanced, in-depth study of a selected period of architectural history in Europe and/or America. See the Schedule of Classes for specific topics to be offered each semester.

ARTH 681. Museums and Communities. 3 Hours.

Semester course; 3 seminar hours. 3 credits. An examination of relationships between museums and communities, focusing on critical/theoretical analyses of how museums have constructed community identities, histories of place and cross-cultural relations. Also provides understanding of organizational structures and the roles and responsibilities of museum administrators.

ARTH 682. The Museum as Educational Institution. 3 Hours.

Semester course; 3 seminar hours. 3 credits. An overview of the history, theory and practice of museums as educational institutions, focusing on education philosophies and teaching methods as well as criteria for evaluating the educational merit of exhibits and programs. Also provides an understanding of the roles and responsibilities of museum educators and the structural organization of museum departments of education.

ARTH 683. Museum Collections. 3 Hours.

Semester course; 3 seminar hours. 3 credits. An examination of the history, motivations and procedures of museums collecting. Considers the ethical and logistical issues involved in acquiring objects (through bequests and purchase), in releasing objects (through restitution and deaccessioning) and in stewardship of objects (through conservation and registration). Also provides understanding of the roles and responsibilities of curators, collections managers, registrars and conservators, as well as an understanding of the structural organization of curatorial/collections staff.

ARTH 684. Curating Museum Exhibitions. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Prerequisite: ARTH 681, ARTH 682, ARTH 683 or ARTH 691. Students work collaboratively to develop an exhibit script that reflects a contemporary museological issue through the display of artworks and/or artifacts.

ARTH 690. Historiography and Methodology of Art History. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Historiographic overview of art history since the mid-18th century that provides a foundational understanding of the changing methodological and theoretical bases for its disciplinary practices in academia and museums. Critical reading and writing skills and research methods will be developed through class discussion, small assignments and an independent research project in the student's primary area of interest.

ARTH 691. Special Topics in Museum Studies. 3 Hours.

Semester course; 3 seminar hours. 3 credits. An advanced, in-depth study of museum histories, theories or practices in a particular time period, region or culture.

ARTH 693. Graduate Museum Internship. 3-6 Hours.

Semester course; variable hours. 3-6 credits. May be repeated for a maximum of 9 credits. Prerequisite: permission of instructor, chair of the graduate committee and/or chair of the Department of Art History. Professionally supervised work in a local, regional, national or international museum.

ARTH 694. Art History and Pedagogy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An examination of teaching philosophies and methods that have been enacted in the development of art history curricula, course design, classroom activities and gallery programs within higher education and museum contexts.

ARTH 695. Writing Seminar. 3 Hours.

Semester course; 3 seminar hours. 3 credits. An investigation and practical application of rhetorical styles of writing for various audiences and purposes in academic, museum and/or online contexts, with particular focus on scholarly writing.

ARTH 721. Seminar in Early Modern Art. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 12 credits. An advanced, in-depth study of a selected aspect of Renaissance or Baroque art in Europe. See the Schedule of Classes for specific topics to be offered each semester.

ARTH 722. Seminar in 19th-century Art. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 12 credits. An advanced, in-depth study of a selected aspect of 19th-century art in Europe and/or America, including though not limited to movements, artists, new techniques, technologies or display venues. See the Schedule of Classes for specific topics to be offered each semester.

ARTH 723. Seminar in 20th-century Art. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 12 credits. An advanced, in-depth study of a selected aspect of 20th-century art in Europe and/or America, including though not limited to movements, artists, new techniques, technologies or display venues. See the Schedule of Classes for specific topics to be offered each semester.

ARTH 726. Seminar in African Art. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 12 credits. A study of the culture and traditional art forms, which may include architecture; sculptural works in wood, stone, ivory and metal; royal attire; jewelry and/or weaponry of a specific African region. See the Schedule of Classes for specific topics offered each semester.

ARTH 728. Seminar in Asian Art. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 12 credits. An advanced, in-depth study of a selected aspect of Asian art. See the Schedule of Classes for specific topics to be offered each semester.

ARTH 741. Seminar in Art and Theory. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 9 credits. An advanced, detailed investigation of critical, aesthetic or social theories as they relate to the history of art. See the Schedule of Classes for specific topics offered each semester.

ARTH 742. Seminar in Trans-millennial Art and Ideas. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 9 credits. An advanced, detailed investigation of an issue, idea or topic that transcends millennia in the history of art. See the Schedule of Classes for specific topics offered each semester.

ARTH 743. Seminar in Art and Representation. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 9 credits. An advanced, detailed investigation of an issue, idea or topic that considers artworks as representations of people, places, ideas, cultural values, etc. See the Schedule of Classes for specific topics offered each semester.

ARTH 749. Seminar in Diasporic Art. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 6 credits. An examination of African-inspired cultural and artistic traditions in North and South America and the Caribbean. See the Schedule of Classes for specific topics offered each semester.

ARTH 771. Qualifying Paper. 1-3 Hours.

Semester course; 1-3 seminar hours. 1-3 credits. May be repeated for a maximum of four credits. Prerequisite: ARTH 695. Provides Master of Arts students with a structure in which to complete a qualifying paper that fulfills degree requirements. Students meet periodically as a group while also working independently with a faculty adviser to articulate a paper topic, conduct research and refine a paper of publishable quality.

ARTH 772. Major Field Exam. 3 Hours.

Semester course; 3 research hours. 3 credits. Enrollment requires permission of director of graduate studies. Provides doctoral students with opportunities to investigate research areas related to their major field of study. Students work with a faculty adviser to establish a bibliography for independent reading and study in preparation for the major field exam. Graded as Pass/Fail.

ARTH 773. Minor Field Exam. 3 Hours.

Semester course; 3 research hours. 3 credits. Enrollment requires permission of director of graduate studies. Provides doctoral students with opportunities to investigate research areas related to their minor field of study. Students work with a faculty adviser to establish a bibliography for independent reading and study in preparation for the minor field exam. Graded as Pass/Fail.

ARTH 774. Dissertation Proposal. 3 Hours.

Semester course; 3 research hours. 3 credits. Enrollment requires permission of director of graduate studies. Students prepare a dissertation proposal under the direction of the dissertation adviser. Graded as S/U/F.

ARTH 791. Special Topics in Art History. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 9 credits. An in-depth investigation of a topic or issue in art history. See the Schedule of Classes for specific topics offered each semester.

ARTH 797. Directed Research Project. 1-3 Hours.

Semester course; variable hours. 1-3 credits. May be repeated for a maximum of 6 credits. Prerequisite: permission of instructor, director of graduate studies and chair of the Department of Art History. Advanced individual work on a subject to be formulated by the student in collaboration with and/or approved by the instructor.

ARTH 899. Dissertation Research. 1-6 Hours.

Semester course; variable hours. Variable credit. A minimum of 6 semester hours required; may be repeated for a maximum of 15 credits. Enrollment restricted to students who have achieved Ph.D. candidacy. Preparation of a dissertation based on independent research and in consultation with a faculty dissertation director. Graded S/U/F.

Arts (ARTS)**ARTS 591. Special Topics. 1-4 Hours.**

Semester course; variable hours. 1-4 credits. May be repeated with different topics for a maximum of 6 credits. Prerequisite: approval of the instructor. Topical course offering a variety of subjects that are not offered as a part of the standard curriculum of any individual department within the School of the Arts. See the Schedule of Classes for specific topics to be offered.

ARTS 592. Individual Projects/Fieldwork. 1-6 Hours.

Semester courses; 1-6 credits. By appointment with director of graduate studies after approval by department chair. (Obtain individual research project form from the dean's office prior to enrollment.) Individual work for graduate students.

ARTS 601. Seminar in Art. 3 Hours.

Continuous courses; 3-3 credits. Discussion and research in the visual arts providing experience and involvement in the various studio areas for students not concentrating in these areas.

ARTS 602. Seminar in Art. 3 Hours.

Continuous courses; 3-3 credits. Discussion and research in the visual arts providing experience and involvement in the various studio areas for students not concentrating in these areas.

ARTS 690. Methods of Art Research. 2 Hours.

Semester course; 2 credits. Review of selected research methods relevant to the composition of a thesis in the student's master's degree area. Preparation of a proto-thesis concludes course work.

ARTS 692. Individual Projects/Fieldwork. 1-6 Hours.

Semester courses; 1-6 credits. By appointment with director of graduate studies after approval by department chair. (Obtain individual research project form from the dean's office prior to enrollment.) Individual work for graduate students.

ARTS 705. Research in the Arts. 3 Hours.

Semester courses; 3, 6 credits. By appointment with director of graduate studies after approval by department chair. (Obtain individual research project form from the dean's office prior to enrollment.) Individual research for graduate students.

ARTS 706. Research in the Arts. 6 Hours.

Semester courses; 3, 6 credits. By appointment with director of graduate studies after approval by department chair. (Obtain individual research project form from the dean's office prior to enrollment.) Individual research for graduate students.

Craft and Material Studies (CRAF)

CRAF 670. Graduate Studio. 6 Hours.

Semester course; 9 studio hours. 6 credits. Repeated for a total of 24 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts craft and material studies concentrations. Primary emphasis is placed on individual creative projects and on discussion of individual creative projects with regular exposure to the critical attention of other graduate students in the department, under the direction of the teaching faculty. Special emphasis is given to the development of personal expression through individual research and criticism.

CRAF 681. Candidacy Research. 1,3 Hour.

Semester course; 1.5 or 4.5 studio hours. 1 or 3 credits. Must be repeated for a total of six credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts craft and material studies concentrations. This course comprises the process of producing work to achieve candidacy, a crucial qualifying step in which student's academic achievements are reviewed and the student's readiness to proceed to the final research phase of the degree program is determined.

CRAF 682. Thesis. 1,3 Hour.

Semester course; 1.5 or 4.5 studio hours. 1 or 3 credits. Must be repeated for a total of six credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts craft and material studies concentrations. This course comprises the process of producing work for and exhibiting in the thesis exhibition; a written thesis; and an oral presentation by second-year M.F.A. students, a crucial qualifying step for students to complete the program. Graded as Satisfactory/Unsatisfactory.

CRAF 683. Independent Studio. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. An independent studio course that allows students to develop specific skills or explore techniques. Approval of supervising faculty member and department chair necessary prior to registration.

CRAF 690. Graduate Seminar. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Must be repeated for a total of 12 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts craft/material studies concentration. Weekly seminar for the purpose of examining contemporary issues within the field of fine art, broadening critical discourse and considering artists' work within the context of a creative practice.

CRAF 691. Special Topics Studio. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. A studio course that focuses on specific issues, theories or historical events in relationship to students' research and studio practice.

CRAF 692. Directed Research. 1-3 Hours.

Semester course; 1-3 research hours. 1-3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. Approval of supervising faculty member and department chair necessary prior to registration. Learning experiences will be designed with the supervising faculty member in the form of a contract between student and instructor.

Design (DESI)

DESI 510. Materials and Methods Studio. 3 Hours.

Semester course; 6 studio hours. 3 credits. Prerequisite: permission of program director. Studio course that develops skills in the use of materials, methods and technologies relevant to a broad range of activities pertaining to design.

DESI 511. Studio in Digital Design and Fabrication Technology. 3 Hours.

Semester course; 2 lecture and 3 studio hours. 3 credits. Prerequisite: permission of program director. A studio-based examination of design research methods with emphasis placed on new technology of three-dimensional digital design and fabrication. The studio will utilize recently installed and existing facilities, faculty and resources at Digital Fabrication Lab at VCUQatar.

DESI 512. Studio in Visual Communications. 3 Hours.

Semester course; 2 lecture and 3 studio hours. 3 credits. Prerequisite: permission of program director. A studio-based examination of design research methods with emphasis placed on time-based media production. The course is designed to provide a lab/studio opportunity for students to develop media skills while focusing on individual production, collaborative projects and critical discussion. The studio will utilize recently installed and existing facilities, faculty, and resources at Media Lab at VCUQatar.

DESI 520. Design Research Methodologies. 3 Hours.

Semester course; 2 lecture and 3 studio hours. 3 credits. Prerequisite: permission of program director. A studio-based examination of design research methods with emphasis placed on linking knowledge, comprehension and application of historic and emerging methods of experimentation to generative and iterative studies.

DESI 601. Interdisciplinary Design Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A seminar to examine the theories and practices related to the contemporary designer's role in the technological, psychological, cultural and aesthetic environment. The seminar will include exploration of historical and contemporary art, architecture, communications, cultural theory and design criticism. The course involves intensive professional debate of various aspects of interdisciplinary design practice, ongoing group discussion, and exercises in critical writing. Professionals at the university and outside of the university will be invited for participation.

DESI 605. Design Strategies and Ethics for Business. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An investigation of precedents and potentials for application of design methods and processes to the development of business strategies and ethics.

DESI 611. Design Studio One. 6 Hours.

Semester course; 12 studio hours. 6 credits. A topical studio focusing on research, experimentation and problem-solving methods from a cross section of design disciplines.

DESI 612. Design Studio Two. 6 Hours.

Semester course; 12 studio hours. 6 credits. Studio course focusing on interdisciplinary, team-based approaches to identifying and solving advanced design problems.

DESI 613. Design Studio Three. 6 Hours.

Semester course; 12 studio hours. 6 credits. Prerequisites: successful completion of 30 credits of graduate study and permission of the program director. Studio course focusing on experimentation, analysis and development of creative projects that directly contribute to a design brief to be used as a basis for the final thesis.

DESI 620. Design Thesis Research and Formulation. 3 Hours.

Semester course; 2 lecture and 3 studio hours. 3 credits. Prerequisites: successful completion of 30 credit hours of graduate study and permission of the program director. Students examine applied research methods with emphasis placed on comprehension and analysis of case studies and then apply design research methods to test original proposals in a studio environment. Through development of design processes, students define an individual or team project of complex scope and intensity.

DESI 621. Design Research Studio: Leadership and Entrepreneurship. 3 Hours.

Semester course; 1 lecture and 6 studio hours. 3 credits. Prerequisites: successful completion of 30 credit hours of graduate study and permission of the program director. Students evaluate emerging leadership methodologies by applying lessons from case studies and emerging fields of knowledge. Course provides collaborative and presentation opportunities.

DESI 630. Teaching Practicum in Design. 3 Hours.

Semester course; 1 lecture and 6 practicum hours. 3 credits. Prerequisite: completion of 18 credit hours of graduate study. Exploration of philosophical, informational and technical aspects of design education. Observation, instruction and practice in teaching. Topics include effective teaching strategies, curriculum development, learning styles and evaluation techniques. Graded as P/F.

DESI 631. Design Internship. 3 Hours.

Semester course; 1 lecture and 6 studio hours. 3 credits. Prerequisites: successful completion of 30 credit hours of graduate study and permission of the program director. Provides supervised practical work experience that is coordinated with professional designers under the guidance of the design faculty. Internship placement is based upon research interest. Graded as P/F.

DESI 690. Thesis Studio. 1-9 Hours.

Semester course; variable hours (2 studio hours per credit; 1 seminar hour per 3 credits). 1, 3, 6 or 9 credits. Prerequisites: successful completion of 30 credit hours of graduate study and permission of the program director. This course will support and assist the student in the development and completion of the final thesis project. Executed under the supervision of a graduate adviser and review committee. Graded as S/U/F.

DESI 692. Interdisciplinary Design Research/Individual Study. 1-3 Hours.

Semester course; 3-9 studio hours. 1-3 credits. May be repeated. The structuring, research, execution and presentation of an independent project in interdisciplinary design under the guidance of a faculty member.

Graphic Design (GDES)**GDES 567. Visual Interface Design. 4 Hours.**

Semester course; 3 lecture and 3 studio hours. 4 credits. Prerequisite: Permission of instructor. A course concentrating on the visual design and development of human-computer interface systems. Emphasis is placed on visual design processes and methods in the diverse arena of user interface design.

GDES 591. Advanced Studio Topics in Visual Communications. 3 Hours.

Semester course; 2 lecture and 3 studio hours. 3 credits. Prerequisite: permission of instructor. May be repeated for a maximum of 6 credits. Topical studio focusing on research and experimentation in specialized visual communication media.

GDES 593. Visual Communications Internship. 3,6 Hours.

Semester course; 3 or 6 credits. May be repeated to a maximum of 6 credits. Prerequisite: Permission of chair required. Supervised study in cross-disciplinary visual communications research projects to integrate theory with practice. Training is provided under the direction and supervision of qualified professional practitioners and a faculty adviser.

GDES 610. Visual Communications Workshop. 4 Hours.

Semester course; 3 lecture and 3 studio hours. 4 credits. Prerequisite: permission of the graduate director. A studio course focusing on the philosophical, communicative and aesthetic relationships of visual communications problem-solving and the effective articulation of concepts.

GDES 611. Visual Communications Workshop. 4 Hours.

Semester course; 3 lecture and 3 studio hours. 4 credits. May be repeated for a maximum total of 16 credits. Prerequisite: permission of the graduate director. A studio course focusing on the philosophical, communicative and aesthetic relationships of visual communications problem solving and the effective articulation of concepts.

GDES 612. Research Methods in Visual Communications. 4 Hours.

Semester course; 3 lecture and 3 studio hours. 4 credits. Prerequisite: permission of program director. A studio-based examination of design research methods with emphasis place on linking knowledge, comprehension and application of historic and emerging methods of experimentation to generative and iterative studies. The course culminates in the writing and presentation of a research proposal for the second year of study.

GDES 621. Visual Communications Seminar. 4 Hours.

Semester course; 4 lecture hours. 4 credits. May be repeated. A detailed examination of selected theoretical, historical, aesthetic and social areas of concern to the designer. Scholarly research, critical analysis and discussion are expected.

GDES 631. Visual Communications Teaching Practicum. 3 Hours.

Semester course; 1 lecture and 6 practicum hours. 3 credits. Prerequisite: Permission of department chair. Observation, instruction, and practice to develop skills in the design, organization, and conduct of courses in visual communications. Explores multiple teaching strategies, student development, learning styles, and evaluation techniques.

GDES 692. Visual Communications Research/Individual Study. 3 Hours.

Semester course; 6 studio hours. 3 credits. May be repeated. The structuring, research, execution, and presentation of an independent project in visual communications under the guidance of a faculty adviser.

GDES 698. Research Documentation and Exhibition Design. 3 Hours.

Semester course; 2 lecture and 3 studio hours. 3 credits. Prerequisite: permission of program director. A studio-based course focusing on the design and production of final research documentation in both book and exhibition formats.

GDES 699. Directed Thesis Research in Visual Communications. 1-8 Hours.

Semester course; variable hours (three studio hours per credit). 1, 4 or 8 credits. May be repeated for a maximum of 12 credits. Prerequisites: successful completion of 30 credit hours of graduate study and permission of department chair. Supervised investigation and presentation of selected problems in visual communications. Executed under the supervision of a graduate adviser and review committee.

Interior Design (IDES)

IDES 500. Art and Design Methods Workshop. 3 Hours.

Semester course; 1 lecture and 4 studio hours. 3 credits. May be repeated for a total of 12 credits. Open only to first-professional track graduate students in interior environments. Provides accelerated instruction in art and design methods for the student with no art background by fully immersing the student in a rigorous studio environment. Focuses on the development of 2-D and 3-D art and design skills including 2-D design methods, 3-D design methods, color theory, and drawing and presentation methods.

IDES 501. Introductory Graduate Design Studio I. 6 Hours.

Semester course; 2 lecture and 8 studio hours. 6 credits. Corequisite: IDES 511. Open to professional entry-level track graduate students in interior environments only. Provides accelerated studio and graphics instruction for designing interior environments for the entering professional entry-level track student that does not have previous experience in interior design. Introduces theories, methods and processes of interior design, facilitates specific interior design applications and focuses on analysis and evaluation of interior environments. Course work is highly sequenced and accelerates in complexity as the semester progresses and combines the development of technical skills with conceptual thinking and design development processes. Course emphasizes interior design development through studio projects and the development of the skills and practices of interior design.

IDES 502. Introductory Graduate Design Studio II. 6 Hours.

Semester course; 2 lecture and 8 studio hours. 6 credits. Corequisite: IDES 512. Open to professional entry-level track graduate students in interior environments only. Provides accelerated studio and graphics instruction for designing interior environments for the entering professional entry-level track student that does not have previous experience in interior design. Introduces theories, methods and processes of interior design, facilitates specific interior design applications and focuses on analysis and evaluation of interior environments. Course work is highly sequenced and accelerates in complexity as the semester progresses and combines the development of technical skills with conceptual thinking and design development processes. Course emphasizes interior design development through studio projects and the development of the skills and practices of interior design.

IDES 511. Introductory Graduate Graphics I. 3 Hours.

Semester courses; 1 lecture and 4 studio hours. 3 credits. Corequisite: IDES 501 for IDES 511, IDES 502 for 512. Open to professional entry-level track graduate students in interior environments only. Provides accelerated manual and computer graphics instruction for designing interior environments for the entering professional entry-level track student who does not have previous experience in interior design graphics. Course work is highly sequenced and accelerates in complexity as the semester progresses.

IDES 512. Introductory Graduate Graphics II. 3 Hours.

Semester course; 1 lecture and 4 studio hours (delivered online, face-to-face or hybrid). 3 credits. Corequisite: IDES 502. Enrollment is restricted to students in the M.F.A. in Design with a concentration in interior environments - professional entry-level option. Provides accelerated manual and computer graphics instruction for designing interior environments for the entering professional entry-level track student who does not have previous experience in interior design graphics. Course work is highly sequenced and accelerates in complexity as the semester progresses.

IDES 521. Advanced Material Studies for Interior Environments. 2 Hours.

Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to students in the M.F.A. in Design with a concentration in interior environments - professional entry-level option. Investigation, selection and practical application of materials and textiles in interior environments.

IDES 522. Environmental Factors for Interior Environments. 2 Hours.

Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to students in the M.F.A. in Design with a concentration in interior environments - professional entry-level option. Contemporary theories and techniques in the design of buildings as related to interior design, small structural considerations, HVAC, acoustics, plumbing and the attributes of building materials.

IDES 591. Topics in Interior Design. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for a maximum of 12 credits. Enrollment requires consent of the instructor. Explores selected topics of current and relevant interest in interior design. Topics will vary each semester and focus on the needs of the student.

IDES 601. Graduate Interior Environments Studio. 6 Hours.

Semester course; 12 studio hours. 6 credits. May be repeated twice. Open to graduate students in interior environments; graduate students from other School of the Arts graduate programs may enroll with the consent of the instructor. Prerequisites: IDES 501, 502, 511, 512 for professional entry-level students; none for post-professional students. Provides advanced studio for designing in specialized areas of interior environments. Topics will vary each semester.

IDES 611. Advanced Graphics for Interior Environments I. 2 Hours.

Semester course; 4 studio hours. 2 credits. Open only to first-professional track graduate students in interior environments. Provides advanced graphics instruction for designing interior environments for the first-professional track student. Course work is highly sequenced and accelerates in complexity as the semester progresses and focuses on the development of technical drawing, rendering and presentation skills for the interior designer.

IDES 612. Advanced Graphics for Interior Environments II. 2 Hours.

Semester course; 4 studio hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to students in the M.F.A. in Design with a concentration in interior environments - professional entry-level option. Provides advanced graphics instruction for designing interior environments for the entry-level student using the computer. Course work is highly sequenced and accelerates in complexity as the semester progresses and focuses on the development of computer-based skills and programs such as AutoCAD, 3-D Viz and Form Z.

IDES 623. Advanced Design Studies. 3,6 Hours.

Semester course; 3 or 6 lecture/seminar hours. 3 or 6 credits. May be repeated. Prerequisites: IDES 501, 502, 511, 512 for professional entry-level students; none for post-professional students. Interior design majors only. Supervised investigation and presentation of selected problems and issues in interior design.

IDES 624. Advanced Furniture Design. 2 Hours.

Semester course; 4 studio hours. 2 credits. For first-professional track students only. Advanced study of furniture design and custom millwork as related to the design of interior environments. Original student designs are developed through the study of structure and materials.

IDES 626. Advanced Light and Color for Interior Environments. 2 Hours. Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to students in the M.F.A. in Design with a concentration in interior environments - professional entry-level option. The study of illumination and its impact on people in interior spaces; theory and practical applications.

IDES 631. Ethics and Business Procedures for Interior Environments. 2 Hours. Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to students in the M.F.A. in Design with a concentration in interior environments - professional entry-level option. Advanced study of the interior design profession as related to professional and business practices including: responsibilities, services, ethics, business and project management, and marketing.

IDES 635. Teaching Practicum in Interior Environments. 3 Hours. Semester course; 1 lecture and 6 laboratory hours. 3 credits. Prerequisite: Completion of one graduate studio. Familiarizes students with different types of teaching methods and practices in interior design curriculums. Observation, instruction and practice in the design, organization, and conduct of courses in interior design. Explores multiple teaching strategies, student development, learning styles and evaluation techniques.

IDES 651. History and Theory of Interior Environments I. 2 Hours. Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to students in the M.F.A. in Design with a concentration in interior environments - professional entry-level option. Study of the major paradigms, theories and styles of the built environment (interior design, furniture and architecture) from antiquity to the late-19th century.

IDES 652. History and Theory of Interior Environments II. 2 Hours. Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Study of the major paradigms, theories and styles of architecture, interior environments and furniture from the beginnings of modernism to the present day.

IDES 690. Graduate Seminar in Interior Environments. 3 Hours. Semester course; 3 lecture hours. 3 credits. A detailed selected investigation of theoretical, historical, aesthetic and social areas of concern to the interior designer. Scholarly research, critical analysis and discussion are expected. The course requires investigative work using resources such as library and archive materials, journals, Internet sources, surveys, oral histories, interviews, case study design, and field documentation and evaluation.

IDES 692. Independent Study in Interior Environments. 1-6 Hours. Semester course; 1-6 lecture hours. 1-6 credits. May be repeated for a maximum of 6 credits. Interior environments majors only. Prerequisite: approval from department chair. An in-depth study of a selected interior design topic.

IDES 693. Interior Design Internship. 2-6 Hours. Semester course; 4-12 studio hours. 2-6 credits (taken in increments of 4 studio hours per 2 credits). Enrollment is restricted to students in the M.F.A. in Design with a concentration in interior environments and requires permission of the instructor. Provides supervised practical work experiences that are coordinated with professional interior designers under the guidance of interior design faculty. Formal arrangements must be made. Graded as Pass/Fail.

IDES 694. Graduate Interior Design Practicum. 0 Hours. Semester course; 0 practicum hours. 0 credits. Prerequisite: IDES 631. Enrollment is restricted to students in the M.F.A. in Design with a concentration in interior environments Provides supervised practical work experiences that are coordinated with professionals in the interior design and/or related fields. Formal arrangements must be made and approved by the Department of Interior Design internship coordinator. The student must work a minimum of 180 hours during the semester. The on-site supervisor and student both complete evaluations of the learning experience at the internship's conclusion.

IDES 699. Creative Project - Thesis. 1-6 Hours. Semester course; 2, 6 or 12 studio hours. 1, 3 or 6 credits. May be repeated. Prerequisite: Approval of Departmental Review Committee. The project must test an original design theory synthesized through the development of a design process, investigative research and an individual project of complex scale and scope.

IDES 800. Research Methods. 3 Hours. Semester course; 3 lecture hours. 3 credits. Prerequisites: graduate status and permission of chair. Explores the foundation and procedures of architectural and design research. Evidence-based design, alternate research methodologies and their philosophical and epistemological limitations.

IDES 801. Theories of Art and Design. 3 Hours. Semester course; 3 lecture hours. 3 credits. Prerequisites: graduate status and permission of chair. Development of art, architectural and design theories from antiquity to present. Emphasis is on the writings of contemporary leading theorists and historians. Students will apply these theories to contemporary current solutions as related to the creation of a healing environment; or students may explore the history of medicine or healing as expressed in the fine and applied arts.

IDES 811. Interdisciplinary Health Care Design Workshop I. 3 Hours. One-week workshop. 3 credits. Prerequisites: graduate status and permission of chair. Contemporary issues in health care professions, health care design and environmental stewardship. Course consists of a one-week workshop that offers lectures from leading experts on a selected issue and an interdisciplinary design problem. Students receive reading assignments to be completed prior to the workshop. After the workshop, during exam week, students meet to present their solution to the design problem to the class and invited guest critics. Students also complete an original research paper on the design problem.

IDES 812. Interdisciplinary Health Care Design Workshop II. 3 Hours. One-week workshop. 3 credits. Prerequisites: IDES 811, graduate status and permission of chair. Contemporary issues in health care professions, health care design and environmental stewardship. Course consists of a one-week workshop that offers lectures from leading experts on a selected issue and an interdisciplinary design problem. Students receive reading assignments to be completed prior to the workshop. After the workshop, during exam week, students meet to present their solution to the design problem to the class and invited guest critics. Students also complete an original research paper on the design problem.

IDES 820. Selected Topics in Health Care Design I. 3 Hours. Semester course; 3 lecture hours. 3 credits. Prerequisites: graduate status and permission of chair. Selected topics in health, health care design and health care administration.

IDES 821. Selected Topics in Health Care Design II. 3 Hours. Semester course; 3 lecture hours. 3 credits. Prerequisites: IDES 820 and graduate status. Continued exploration of selected topics in health, health care design and health care administration.

IDES 899. Dissertation. 3-12 Hours.

Variable hours. 3-12 credits. May be repeated for credit. Prerequisite: ABD status. Research and work leading to the completion of the dissertation thesis or dissertation project. Graded S/U/F.

Kinetic Imaging (KINE)**KINE 600. Graduate Studio. 6 Hours.**

Semester course; 9 studio hours. 6 credits. Must be repeated for a total of 24 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts kinetic imaging concentration. Primary emphasis is placed on individual creative projects and on discussion of individual creative projects with regular exposure to the critical attention of other graduate students in the department, under the direction of the teaching faculty. Special emphasis is given to the development of personal expression through individual research and criticism.

KINE 671. Special Topics Studio. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. A studio course that focuses on specific issues, theories or historical events in relationship to students' research and studio practice.

KINE 681. Candidacy Research. 1,3 Hour.

Semester course; 1.5 or 4.5 studio hours. 1 or 3 credits. Must be repeated for a total of six credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts kinetic imaging concentration. This course comprises the process of producing work to achieve candidacy, a crucial qualifying step in which a student's academic achievements are reviewed and the student's readiness to proceed to the final research phase of the degree program is determined.

KINE 682. Thesis. 1,3 Hour.

Semester course; 1.5 or 4.5 studio hours. 1 or 3 credits. Must be repeated for a total of six credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts kinetic imaging concentration. This course comprises the process of producing work for and exhibiting it in the thesis exhibition; a written thesis; and an oral presentation by second-year M.F.A. students, a crucial qualifying step for students to complete the program. Graded as Satisfactory/Unsatisfactory.

KINE 690. Graduate Seminar. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Must be repeated for a minimum of six credits and no more than 12 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts kinetic imaging and photography and film concentrations. Weekly seminar for the purpose of examining contemporary issues within the field of fine art, broadening critical discourse and considering artists' work within the context of a creative practice.

KINE 691. Independent Studio. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. An independent studio course that allows students to develop specific skills or explore techniques. Approval of supervising faculty member and department chair necessary prior to registration.

KINE 693. Directed Research. 1-3 Hours.

Semester course; 1-3 research hours. 1-3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. Approval of supervising faculty member and department chair necessary prior to registration. Learning experiences will be designed with the supervising faculty member in the form of a contract between student and instructor.

KINE 695. Advanced Sound. 3 Hours.

Semester course; 3 lab/studio hours. 3 credits. May be repeated for a total of 12 credits. Prerequisite: experience with multichannel sound software such as Pro Tools. Focuses on sound as a medium and its connection to animation and video. Designed as an advanced studio course where students develop their own aesthetic in sound and explore creative possibilities. Expands on recording and mixing techniques with a particular focus on 5.1 surround sound mixing for video, animation and sound art.

Music Education (MUED)**MUED 583. Special Workshop in Music Education. 0.5-3 Hours.**

Semester course; 0.5-3 credits. Flexible term courses on selected aspects of music education. See the Schedule of Classes for specific topics to be offered each semester.

MUED 591. Topics in Music Education. 1-3 Hours.

Semester course; variable hours. 1-3 credits. May be repeated for a maximum of 6 credits with different topics. Flexible semester courses in selected topics in music education philosophy, curriculum, integrated and interdisciplinary arts, technology and selected topics of current interest or needs relative to music education. See the Schedule of Classes for specific topics to be offered each semester.

MUED 600. Seminar in Music Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated up to two times with different topics. Investigation of contemporary issues and problems in music education. Students will present oral reports and written papers, which explore new directions and implications for music educators and music education programs.

MUED 604. Choral Conducting and Rehearsal Techniques. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will seek to develop the skills of the choral conductor in rehearsal and performance. Instruction in rehearsal technique and pacing, conducting technique and interpretive gesture, choral diction, score analysis and preparation, performance practices, and the affective/effective conductor will be applied to individual student performance at the podium.

MUED 606. Choral Literature and Style. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will provide the practicing choral musician with a survey of choral repertoire through the ages, highlighting various genres within each historical period. Emphasis will be placed on stylistic considerations and performance practices. Students will be engaged in determining the standards which define quality choral repertoire.

MUED 608. Teaching the Adolescent Singer. 3 Hours.

Semester course; 3 lecture hours. 3 credits. In this course students will study psychological, behavioral and developmental aspects of the young singer. An in-depth look at the characteristics of the changing male and female voice will include research and conclude with observations of adolescent voices. The class will also cover range, registration and choral repertoire appropriate for the various stages of the adolescent singer.

MUED 610. Psychology of Music. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an introduction of the psychological foundations of music behavior. Topics will include functions of music in human society and culture, psychoacoustics of musical sound, cognitive processes of music perception and the creation/recreation of music, affective response, music learning theories and measurement of musical ability and learning.

MUED 614. Instrumental Conducting Techniques. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students in this class will discuss literature, score study strategies, rehearsal techniques and ensemble motivation issues. Conducting technique and rehearsal technique will be developed by hands-on experiences with a workshop band, as well as through guided discussions and classroom sessions. The goal is personal musical growth and enhanced podium effectiveness for each participant.

MUED 616. Researching the Wind Band: Strategies and Resources. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This class is designed to enable students to gain greater access to information relative to all aspects of the wind band. Students will become familiar with a wide variety of sources including written materials, Web-based materials, recordings, video and organizations. There will also be assignments to acquaint students with methods used in the various facets of wind band research.

MUED 618. History and Literature of the Wind Band. 3 Hours.

Semester course; 3 lecture hours. 3 credits. In this class students will study the historical development of wind bands and wind band repertoire. The result of this study will be to enable students to evaluate new repertoire by comparison to masterworks and to be able to place pieces into a historical continuum. Studying the history of wind bands is necessary to understand the current state of the profession and how wind bands fit into the broader spectrum of music history.

MUED 620. Introduction to Research in Music Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Development of fundamental skills necessary to understand and evaluate research in music education. Focuses on the basic principles, concepts and techniques of research methodology applied specifically to music education. Includes introduction to quantitative, qualitative, ethnographic and historical methodology.

MUED 676. School Music Supervision and Administration. 2 Hours.

Semester course; 2 lecture hours. 2 credits. The study of the organization, curriculum, course content, administration, and personnel problems in public school music.

MUED 783. Final Project in Music Education. 1 Hour.

Semester course; 1 laboratory hour. 1 credit. May be repeated for a total of 5 credits. The final project is an intensive experience in identifying and developing a topic of interest and value to the student and the profession, and the final presentation of that topic. This course is part of the culminating process for the music education track in the Master of Music program. As an individualized project/course, the faculty chair provides initial approval and gauges progress toward completion of the final project. It is the responsibility of the student to maintain consistent communication with their chair throughout the semester to ensure adequate progress is being made. Completion is determined by the final approval of the faculty chair and committee (if applicable). Completion of the final project is not determined by total number of credits earned in the course. Graded as S/U/F.

MUED 799. Thesis. 1-3 Hours.

Semester course; 1-3 credits. May be repeated. Prerequisite: Permission of the music education coordinator. Preparation of a thesis based on independent research.

Music History, Literature and Theory (MHIS)**MHIS 591. Topics in Music. 1-3 Hours.**

Semester course; variable hours. 1-3 credits. May be repeated for a maximum of 9 credits. Flexible term courses in selected aspects of music performance, theory, literature, or history. See the Schedule of Classes for specific topics to be offered each semester.

MHIS 592. Individual Project. 1-6 Hours.

Semester courses; 1-6 credits. Prerequisites: permission of supervising faculty member, adviser and department chair. Open only to degree-seeking graduate students in music. Individual work in an area not otherwise available to the student.

Painting and Printmaking (PAPR)**PAPR 525. Issues in Contemporary Visual Arts. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 6 credits. Prerequisite: Painting and printmaking majors only. The investigation of content and meaning of major directions in contemporary art as they relate to the studio. Students will relate their own work to major movements in contemporary visual art.

PAPR 527. Art and Critical Theory. 3 Hours.

Semester courses; 3 lecture hours. 3, 3 credits. Prerequisite: General art history or equivalent. Major themes in art criticism and theory from 1940 to the present. This course provides an introduction to the literature of art criticism as well as artists' writings in relation to studio production.

PAPR 605. Graduate Studio. 6 Hours.

Semester course; 9 studio hours. 6 credits. May be repeated for a maximum total of 24 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts painting and printmaking concentration. Primary emphasis is placed on individual creative projects and on discussion of individual creative projects with regular exposure to the critical attention of other graduate students in the department, under the direction of the teaching faculty. Special emphasis is given to the development of personal expression through individual research and criticism.

PAPR 650. Candidacy Research. 1,3 Hour.

Semester course; 1.5 or 4.5 studio hours. 1 or 3 credits. Must be repeated for a total of six credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts painting and printmaking concentration. This course comprises the process of producing work to achieve candidacy, a crucial qualifying step in which student's academic achievements are reviewed, and the student's readiness to proceed to the final research phase of the degree program is determined.

PAPR 660. Professional Practices. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Seminar for the purpose of examining the range of professional practices in the field of contemporary art. Students will learn skills that apply to various parts of the field. The course will also address major debates within the field.

PAPR 670. Thesis. 1,3 Hour.

Semester course; 1.5 or 4.5 studio hours. 1 or 3 credits. Must be repeated for a total of six credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts painting and printmaking concentration. This course comprises the process of producing work for and exhibiting it in the thesis exhibition; a written thesis; and an oral presentation by second-year M.F.A. students, a crucial qualifying step for students to complete the program. Graded as Satisfactory/Unsatisfactory.

PAPR 680. Graduate Group Critique. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a total of 12 credits. Enrollment is restricted to students in the painting and printmaking concentration of the M.F.A. in Fine Arts; those in other M.F.A. concentrations may enroll with permission of the instructor. A seminar class in which primary emphasis is placed on the discussion of individual creative projects with regular exposure to the critical attention of the other graduate students in the department, under the direction of the teaching faculty. Special emphasis is given to the development of personal expression through individual research and criticism.

PAPR 683. Independent Studio. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. An independent studio course that allows students to develop specific skills or explore techniques. Approval of supervising faculty member and department chair necessary prior to registration.

PAPR 690. Graduate Seminar. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Must be repeated for a total of 12 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts painting and printmaking concentration. Weekly seminar for the purpose of examining contemporary issues within the field of fine art, broadening critical discourse and considering artists' work within the context of a creative practice.

PAPR 691. Special Topics Studio. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. A studio course that focuses on specific issues, theories or historical events in relationship to students' research and studio practice.

PAPR 692. Directed Research. 1-3 Hours.

Semester course; 1-3 research hours. 1-3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. Approval of supervising faculty member and department chair necessary prior to registration. Learning experiences will be designed with the supervising faculty member in the form of a contract between student and instructor.

Photography and Film (PHTO)**PHTO 621. Directed Research. 1-3 Hours.**

Semester course; 1-3 research hours. 1-3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations; nonmajors can enroll with permission of the instructor. Approval of supervising faculty member and department chair necessary prior to registration. Learning experiences will be designed with the supervising faculty member in the form of a contract between student and instructor.

PHTO 670. Graduate Studio. 6 Hours.

Semester course; 9 studio hours. 6 credits. Repeated for a total of 24 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts photography and film concentration. Primary emphasis is placed on individual creative projects and on discussion of individual creative projects with regular exposure to the critical attention of other graduate students in the department, under the direction of the teaching faculty. Special emphasis is given to the development of personal expression through individual research and criticism.

PHTO 681. Candidacy Research. 1,3 Hour.

Semester course; 1.5 or 4.5 studio hours. 1 or 3 credits. Must be repeated for a total of six credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts photo/film concentration. This course comprises the process of producing work to achieve candidacy, a crucial qualifying step in which student's academic achievements are reviewed, and the student's readiness to proceed to the final research phase of the degree program is determined.

PHTO 690. Graduate Seminar. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Must be repeated for at least six credits and no more than 12 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts photography and film and kinetic imaging concentrations. Weekly seminar for the purpose of examining contemporary issues within the field of fine art, broadening critical discourse and considering artists' work within the context of a creative practice.

PHTO 691. Special Topics Studio. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. A studio course that focuses on specific issues, theories or historical events in relationship to students' research and studio practice.

PHTO 692. Independent Studio. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. An independent studio course that allows students to develop specific skills or explore techniques. Approval of supervising faculty member and department chair necessary prior to registration.

PHTO 693. Fieldwork, Internship. 3,6 Hours.

Semester course; 6 or 12 studio hours. 3 or 6 credits. May be repeated. Professional field experience in the theoretical and practical applications of photography and/or film through cooperative organizations. Formal arrangements will be made with state agencies, industries, community organizations, and professionals in the field.

PHTO 699. Thesis. 1,3 Hour.

Semester course; 1.5 or 4.5 studio hours. 1 or 3 credits. Must be repeated for a total of six credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts photography and film concentration. This course comprises the process of producing work for and exhibiting it in the thesis exhibition; a written thesis; and an oral presentation by second-year M.F.A. students, a crucial qualifying step for students to complete the program. Graded as Satisfactory/Unsatisfactory.

Sculpture and Extended Media (SCPT)**SCPT 510. Issues in Contemporary Visual Art. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. This course involves in-depth research and analyses of some of the aesthetic, philosophical and political issues preoccupying contemporary artists today. See the Schedule of Classes for specific topics to be offered each semester.

SCPT 530. Digital Fabrication. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. A studio course that focuses on computer modeling, 3D scanning and several forms of digital fabrication.

SCPT 600. Graduate Studio. 6 Hours.

Semester course; 9 studio hours. 6 credits. May be repeated for a total of 24 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts sculpture concentration. Primary emphasis is placed on individual creative projects and on discussion of individual creative projects with regular exposure to the critical attention of other graduate students in the department, under the direction of the teaching faculty. Special emphasis is given to the development of personal expression through individual research and criticism.

SCPT 610. Professional Practices. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts sculpture concentration. Seminar for the purpose of examining the range of professional practices in the field of contemporary art. Students will learn skills that apply to various parts of the field. The course will also address major debates within the field.

SCPT 681. Candidacy Research. 1,3 Hour.

Semester course; 1.5 or 4.5 studio hours. 1 or 3 credits. Must be repeated for a total of six credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts sculpture concentration. This course comprises the process of producing work to achieve candidacy, a crucial qualifying step in which a student's academic achievements are reviewed and the student's readiness to proceed to the final research phase of the degree program is determined.

SCPT 682. Thesis. 1,3 Hour.

Semester course; 1.5 or 4.5 studio hours. 1 or 3 credits. Must be repeated for a total of six credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts sculpture concentration. This course comprises the process of producing work for and exhibiting it in the thesis exhibition; a written thesis; and an oral presentation by second-year M.F.A. students, a crucial qualifying step for students to complete the program. Graded as Satisfactory/Unsatisfactory.

SCPT 690. Graduate Seminar. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Must be repeated for a total of 12 credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts sculpture concentration. Weekly seminar for the purpose of examining contemporary issues within the field of fine art, broadening critical discourse and considering artists' work within the context of a creative practice.

SCPT 691. Special Topics Studio. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts sculpture concentration. A studio course that focuses on specific issues, theories or historical events in relationship to students' research and studio practice.

SCPT 692. Independent Studio. 3 Hours.

Semester course; 4.5 studio hours. 3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. An independent studio course that allows students to develop specific skills or explore techniques. Approval of supervising faculty member and department chair necessary prior to registration.

SCPT 693. Directed Research. 1-3 Hours.

Semester course; 1-3 research hours. 1-3 credits. May be repeated for a maximum of nine credits. Enrollment is restricted to graduate students in the M.F.A. in Fine Arts concentrations. Approval of supervising faculty member and department chair necessary prior to registration. Learning experiences will be designed with the supervising faculty member in the form of a contract between student and instructor.

Theatre (THEA)**THEA 503. Periods and Practices in Costume History I. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. A study of the cultural and social implications of costume history, design and production by specific design technologies from antiquity to 1800. Work includes costume shop work with fabrics as well as studio work with the interaction of lighting and fabrics.

THEA 504. Periods and Practices in Costume History II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: THEA 503. This course continues work in the study of the cultural and social implications of costume history, design and production by specific design technologies from 1800 to the present. The course will include additional work with ongoing main stage productions. Work includes costume shop work with fabrics as well as studio work with the interaction of lighting and fabrics.

THEA 505. Advanced Scene Design III. 3 Hours.

Semester course; 1 lecture and 4 studio hours. 3 credits. Prerequisites: THEA 306 and permission of instructor. Intensive study of the professional standards and practices expected of scene designers.

THEA 506. Advanced Scene Design IV. 3 Hours.

Semester course; 1 lecture and 4 studio hours. 3 credits. Prerequisites: THEA 505 and permission of instructor. Continued intensive study of the professional standards and practices expected of scene designers.

THEA 508. Scene Painting. 3 Hours.

Semester course; 10 studio hours. 3 credits. May be repeated with permission of instructor for up to 12 credits. Study of the materials and techniques of scenic painting as well as the practices and expectations of those pursuing careers as scenic artists.

THEA 509. Theatre History and Historiography. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Study of the origins of modern theatre practice alongside the global history of dramatic literature and theory, coupled with the analysis of methodologies used to record the development of performance and performance scholarship.

THEA 518. The Pedagogy of Movement. 3 Hours.

Semester course; 6 studio hours. 3 credits. Exploration of the principles of teaching movement and its practical application to the stage, with special emphasis on the links between physical theatre and the vocabulary of the Stanislavski system of acting.

THEA 570. Applied Theatre. 3 Hours.

Semester course; 1 lecture and 4 studio hours. 3 credits. Practical application of theatrical techniques or performance in non-theatrical settings.

THEA 593. Professional Internship. 3 Hours.

Semester course; 3 field experience hours. 3 credits. Enrollment requires permission of the graduate program director. An internship in theatre conducted in cooperation with selected professional or semiprofessional theatre organizations.

THEA 600. Introduction to Performance Studies. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Interdisciplinary and multicultural study of cultural, social and aesthetic structures of performance.

THEA 602. Advanced Topics in Voice and Speech Pedagogy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An exploration of a variety of specialty topics which may include but is not limited to dialect acquisition, speech and phonetics, archetypes and the voice, and Viewpoints and Suzuki actor training.

THEA 603. Dramatic Literature and Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Multicultural study of selected plays in the history of dramatic literature, criticism and theory.

THEA 604. Modern Theatre: Theory and Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Seminar in the performance practices, texts and theories that have shaped the theatre throughout the 20th century.

THEA 605. Advanced Studies in Stage Design. 3 Hours.

Continuous courses; 1 lecture and 4 studio hours. 3-3 credits. Prerequisite: Permission of instructor. An advanced study in specific problems in stage design.

THEA 606. Advanced Studies in Stage Design. 3 Hours.

Continuous courses; 1 lecture and 4 studio hours. 3-3 credits. Prerequisite: Permission of instructor. An advanced study in specific problems in stage design.

THEA 608. Problems in Scenic Techniques. 3 Hours.

Continuous courses; 1 lecture and 4 studio hours. 3-3 credits. Prerequisite: Permission of instructor. An advanced, detailed study of selected problems in contemporary theory and practice of scenic techniques.

THEA 610. Proseminar in Text and Performance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces graduate students to the study of performance research and documentation and to the theoretical perspectives that shape the discipline of theatre studies.

THEA 614. Pedagogy of Acting. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course guides students through creating and implementing a curriculum appropriate for a beginning acting class. Discussions of acting theory and teaching practice are interspersed with teaching demonstrations complete with peer feedback and instructor critique.

THEA 619. Theatre Pedagogy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Theory and practice in the teaching of college-level theatre.

THEA 621. Problems in Costume Design. 3 Hours.

Semester courses; 2 lecture and 2 studio hours. 3, 3 credits. May be repeated. Prerequisite: Permission of instructor. An advanced study in specific problems in costume design.

THEA 622. Problems in Costume Design. 3 Hours.

Semester courses; 2 lecture and 2 studio hours. 3, 3 credits. May be repeated. Prerequisite: Permission of instructor. An advanced study in specific problems in costume design.

THEA 630. Production. 6 Hours.

Semester course; 6 laboratory hours. 3 credits. May be repeated for a maximum of 12 credits. The design, rehearsal and performance of dramatic works.

THEA 651. Individual Study in Graduate Design. 3 Hours.

Semester course; 1 lecture and 4 laboratory hours. 3 credits. Prerequisite: permission of instructor. May be repeated. Intensive individual training in design and presentation processes as they apply to contemporary professional production.

THEA 661. Graduate Direction. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Graduate-level studio course designed to introduce students to concepts involved in play direction, including play analysis, composition, blocking, style and form. Exercises and projects will reinforce elements discussed in class and include opportunities for stage work complete with peer feedback and instructor critique.

THEA 694. Theatre Pedagogy Practicum. 3 Hours.

Semester course; 3 practicum hours. 3 credits. Research, design and implementation or thoroughly planned implementation of a curricular research and development project of relevance to a formal speech and/or theatre pedagogy program.

THEA 696. Dramaturgy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Study of the function of the dramaturg in the American theatre. Readings, research and practical exercises for production dramaturgy of classic and contemporary plays, as well as developmental dramaturgy.

THEA 697. Research and Special Problems in Theatre. 3 Hours.

Semester course; 3 research hours. 3 credits. Directed study and research on approved problems or projects in theatre. Preliminary research toward the development of a thesis.

THEA 791. Seminar in Special Issues in Theatre. 3 Hours.

Semester course; 3 seminar hours. 3 credits. May be repeated for a maximum of 12 credits. An advanced, detailed study of selected contemporary issues not included in the regular curriculum. See the Schedule of Classes for specific topics to be offered each semester.

THEA 799. Thesis. 3 Hours.

Semester course; 3 thesis hours. 3 credits. May be repeated for a maximum total of six credits. Preparation of a thesis based on independent research.

School of Business

Accounting (ACCT)

ACCT 507. Fundamentals of Accounting. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Theoretical and technical aspects for accumulating and reporting financial information for business. Emphasis on current financial accounting issues confronting businesses and interpretation of financial information reported by business. This is a graduate foundation course.

ACCT 591. Topics in Accounting. 1-3 Hours.

Semester course; 1-3 lecture hours (delivered online, face-to-face or hybrid). 1-3 credits. Study of current topics. Topics may vary; see the Schedule of Classes for the list of topics offered each semester.

ACCT 604. Advanced Auditing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ACCT 406 with a minimum grade of C. Development of auditing theory, special disclosure issues, statistical sampling, and ethical, legal and social responsibilities of external and internal auditors. Emphasis on contemporary topics in auditing.

ACCT 608. Managerial Accounting Concepts. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: ACCT 507. The use of accounting information contained in reports to management. The functions of planning, decision making, and control are studied as accounting data are reported through the firm's information system and in special analyses.

ACCT 610. Forensic Accounting. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ACCT 406 with a minimum grade of C. Study of forensic accounting topics, including fraudulent financial reporting, employee fraud, money laundering, litigation services, evidence management, computer forensics and business valuation.

ACCT 620. Accounting Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ACCT 507. The study of accounting methods, topics and data sources. Students will develop the skills needed to critically evaluate accounting research through experiential learning. An introduction to the steps of the research and publication process.

ACCT 621. Accounting Analytics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: ACCT 507 and SCMA 524. Students will collect, prepare and translate accounting-related data into insights and visualizations for effective decision-making.

ACCT 662. Advanced Topics in Accounting Information Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ACCT 307 with a minimum grade of C. Study of accounting systems, concepts and applications with reference to actual problems encountered in the analysis, design, implementation, use, audit and evaluation of accounting systems in a computer environment.

ACCT 680. Tax Research and Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ACCT 301 with a minimum grade of C. Tax research methodology; the sources of tax law and their relationship to tax research.

ACCT 681. Tax Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ACCT 301 with a minimum grade of C. The Internal Revenue Service and the practices and procedures involved and/or available for the settlement of tax controversies and common elections of accounting methods.

ACCT 682. Corporate Taxation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ACCT 301 with a minimum grade of C. Corporate tax laws as related to the corporations involved and to individual shareholders; tax aspects of the creation, operation, reorganization, and partial liquidation of corporations; corporate distributions.

ACCT 697. Guided Study in Accounting. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for credit. Enrollment is restricted to accounting majors; the accounting department chair and graduate studies office in the School of Business must approve the proposed work before the student can register. This course may also be used by accounting graduate students to do research on problems in accounting. Students will be assigned reading and will prepare a written report. Graded as pass/fail.

ACCT 790. Research Methods Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open only to Ph.D. students in business. Analyzes and critiques general theories, practices and functions in a specialized area of accounting research.

ACCT 791. Managerial Accounting Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open only to Ph.D. students in business. Presents contemporary issues in managerial accounting and auditing research.

ACCT 792. Financial Accounting Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open only to Ph.D. students in business. Presents and analyzes contemporary issues in financial accounting.

ACCT 793. International Accounting Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open only to Ph.D. students in business. Presents contemporary issues and research in international accounting.

ACCT 794. Behavioral Research Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open only to Ph.D. students in business. Provides knowledge and skills for advanced accounting research.

ACCT 795. Auditing Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open only to Ph.D. students in business. Presents contemporary issues in auditing research.

ACCT 797. Guided Study in Accounting. 6 Hours.

Year course; 6 credits. Graduate students will work under supervision in outlining a graduate thesis and in carrying out the thesis.

ACCT 898. Dissertation Research. 1-12 Hours.

Semester course; variable hours. 1-12 credits. Enrollment restricted to Ph.D. in Business students.

Brandcenter (BRND)**BRND 591. Topics in Branding. 1-3 Hours.**

Semester course; 1-3 lecture hours. 1-3 credits. A course for the study of current trends and opportunities in branding. See the Schedule of Classes for topics offered each semester and prerequisites as determined by the department.

BRND 608. Accounting for Communication Professionals. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to Brandcenter students. Course goal is to equip nonfinancial advertising students with the basic concepts of accounting and to apply their understanding of these principles to specific managerial situations within the advertising agency, brand management and marketing department environments. Students will also develop a framework for analyzing media results, ROI and various market/brand plan outcomes.

BRND 617. Brand Influence and Reputation. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to Brandcenter students. This course highlights the influence a brand can have not only on its audience, but also its category – and even in the world. It uses real-world examples of how brands effectively build their reputation through communication.

BRND 619. Critical Business Skills. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to Brandcenter students. Class will teach marketers and brand builders how to converse and partner with their creative partners (internally and/or externally). The course will focus on both real-world and practical examples as well as the 'soft' skills required to build world-class relationships.

BRND 620. Brand Design for Brand Managers. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to Brandcenter students only. Building student understanding of the role of design in its various forms within the marketing mix. Focused on design theory and covers all aspects of design and platforms and how consumers perceive brand essence.

BRND 621. Strategy and Design. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to Brandcenter students. Building students' understanding of the role of strategists and experience designers working as a team.

BRND 622. Visual Storytelling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to Brandcenter students. The goal of this class is to take a story and translate it successfully to the screen. Class will include lectures and technology sessions. Classes will be divided between discussions about existing films and spots, and classes devoted to learning the use of lights, cameras and software editing. Three short films will be produced.

BRND 623. Physical Computing I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to Brandcenter students only. Conceptualizing projects with brands in mind and creating prototypes and making sure the final output fits the brand it is paired with. This class will yield actual working prototypes that can help get across the function and look to a design/engineering team to create a production model.

BRND 624. Physical Computing II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BRND 623. Restricted to Brandcenter students only. Dives deeper and builds off the content learned in the prerequisite course.

BRND 625. Comms Planning and UX. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to Brandcenter students. This class will instruct students on traditional tools such as Simmons, add in new media channel tools such as Sysomos and give students a foundation on the skill set of comms planning and the incorporation of UX attributes into their strategic work.

BRND 626. HR as Brand. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to Brandcenter students. This class will reinforce the power of marketing a brand to an internal audience, as well as potential employees. It will focus on the impact internal marketing can have on recruiting, team-building and individual growth.

BRND 627. Visual Storytelling and Design for Strategists. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to Brandcenter students. The goal of this class is to take a story and translate it successfully to the screen. Class is geared to strategy students. Basic production techniques will be taught. By the end of the semester, students will be able to write, produce, shoot and edit a variety of commercial and viral video pieces. Short films will be produced. In order to bring this visual sensibility to all their work, strategists will be taught key design software that will enable them to improve the communication value of their written and presentation work.

BRND 629. Strategic Thinking. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to Brandcenter students. Contrasting historically rigid ways of approaching problems to newer, more dynamic approaches will prepare students to professionally engage a constantly shifting world of business, consumer, political and economic forces. Students will engage in semester-long projects to develop new ways of thinking strategically, including writing a strategic plan and scenario plans (the art of looking ahead and envisioning various realities for a company). Students will work directly with local small business owners in developing and formally presenting relevant strategies.

BRND 630. Problem Solving for Art Directors. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Restricted to Brandcenter students only. Explores the media of print, Internet and television to develop and understand the basis of good design and art direction. Will work through the process of visual concepts and execution.

BRND 631. Craft. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours (delivered online, face-to-face, or hybrid). 3 credits. Enrollment is restricted to Brandcenter students or by permission of instructor. Explores the delivery of concepts to an audience to determine how the message is received. Will teach how to attack a problem, how to work through a creative block and how to be a better judge of your own work.

BRND 633. User Participation Platforms. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Harness the power of Web users by designing within the architecture of user participation. Branding is no longer a one-way communication model. This course focuses on understanding and managing the communications from consumers to other consumers via the Web. Students will learn to cultivate organic growth and orchestrate grassroots efforts, as well as explore considerations in physical computing and augmentation of technology within someone's reality.

BRND 635. Creating Gravitational Pull. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Driving traffic to websites. Includes search engine optimization and search engine marketing, but goes way beyond. Designing integrated brand campaigns linking different channels and media types to take consumers on a journey with different touch points, channels and devices. Students will use proven strategies and design campaigns to have a live website and pull visitors to it. Students are expected to demonstrate their abilities on live sites where the effectiveness of their efforts is realized in real-time results.

BRND 638. Brand Engagement. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to Brandcenter students only or by permission of instructor. Enhancing consumers' brand experience. Students explore interactive ways to engage consumers. Core aspects of the future of the Web are explored. Students will be familiar with current engagement techniques, and they will create new ways to connect with consumers. Emphasis on the creation of ideas of sufficient scope as to become the basis for ad campaigns covering many platforms, especially including the Web.

BRND 639. Cultural Impact: Advanced Account Planning. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face, or hybrid). 3 credits. Enrollment is restricted to Brandcenter students or by permission of instructor. Identify a cultural issue that can impact business results and formulate a hypothesis for investigating the issue. Students gain experience in identifying a research need, in developing a research plan and methodology and in fielding the plan. After research, students get experience determining what they have learned and knowing what it means to the client.

BRND 640. Problem Solving. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to Brandcenter students only or by permission of instructor. Focuses on developing ability to create well-written, creatively focused advertising copy that solves communications problems. Addresses headline and body copy issues through presentation of students' work and research on major copywriters and their work.

BRND 648. Innovation. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to Brandcenter students or by permission of instructor. This course will challenge students to learn the techniques of innovators in business and the community. The course combines lectures and instruction with a semester-long innovation competition in partnership with global brands. Both invention and execution will be explored.

BRND 649. Brand Analytics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to Brandcenter students only. Learning and applying statistical methodologies for analytics in order to make smart decisions for effective brand management. Techniques for decision-making are explored along with Web analytics, performance metrics and ROI.

BRND 651. Creative Thinking. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours (delivered online, face-to-face or hybrid.) 3 credits. Enrollment is restricted to Brandcenter students. Focuses on developing the creative skills necessary for solving advertising communication problems. Enables students to maximize and strengthen creative abilities through lecture, brainstorming sessions and team-oriented strategy sessions focusing on real case projects.

BRND 652. Concept Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BRND 651. Develops students' ability to create visually effective work that targets specific groups of consumers through ongoing review and discussion sessions designed to pinpoint strategies and create relevant visually oriented ideas quickly. Emphasizes a teamwork approach to art direction and concept development.

BRND 653. Portfolio Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BRND 652. Focuses student toward creative solutions to communication problems. Addresses specific strategies including briefs and concept work that require extensive copy. Emphasizes a team approach to copywriting and art direction.

BRND 659. Brand Experiences. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to Brandcenter students. Provides thorough coverage for designing comprehensive brand communications for real-world clients that involve physical experiences for consumers. Projects will force students to think about every aspect of the consumer experience including store appearance, product selection, employee behavior and the purchasing process. An emphasis will be placed on producing comprehensive campaigns that develop strategic and creative brand experiences for customers.

BRND 662. Research Methodologies. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to Brandcenter students only or by permission of instructor. Review a variety of qualitative and quantitative research techniques as well as an introduction to writing creative briefs. Students will learn how to translate research into insightful creative and business platforms. This is a practical course that prepares students to be senior-level strategic thinkers throughout their careers.

BRND 664. Persuasion. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to Brandcenter students or by permission of instructor. This course offers an intensive in skills necessary to persuade when presenting work and ideas. Topics such as voice delivery, personal style, effective presentation of creative work, storytelling and capturing audience attention will be covered. Student presentations will be critiqued and videotaped for analysis.

BRND 667. Applied Brand Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to Brandcenter students only. Exposes students to detailed, practical information about the tools and tactics used to apply inventive brand strategies. Students will be exposed to managerial functions involving marketing and project management, while being challenged to synthesize and simplify complex information in order to create actionable plans. A portion of the course is dedicated to the use of a simulation case, "Pharmasim," which allows students to test theories and get real-time feedback on the likely results of their decisions.

BRND 668. Advanced Brand Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to Brandcenter students only. Involves intensive, interactive exploration of factors that affect the success of brands. Students study brand delivery systems from product and packaging design through sales channels to the ultimate consumer. The curriculum combines individual casework and team assignments to ground students in the art and science of strategy development. Students are also exposed to guest lecturers with brand management and integrated marketing expertise. Since brand managers must direct and manage the efforts of colleagues and agencies not under their control, there is a concentration on developing forceful, persuasive communication skills.

BRND 670. Creative Fusion. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to Brandcenter students. Integrating new branding methods with traditional approaches (like advertising, public relations and direct marketing) to develop powerful, coordinated and synergistic campaigns.

BRND 673. Experimentation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to Brandcenter students only. Creative tracks working together in teams to create shifts in established paradigm and executing a prototype of these solutions.

BRND 677. The Business of Branding. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Requires students to develop ideas ranging from strategic to tactical and from rational to emotional. Students will be called on to develop and examine ideas that differentiate brands, build sales and affect market share. The new business process will be considered and successful presentation techniques will be evaluated. Ethical considerations faced by industry practitioners will be explored.

BRND 691. Topics in Branding. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. A course for the study of current trends and opportunities in branding. See the Schedule of Classes for topics offered each semester and prerequisites as determined by the department.

BRND 695. Internship: Brandcenter. 1 Hour.

Semester course; 1 credit. Restricted to Brandcenter students only. Selected students will receive on-the-job training under the supervision of the instructor and employer. Internships are available in a variety of branding opportunities.

BRND 696. Advanced Portfolio. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to Brandcenter students. Continues the development and demonstration of conceptual and creative abilities and insights in a variety of areas sought by agency art directors, copywriters and recruiters. Individual development of concepts and materials necessary for the creation of mini-books and portfolios under one-on-one instruction. Independent projects pursued specifically for individual portfolio development.

Business (BUSN)**BUSN 501. Advanced Career and Professional Development. 1 Hour.**

Semester course; 1 lecture hour. 1 credit. Prerequisite: HONR 200, HONR 250 or UNIV 200. Enrollment is restricted to undergraduate students in the School of Business who have completed at least 24 credit hours (sophomore standing) and have significant work experience, or any graduate students in the School of Business. This course focuses on preparing students to leverage their current work experience to advance their career and succeed in the world of business today. Students will evaluate their work experience and how it aligns with industry needs, refine their professional style and presentation materials, create a career plan, and prepare to successfully market themselves for a job or promotion.

BUSN 601. Studies in Contemporary Business Issues: _____. 1 Hour.

Semester course; 1 lecture hour; content delivered online. 1 credit. May be repeated for a maximum of six credits. Enrollment restricted to students in the online MBA program. Course provides advanced study and analysis of contemporary business issues.

BUSN 610. On-campus Residency. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for a maximum of three credits. Enrollment restricted to students in the online MBA program. MBA faculty will lead this two-day residency immersion session offering activities such as seminars, case and/or simulation assignments, and meetings with business and thought leaders to enhance team-building, leadership and professional development skills. Students will be evaluated on face-to-face presentation skills, group interaction and career development plans. Graded as pass/fail.

BUSN 700. Principles of Scientific Inquiry in Business. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A seminar on the philosophical and epistemological foundations of scientific inquiry as they relate to research in business and its allied disciplines. The focus will be on the underlying logic, elements, reach and limits of alternative frameworks, such as positivism, empiricism and Bayesian analysis, and the conditions under which each is the preferred method of inquiry.

BUSN 701. Research Methods in Business. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: admission to Ph.D. program and permission of instructor. A seminar on the design of research in business, including the philosophy of science, theory development and the design of research capable of testing hypotheses, analytic levels, measurement theory and methods, and research design alternatives.

BUSN 702. Research Analysis in Business. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 524 or equivalent and acceptance into the doctoral program. Study of the scientific method as currently applied in business and organizational research, with emphasis on the conduct of studies, data analysis and presentation of empirically based knowledge.

BUSN 898. Post-Candidacy Doctoral Research in Business. 1-9 Hours.

Semester course; 1-9 research hours. 1-9 credits. May be repeated for credit. Enrollment is restricted to School of Business assistantship-funded Ph.D. in Business students admitted to doctoral candidacy. Students will participate in supervised discipline-specific research related to their dissertation topic under the guidance of their dissertation adviser. Students must have approval from their current degree program coordinator to register. This course can be approved as a substitution for any post-candidacy degree requirement. Graded as Satisfactory/Unsatisfactory.

Computer and Information Systems Security (CISS)**CISS 609. Advanced Computational Intelligence. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students with an undergraduate course in artificial intelligence, or equivalent background with permission of instructor. Exploration of issues related to application of computational intelligence techniques to system security, particularly in the detection of anomalous system behavior. Of particular interest are issues associated with the automated detection of anomalies caused by authorized users through intended malicious behavior or through accidental misuse, and issues associated with automated user authentication.

CISS 616. Data Warehousing. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: INFO 610. Covers important concepts and techniques in the design and implementation of a data warehouse. Topics include the data warehouse architecture, the logical and physical design issues in the data warehousing development process, technical factors (i.e., hardware, client/server technology, data warehousing and DBMS technologies) and implementation considerations (i.e., data extraction, clean-up and transformation tools). Introduces online analytical processing and data mining. Crosslisted as: INFO 616.

CISS 618. Database and Application Security. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Theory and practice of database and software security focusing in particular on some common database software security risks and on the identification of potential threats and vulnerabilities. Crosslisted as: CMSC 618.

CISS 624. Applied Cryptography. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides a comprehensive survey of modern cryptography. Included are techniques of enciphering and deciphering messages using cryptographic algorithms, block ciphers and block cipher modes, hash functions and message authentication codes, public key cryptography and digital signatures, and steganography. Crosslisted as: CMSC 620.

CISS 634. Ethical, Social and Legal Issues in Computer and Information Systems Security. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Analyzing socio-political and ethical issues surrounding computer and information systems security. Topics include privacy laws, identity theft, information collection and retention policies, and enforcement.

CISS 646. Computer and Information Systems Access Control. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Detailed discussion of access control, including administration, identification and authentication techniques, methodologies and implementations, methods of attack, monitoring, and penetration testing.

CISS 654. Business Continuity and Disaster Recovery Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Fundamentals of business continuity and disaster recovery planning. Includes risk assessment, physical facility protection, data recovery planning, strategies for network backup, desktop recovery, emergency decision making, and maintenance and testing of the plan and its components.

CISS 693. Practice of Computer and Information Systems Security. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students will undertake practical research projects. Written reports of the investigations are required. This course is intended to be taken at the end of the program.

CISS 697. Guided Study. 1-3 Hours.

Semester course; variable hours. 1-3 credits. Intended for graduate students in the Computer and Information Systems Security program wishing to do research on problems in computer and information systems security. Approval of proposed work is required by the director of graduate programs of the Department of Information Systems or of the Department of Computer Science no later than the 10th week of the prior semester. Each student will work with an appropriate faculty member on an approved research proposal. The student will submit a written report on the research conducted as the final product for the course. This course is intended to be taken near the end of the student's degree program.

Decision Analytics (DAPT)**DAPT 611. Analysis and Design of Database Systems. 2 Hours.**

Semester course; 2 lecture hours. 2 credits. Focuses on relational databases for structured data and includes entity relational diagram and extended entity relational diagram and transformation of ERD and EERD into relational schema. The course will give students competence in SQL and other search techniques, data validation and data cleansing.

DAPT 612. Natural Language Processing and AI for Unstructured Data. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students in the Master of Decision Analytics weekend program. An in-depth exploration of unstructured data leveraging advanced NLP/NLU and generative AI techniques. Topics include data extraction, topic modeling, semantic search and applying large language models for actionable insights.

DAPT 613. Tools for Business Intelligence. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in the Master of Decision Analytics weekend program. Provides students with techniques and skills for leveraging real-world data to support decision-making using data visualization software. Topics include dashboarding, analytics workflow, data preparation and visualization.

DAPT 614. Advanced SQL. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: DAPT 611. This course is designed to prepare students for multiple table queries using structured query language and will provide advanced training in the application of SQL to real data problems.

DAPT 615. Emerging Technologies. 1 Hour.

Semester course; 1 lecture hour. 1 credit. The course emphasizes the study of a variety of big data technologies to gain insight that will be used to get people throughout the enterprise to run the business more effectively and to provide better service to customers. The course focuses on big data solutions that are processed in a platform that can handle the variety, velocity and volume of data by using a family of components that require integration and data governance.

DAPT 617. Analytics Computing I. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in the Master of Decision Analytics weekend program. This is a hands-on analytics programming language course, focused on the core skills of data exploration, manipulation and visualization.

DAPT 618. Analytics Computing II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in the Master of Decision Analytics weekend program. This is a hands-on Python course, covering fundamental concepts, best practices and practical applications.

DAPT 619. Analytics Computing III. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: DAPT 618. Enrollment is restricted to students in the Master of Decision Analytics weekend program. In-depth Python programming course equipping students for advanced analytics projects.

DAPT 620. Machine Learning. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Covers concepts and applications of supervised, unsupervised and reinforcement learning, using various software tools. There is added emphasis on deep learning and large language models along with generative AI applications and use cases. Students will learn when different machine learning techniques and approaches can be utilized, how different models function, and how to understand and analyze results and drive improvements.

DAPT 621. Statistics for the World of Big Data. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students in the Master of Decision Analytics weekend program. Covers single variable and multivariable statistical techniques, using commercial computer packages. Students will learn when different techniques are warranted, conceptually how techniques function, how to perform the analysis and interpret the program outputs.

DAPT 622. Statistics for the World of Big Data II. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: DAPT 621. Enrollment is restricted to students in the Master of Decision Analytics weekend program. Continues an emphasis on data visualization and statistical modeling for different types of variables, including relationships between multivariable variables.

DAPT 630. AI Foundations. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in the Master of Decision Analytics weekend program. Provides a broad overview of artificial intelligence, including its history and evolution to current state and outlook. The course describes the most highly used and emerging fields within AI, and how it is rapidly becoming a factor in all industries, functions and domains. Students will learn how AI is influencing products and experiences, enabling new capabilities at an unprecedented rate, creating opportunities and risks, and how business leaders can and should incorporate AI into their strategies and business models. Provides a foundation for students to build on in subsequent courses.

DAPT 631. Data Mining. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Data mining is the extraction of implicit, previously unknown and potentially useful information from data. Data mining tasks include classification and regression (pattern recognition), cluster analysis, association analysis, and anomaly detection. This class will introduce methods for each of these tasks, their implementation in relevant software and the interpretation of data mining results.

DAPT 632. Forecasting Methods and Applications for Managerial Decision-making. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Methods covered include moving average and exponential smoothing, seasonal adjustments, time-series, and forecast averaging. Particular emphasis on developing and implementing forecasting systems in an interactive organization and appreciation of issues and caveats.

DAPT 633. Introduction to Marketing and Customer Analytics. 1 Hour.

Semester course; 1 lecture hours. 1 credits. Enrollment is restricted to students in the Master of Decision Analytics weekend program. Examines how firms make use of analytic tools to target advertising, improve customer response and service, and improve financial performance. The course will apply quantitative tools students have already seen (statistical analysis, simulation and regression analysis) to marketing and customer-response decisions.

DAPT 641. Introduction to Simulation Methods. 1 Hour.

Semester course; 1 lecture hour. 1 credit. An introduction to the application and theoretical background of simulation. Topics include Monte Carlo simulation and modeling systems using discrete event simulation. Theoretical topics include random variable generation, model verification and validation, statistical analysis of output, and decision-making via simulation. A high-level simulation language will be utilized.

DAPT 642. Decision and Risk Analysis. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Presents a formal methodology for prescriptive decision-making under risk and uncertainty. Decision analysis applies to hard problems involving sequential decisions, major uncertainties, significant outcomes and complex values. The course includes building and solving influence diagrams and decision trees; modeling uncertainty with subjective probabilities; the value of information; and modeling risk preferences with utility functions. Decision and risk analysis applications in business and government are considered.

DAPT 643. Introduction to Optimization Models. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Mathematical optimization is used to support quantitative and logical decision-making by providing a prescription of choices that minimize cost or maximize profit. This class provides an introduction to using optimization tools to model, solve and interpret results of real-world decision problems. Examples of applications include loan allocation, workforce scheduling, multi-period financial models and portfolio optimization.

DAPT 651. Personal, Interpersonal and Organizational Awareness. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This is an application-based course involving the understanding and application of communicating information in the personal, interpersonal/team and organizational setting. The focus is on barriers to communication, personal and audience awareness, listening skills, nonverbal communication behaviors, team-building and meetings management. A variety of practica and simulations will be used during this course.

DAPT 652. Professional Presentations: Strategy, Delivery and Technology. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This is an application-based course involving the audience-centered design and application of effective oral presentations. The focus will be on the development and enhancement of public presentation skills in different types of formal and informal public situations. Further ability in appropriate presentation technology will be provided and assessment will be behavior-driven. A variety of practica and simulations will be used during this course.

DAPT 653. Team Dynamics in Analytics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in the Master of Decision Analytics weekend program. This exploratory course will prepare students for elevated experiences in team dynamics and the ingredients for participation on high-performing teams.

DAPT 654. Written Communications: Strategy, Structure and Connection II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Continues topics and lessons from DAPT 653.

DAPT 661. Cases in Analytics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in the Master of Decision Analytics weekend program. This course is offered in the program's first semester and consists of a real sponsored analytics case project that focuses on exploratory data analysis and some data mining. Students will work independently and collaborate within their cohort to address the questions posed by the sponsoring organization. Students will gain experience with a framework for analytics projects and exploratory data analysis and present results in a written report and oral presentation to sponsoring management.

DAPT 670. Analytics Problem Formation. 1 Hour.

Semester course; 1 lecture hour. 1 credit. An introduction to problem formulation and the decision-making process that must precede the application of analytics. Topics include objectives generation, structuring objectives, decision diagrams for risk and uncertainty modeling, and qualitative approaches to decisions under risk and value tradeoffs.

DAPT 681. Analytics Practicum I. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students in the Master of Decision Analytics professional track. This course will allow students to apply the concepts, theories and skills learned in other courses to a real analytics project from a sponsoring organization. Teams of students will formulate a problem based on discussions with management of the sponsoring organization; query the sponsor's and/or public databases for appropriate data; perform required statistical analysis; and present results in both a written report and oral presentation to sponsoring management.

DAPT 682. Analytics Practicum II. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Continues project from DAPT 681.

DAPT 691. Topics in Decision Analytics. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for credit. Study of current topics in decision analytics. Topics may vary from semester to semester.

Economics (ECON)**ECON 501. Introduction to Econometrics. 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: ECON 203 with a minimum grade of B, ECON 205 with a minimum grade of B or ECON 210; and SCMA 301*, STAT 210 or STAT 212. Provides students with an understanding of the theory and properties of the ordinary least squares regression model with nonexperimental cross-sectional samples. Emphasis is placed on both the conditions under which the model produces unbiased and efficient estimates of the population parameters and, conversely, the conditions under which a given model should be expected to produce biased estimates. Applications include to models from labor and health economics and the hedonic pricing model. *Formerly MGMT 301.

ECON 604. Advanced Microeconomic Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ECON 614. Theory of prices and markets; value and distribution. Partial and general equilibrium analysis.

ECON 607. Advanced Macroeconomic Theory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ECON 614. An introduction to modern macroeconomics at the graduate level. Presents theoretical and computational tools necessary to understand modern macroeconomics research, as well as to improve students' ability to communicate this research to others. Core subjects will include economic growth, intertemporal decisions, public economics and general equilibrium.

ECON 610. Managerial Economics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. M.B.A. students must take in conjunction with MGMT 641 or by permission of assistant dean of master's programs. Analysis of business decisions, applying tools of economic theory. Decisions on demand, production, cost, prices, profits and investments.

ECON 612. Econometrics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ECON 501. Provides empirical content to theoretical concepts in economics by formulating and estimating models. Introduction to analysis with pooled cross-sections, time series and panel data. Focuses on analytic solutions when the classical OLS assumptions such as homoskedasticity and strict exogeneity are violated. Special emphasis on the difference-in-difference model, instrumental variable estimation and related approaches.

ECON 614. Mathematical Economics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: ECON 203 with a minimum B grade and ECON 211; or ECON 210 and ECON 211. Economic analysis utilizing simple mathematical methods. Includes derivation and exposition of theories and the application of tools to widen the scope and increase the usefulness of economics.

ECON 617. Financial Markets. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: ECON 501, MGMT 524, STAT 541, or MGMT 302; and ECON 500 or FIRE 520. Theories of markets for loanable funds are related to empirical findings and institutional structures. Yields of financial assets, kinds of debt instruments, financial institutions, public policy, financial models, and the role of money and credit in economic growth are considered.

ECON 620. The Economics of Industry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ECON 301, ECON 303 or ECON 610. The application of economic analysis to the structure, conduct, and performance of industry; public regulation and policies to promote workable competition.

ECON 641. Econometric Time-series Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: ECON 501 and ECON 614. Provides the analytical and programming tools needed to adeptly handle the statistical analyses of econometric time-series data. Topics include: stationarity, unit-roots, univariate time-series models, vector autoregressions and co-integration. These tools will be used to analyze movements in interest rates, exchange rates and equity markets as well as the transmission of monetary policy actions.

ECON 642. Panel and Nonlinear Methods in Econometrics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: ECON 501. Includes panel data analysis (fixed and random effects); identification and estimation of nonlinear models, limited dependent variable models (probit, logit, tobit, etc.), duration models; and hypothesis/specification tests. The techniques discussed in class will be used to analyze a variety of empirical questions. The course has an applications rather than a theoretical focus.

ECON 682. An Economic Approach to Environmental Issues. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: ECON 203 with a minimum B grade and ECON 211. The effect of externalities in terms of efficiency and equity considerations. The role and problems of benefit-cost analysis in decision making is developed. The interrelationship of air, water, and land quality issues is analyzed. The use rate of natural resources, energy consumption, and the steady-state economy and their impacts are evaluated.

ECON 691. Topics in Economics. 1-3 Hours.

Semester course; 1-3 lecture hours. 1, 2 or 3 credits. Study of current topics. Topics may vary from semester to semester.

ECON 693. Field Project in Economics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Students will work under the supervision of a faculty adviser in planning and carrying out a practical research project. A written report of the investigations is required. To be taken at the end of the program.

ECON 697. Guided Study in Economics. 1-3 Hours.

Semester course; 3 lecture hours. 1, 2 or 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Graduate students wishing to do research on problems in business administration or business education will submit a detailed outline of their problem. They will be assigned reading and will prepare a written report on the problem. To be taken at the end of the program.

Fast Track MBA (FMBA)

FMBA 601. Team Building and Leadership. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how organizations steer members toward what needs doing. Design, functions and creation of teams, engaging leadership and motivation processes to set and achieve organizational goals; management of emerging communication and evaluation processes; interacting with boards and with customers are developed across disciplines.

FMBA 602. Team Building and Leadership. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how organizations steer members toward what needs doing. Design, functions and creation of teams, engaging leadership and motivation processes to set and achieve organizational goals; management of emerging communication and evaluation processes; interacting with boards and with customers are developed across disciplines.

FMBA 603. Business Foundations. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how to build a foundation in business quantitative techniques. Concepts of accounting/financial reporting, quality, finance concepts, control and hypothesis testing are developed and integrated across disciplines.

FMBA 604. Analysis and Decisions. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how organizations define and choose. Concepts and tools of problem-solving for administrative decisions; concepts and tools of measurement, planning and control; management of conflict, cooperation, negotiation and implementation are developed and integrated across disciplines.

FMBA 605. Analysis and Decisions. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how organizations define and choose. Concepts and tools of problem-solving for administrative decisions; concepts and tools of measurement, planning and control; management of conflict, cooperation, negotiation and implementation are developed and integrated across disciplines.

FMBA 606. Analysis and Decisions. 1-6 Hours.

Semester course; 1-6 lecture hours. 1-6 credits. Presents how organizations define and choose. Concepts and tools of problem solving for administrative decisions; concepts and tools of measurement, planning, and control; management of conflict, cooperation, negotiation, and implementation are developed and integrated across disciplines.

FMBA 607. Global Challenges. 3 Hours.

Semester course; 3 credits. Presents an educational tour for direct experience of influences and perspectives: France, Great Britain, Indonesia or Mexico.

FMBA 608. Organizational Culture. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how organizations develop and operate. Concepts of information technology-adding values, environmental regulations/law, entrepreneurial culture, probability market orientation and management functions are explored.

FMBA 609. Productivity and Innovation. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how organizations change and improve. Management of creativity, critical thinking and rewards; development of resources; implementing concepts of quality, effectiveness and change are developed across disciplines.

FMBA 610. Productivity and Innovation. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how organizations change and improve. Management of creativity, critical thinking and rewards; development of resources; implementing concepts of quality, effectiveness and change are developed across disciplines.

FMBA 611. Strategic Management. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how organizations define, plan and accomplish missions. Comprehensive integration of business functions and processes; systems thinking, managing shareholder value; anticipating and interacting with changing internal and external environments; formulation and implementation of strategy and integrated across disciplines.

FMBA 612. Strategic Management. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how organizations define, plan and accomplish missions. Comprehensive integration of business functions and processes; systems thinking, managing shareholder value; anticipating and interacting with changing internal and external environments; formulation and implementation of strategy and integrated across disciplines.

FMBA 613. Strategic Management. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presents how organizations define, plan and accomplish missions. Comprehensive integration of business functions and processes; systems thinking, managing shareholder value; anticipating and interacting with changing internal and external environments; formulation and implementation of strategy and integrated across disciplines.

FMBA 614. Health Care Management I: National Perspective. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students develop an understanding of how health care evolved in the United States and articulate major policy issues. Course emphasizes the major components of health care reform and what policy issues they are intended to address. Focus is on how information technology supports quality of care, the business of health care and health care reform.

FMBA 615. Health Care Management II: Employer's Perspective. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students will develop an understanding of the business and financing of health care. Course emphasizes the design of insurance costs, the associated costs and employer options. Also explores how wellness affects population health and health care costs.

FMBA 616. Health Care Management III: Industry Perspective. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students will develop an understanding of the unique economic issues of health care, the importance of process improvement and compliance for health care organizations and the effect of costs. Course focuses on the roles of innovation and marketing in the health care industry.

FMBA 691. Topics in Business. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for credit. Study of current topics. Topics may vary from semester to semester.

Finance, Insurance and Real Estate (FIRE)

FIRE 520. Financial Concepts of Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Pre- or corequisite: SCMA 524, STAT/BIOS 543, STAT 541 or SCMA 301. A study of the essential concepts of financial management in a global environment, including working capital management, capital budgeting, capital structure planning and dividend policy. This is a foundation course.

FIRE 526. Exchange Traded Funds. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: FIRE 317 or FIRE 623. A course on exchange traded funds. The course will cover a discussion of the primary and secondary markets for ETFs – including the creation/redemption process – before moving on to important investor considerations, such as costs and risks. How ETFs are used in strategic, tactical and portfolio efficiency applications will be evaluated.

FIRE 540. Financial Analytics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: FIRE 311 or FIRE 520. Study of data skills of management, visualization and analysis of financial data. Students will work on analytics-based projects in the areas of accounting, markets, real estate, financial institutions, statistics, financing under uncertainty, investments and security analysis, risk management, and derivatives. Open to qualified undergraduates.

FIRE 610. Financial Modeling and Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: FIRE 520. The emphasis of this course will be to transition from financial theory to financial modeling using empirical data. The course will cover the following areas relating to financial modeling: asset returns and risk, portfolio theory, capital asset pricing model, stock valuation, option valuation, bond valuation and interest rate risk, and value at risk. The course will also introduce students to logical thinking and applicable programming languages.

FIRE 615. Foundations in Real Estate. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides a basic overview of the participants, processes, workings of different components of the real estate industry (including a variety of uses spanning from residential, office, retail and industrial to specialized) as well as the quantitative components of real estate decision-making. Additionally, students are introduced to an overview of the linkage between real estate markets and public policy.

FIRE 620. Introduction to Financial Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of essential concepts of financial management in a global environment, including time value, capital budgeting and valuation, cost of capital structure, dividend policy, and working capital management, at a level appropriate to the Master of Management program.

FIRE 621. Cases in Financial Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Pre- or corequisite: FIRE 623. Applications of financial modeling and quantitative methods in analyzing financial problems and policies of firms, including capital management, capital rationing and cost of capital, and capital structure.

FIRE 622. Financial Intermediation and Analysis of Fixed-income Securities. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: FIRE 520. Examines the quantitative and qualitative aspects of financial intermediation within an economy. Quantitative modeling tools to manage risks. Valuation of a fixed-income security using no-arbitrage framework.

FIRE 623. Financial Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: FIRE 520. Examines the theoretical underpinnings and practical applications of corporate finance. Key topics include risk and return, financial policy, financial forecasting, capital budgeting, and working capital management. Students are tasked with applying theoretical concepts via financial modeling and quantitative analysis.

FIRE 626. Risk Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: FIRE 520. Introduces risk management principles and their application in making good business decisions. Emphasizes techniques and tools, along with their limitations in the real world. Covers the core concepts of risk management in a global business environment, including market risk, credit risk, operational risk, investment risk and enterprise risk. Includes perspective on the relevant risks and applicable techniques from the viewpoint of financial intermediaries (e.g. banks) and institutional investors (e.g. pension and hedge funds), as well as hedgers (e.g. non-financial corporations).

FIRE 627. Real Estate Development. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. A study of the development process; including market analysis, site selection, pre-acquisition strategic planning, and project management.

FIRE 629. Cases in Real Estate. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on linking the investment with a particular investor, whether that be an individual or institution, whose objectives, attitudes toward risk, ability to borrow and tax situation may vary considerably. The issues covered provide an opportunity to develop qualitative and quantitative tools necessary for investment analysis.

FIRE 630. Real Estate Valuation. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Theory and practice of real property valuation from fundamental concepts to complex income-producing properties and partial-interest valuations. Technology-related tools are employed in the course, including financial modeling with various software programs.

FIRE 635. Investments and Security Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: FIRE 520. Understand investment concepts of diversification, leverage, short-selling and valuation of financial assets such as stocks, bonds, options and mutual funds. Study portfolio theories, asset pricing models and their applications to manage investment risks. Apply the investment concepts using real-life data and programming tools.

FIRE 638. Real Property Investment Law. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BUSN 323* or MGMT 530. Covers legal aspects of real property development from acquisition through disposition; emphasizes selection of appropriate ownership form, financing, operation, and tax considerations. *Formerly MGMT 323, SCMA 323.

FIRE 639. International Finance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: FIRE 520. A study of financial management of multinational enterprises, banks, firms with foreign subsidiaries, exporters, and service industries. Additionally, financing trade and investments, international money and capital markets, foreign exchange risks, and governmental policies will be covered.

FIRE 650. Derivatives. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: FIRE 520. Introduces theoretical concepts and their application in valuing and using financial derivatives. Emphasizes quantitative techniques and computation tools to value such financial products, along with their practical applications and limitations in the real world. Study of valuation, pricing and use of derivatives to manage risk in a global environment.

FIRE 654. Short-term Financial Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: FIRE 520. Techniques of short-term financial management (or working capital management) in a global environment for business firms, including understanding payment systems to achieve efficient cash management of accounts receivable, management of inventory, management of accounts payable, and short-term borrowing from banks and other suppliers of short-term credit.

FIRE 657. Current Issues in Investments and Markets. 3 Hours.

3 lecture hours. 3 credits. Prerequisite: FIRE 635. Advanced study of selected topics in global investments and securities markets using experiential exercises. Topics selected by the instructor. Readings from recent journals, cases, and/or software may be used. Possible topics may include: fixed income mathematics; portfolio management; advanced investments theory; factors explaining security price movements; advanced security analysis; using information to make investment decisions; and security market microstructure.

FIRE 658. Real Estate Finance and Investments. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Emphasizes economic and financial analysis of commercial real estate investments, alternative financing structures and surveys recent trends in the securitization of commercial real estate debt and equity markets.

FIRE 664. Current Issues in Corporate Finance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: FIRE 623. Advanced study of selected topics in corporate finance and financial management in global entrepreneurial settings. Topics selected by the instructor. Readings from recent journals, cases and/or software may be used. Possible topics include: theory and evidence concerning major corporate financial policy decisions, bankruptcy costs and agency costs that relate to capital structure and dividend policy, issues in corporate control, alternative methods of issuing and retiring securities mergers and acquisitions, advanced valuation theory, advanced financial analysis, advanced capital budgeting, using information to make financial decisions.

FIRE 690. Research Seminar in Finance, Insurance and Real Estate. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. This course is designed to provide research experience for candidates not following the FIRE 798-799 program.

FIRE 691. Topics in Finance, Insurance and Real Estate. 1-3 Hours.

Semester course; 1-3 lecture hours. 1, 2 or 3 credits. Prerequisites vary by topic. Study of current topics. Topics may vary from semester to semester.

FIRE 693. Field Project in Finance, Insurance and Real Estate. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Students will work under the supervision of a faculty adviser in planning and carrying out a practical research project using experiential exercises. A written report of the investigations is required. To be taken at the end of the program.

FIRE 697. Guided Study in Finance, Insurance and Real Estate. 1-3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Graduate students wishing to do research on problems in business administration or business education in an international environment will submit a detailed outline of their problem. They will be assigned reading and will prepare a written report on the problem. To be taken at the end of the program.

Information Systems (INFO)**INFO 511. Data Reengineering. 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: INFO 364 and INFO 465. Reengineering data from one form structure to another – including big data technologies, network, hierarchical, relational and other types. This material exposes students to a range of methods, tools and techniques for understanding existing structures and using these as the basis for designing the next versions. Appropriate tools for data reengineering and a real-world project provide students with practical experience. Formerly INFO 611.

INFO 520. Data Communications. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Computer network design, communication line control, and communication hardware and software. Formerly INFO 620.

INFO 530. Systems Development. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: INFO 361 and 364. Covers business process and data requirements modeling for information systems, using advanced methods and techniques. Students will gain hands-on experience developing specifications and a functional prototype application with current CASE and development tools. Formerly INFO 630.

INFO 532. Business Process Reengineering. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: INFO 361 and INFO 465. Critically reviews business process re-engineering methods and practices. Topics include strategy visioning, performance benchmarking, process modeling and analysis, and planning organizational change. State-of-the-art business engineering tool-sets are used to provide practical experience. Formerly INFO 632.

INFO 535. Ethical, Social and Legal Issues in Computer and Information Systems Security. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Analyzing socio-political and ethical issues surrounding computer and information systems security. Topics include privacy laws, identity theft, information collection and retention policies, and enforcement. Formerly INFO 635.

INFO 544. Principles of Computer and Information Systems Security. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Explores issues related to protecting information resources of a firm. Various tools and techniques useful for assessing CISS concerns in organizations are introduced. Principles and models for CISS and security management are presented and selected computer and CISS topics are introduced. Material is presented and discussed from a management frame of reference. Formerly INFO 644.

INFO 601. Database Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Focuses on relational databases for managing structured data and includes the entity relational diagram, transformation of ERD into relational schema, data normalization and structured query language.

INFO 602. Big Data Analytics with Cloud Platforms. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: INFO 364 or INFO 601; and INFO 350 or INFO 648. An in-depth, hands-on exploration of various cutting-edge information technologies used for big data analytics including the Hadoop environment, its architecture, MapReduce and its abstractions, and the Apache Spark software library. The course will also cover the importation of data from heterogeneous sources into big data platforms (extract-transform-load or ETL) using high-level scripting language and using big data analytics tools for data mining and text analytics. Students will use Java libraries for machine learning.

INFO 609. Data-centric Analysis/Planning. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Teaches methods of monetizing or otherwise valuing intangible data practice improvement opportunities in the context of organizational strategy as part of (potentially) semester-long participation with regional organizations. Students use data-centric re-engineering-based business case development to gain practical experience. Sets of students will work closely with organizational leadership during the projects to articulate a specific business case. Teams will evaluate data-centric means of improving operational effectiveness and/or innovation opportunities and recommend specific approaches and estimated benefits.

INFO 610. Analysis and Design of Database Systems. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: INFO 364. Designed to prepare students for the development of data-driven information systems using advanced database management techniques. Included are topics related to advanced SQL statements, procedural SQL programs and NoSQL databases.

INFO 614. Data Mining. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: MGMT 302, SCMA 302, SCMA 524 or permission of the instructor. A data mining process has the goal of discovering nontrivial, interesting and actionable knowledge from data in databases. The course introduces important concepts, models and techniques of data mining for modern organizations. Students gain a deeper understanding of concepts and techniques covered in lectures by doing a practical term project that applies one or more of the data mining models and techniques. Students also are given the opportunity to gain knowledge on the features and functionalities of state-of-the-art data mining software through their preparation of a research report.

INFO 616. Data Warehousing. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: INFO 610. Covers important concepts and techniques in the design and implementation of a data warehouse. Topics include the data warehouse architecture, the logical and physical design issues in the data warehousing development process, technical factors (i.e., hardware, client/server technology, data warehousing and DBMS technologies) and implementation considerations (i.e., data extraction, clean-up and transformation tools). Introduces online analytical processing and data mining. Crosslisted as: CISS 616.

INFO 617. Text Analytics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: INFO 350 or INFO 648. Text analytics are the methods and techniques used to discover interesting patterns and extract valuable information from textual data to support the decision-making process. This course introduces the major techniques of text analytics with an emphasis on hands-on coverage of text mining and analytics using a programming language (e.g., Python).

INFO 622. Internet Security Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Studies the principles of network security and secure operating systems. Included are topics relating to the use of intrusion detection, intrusion prevention and other related tools.

INFO 636. Securing Cloud Infrastructure. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course provides hands-on comprehensive study of cloud concepts and capabilities across the various cloud service models (IaaS, PaaS, SaaS), with mainstream cloud infrastructure services and related vendor solutions covered in detail. The cloud security model and its associated challenges are presented, focusing on performance, visualization, cloud mobility, security, usability and utility of the secure solutions.

INFO 640. Information Systems Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. A detailed study of the issues, principles, techniques and best practices in managing information systems and enterprise knowledge as organizational resources. Managing enterprise knowledge and information systems involves taking a disciplined approach to managing the infrastructures and harnessing the collective knowledge capital and brain-power of individuals and organizations. Topics include: IT operations, issues in strategic management, establishing standards and procedures, performance evaluation and benchmarking, hardware and software acquisition, physical environments and security issues, outsourcing and partnerships, personnel, knowledge ontology, meta-knowledge and others.

INFO 641. Strategic Information Systems Planning. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: INFO 640 or INFO 661. Focuses on developing, implementing and evaluating strategic plans for corporate information systems. Assesses the role of information systems as a competitive tool. Methods and frameworks for strategic analysis are introduced. Mechanisms for establishing an information systems strategy are presented. Emphasis placed on understanding change management issues in IS planning for organizations.

INFO 642. Decision Support and Intelligent Systems. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: INFO 610 and 630. Focuses on the design and deployment of decision technology of two broad types: decision support systems, which are meant to be employed in an advisory capacity by their human users, and intelligent systems, which are generally designed as autonomous decision agents and so intended to displace human functionaries.

INFO 643. Information Technology Project Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: INFO 640 or 661 or permission from the director of graduate studies in the School of Business. Provides a clear understanding of project management techniques. Covers aspects of planning, organizing, controlling and implementing IT projects. IT project management processes, project scheduling and links with information systems strategy and change management are explored.

INFO 645. Prescriptive Analytics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: BIOS 543, SCMA 301, SCMA 524 or STAT 543. Examines the formulation, analysis and solution of quantitative models for business problems. Applications relevant in diverse business disciplines will be investigated, and the models may include optimization, simulation and other advanced analytics-modeling paradigms. Current computer solution methods will be utilized. Formerly SCMA 645.

INFO 646. Security Policy Formulation and Implementation. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Course covers aspects of policy formulation and implementation. A security policy is considered as a vehicle for executing good strategy. The course analyzes current problems with security strategy formulation and compliance. The content and context of security policies is evaluated to ensure effectiveness.

INFO 648. Business Data Analytics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: BIOS 543, SCMA 302, SCMA 524, STAT 543 or ECON 501. Techniques and skills for leveraging real-world data to support decision-making using computational software. Topics include the analytics workflow, data preparation, visualization, cluster analysis, predictive modeling and learning-enabled optimization. Formerly SCMA 648.

INFO 654. Systems Interface Design. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 640 or 661. Analyzes factors important in designing the interface for business information systems. Includes designing and developing systems for the Internet. Requires students to work in teams to produce prototype interactive systems.

INFO 658. Securing the Internet of Things. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: INFO 661 or INFO 640. Overviews the emerging field of the Internet of Things with emphasis on how information infrastructure and networks will change the exchange of goods and services in a socially connected world. Specific topics include technological (including hardware/software) infrastructures, types of IoT applications, key IoT policy issues and future trends, IoT security, and privacy challenges in a socially connected world.

INFO 661. Information Systems for Managers. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides an understanding of the importance and role of information systems in modern business decision making. Emphasizes choices about information technology and managing projects.

INFO 664. Information Systems for Business Intelligence. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides students with techniques and practices for modern decision-making in support of business/corporate performance. Includes hands-on experience with various information analysis, business intelligence and decision support techniques and tools with applications to various business-problem scenarios, such as portfolio analysis, project selection, market research and supply-chain optimization.

INFO 690. Research Seminar in Information Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. This course is designed to provide research experience for candidates not following the INFO 798-799 program.

INFO 691. Topics in Information Systems. 1-3 Hours.

Semester course; 1-3 lecture hours. 1, 2 or 3 credits. Study of current topics. Topics may vary from semester to semester.

INFO 693. Field Project in Information Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Students will work under the supervision of a faculty adviser in planning and carrying out a practical research project. A written report of the investigations is required. To be taken at the end of the program.

INFO 697. Guided Study in Information Systems. 1-3 Hours.

Semester course; 3 lecture hours. 1, 2 or 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Graduate students wishing to do research on problems in business administration or business education will submit a detailed outline of their problem. They will be assigned reading and will prepare a written report on the problem. To be taken at the end of the program.

INFO 700. Survey of Information Systems Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is designed to provide incoming Ph.D. students with an introduction to information systems research. Students will survey various research streams in the field of information systems by familiarizing themselves with the research undertaken by faculty in the IS department. During the semester, students will learn about the various research areas in light of theories that support research and the primary research methods used in these areas. In addition, students will review literature to identify critical research issues in a specific topic area chosen for research and propose solutions to address those issues.

INFO 701. Qualitative Research in Information Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. The course is designed to cover qualitative research published in the information systems discipline and an array of qualitative research methods, including but not limited to grounded theory, positivist case studies, interpretive case studies, hermeneutics, ethnography, action research and interviewing methods. Students will be exposed to the published literature of qualitative research in the IS discipline, as well as to the principles that distinguish qualitative research from other types of IS research. The research methods and techniques will be discussed using published examples of such research. Including a project, the course will help students conduct their own qualitative research.

INFO 702. Design Science Research and Methods in Information Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. The course is designed to explore the theories and methods that are used in the various phases of design science research. Students will be exposed to the principles that distinguish design science research from other types of information Systems research. The research methods and techniques used in the various phases of design science research will be discussed using examples from IS analysis and design, database, IS security, decision support and intelligent systems, knowledge management, or other subfields.

INFO 710. Database Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores advanced concepts related to management of modern organizations' data resources. Focuses on data administration and the technical aspects of database systems. Some of the database research issues covered include: data quality, design, security, metadata, XML databases and data warehousing. Prepares students for further research into aspects of database systems.

INFO 720. Analysis and Design of Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the philosophical and theoretical foundations of information systems development methodologies and their evolution. Provides an intellectual foundation for students wishing to write a doctoral dissertation in this subject matter. Students will be required to read and analyze articles considered fundamental to the current understanding of the subject.

INFO 730. Information Systems Strategy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides the basis for further Ph.D.-level work in information systems strategy. Covers the theoretical foundations of the subject area. In particular the economic, psychological, sociological and cultural aspects are considered. This focus helps students to identify different research orientations and helps develop an informed opinion on critical research areas.

INFO 740. AI-based Decision Support Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides the basis for further Ph.D.-level work in decision support and intelligent systems. Explores the theoretical and technical aspects of the subject area. This course will help students identify different research orientations with respect to the notion of intelligent systems and build an informed opinion on critical research areas. Explores issues around classes of decision predicates and decision situations. The course also helps students understand technical innovations in decision technologies as they relate to the study of decision support and intelligent systems.

INFO 750. Information Systems Security. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides the basis for further Ph.D.-level work in information systems security. Covers the theoretical aspects of the subject area. It helps students identify different research orientations with respect to IS security and build an informed opinion on critical research areas. Explores issues around what IS security is (ontology) and how to acquire the relevant knowledge (epistemology). The course also helps students understand methods of social science research as they relate to IS security.

INFO 760. Knowledge Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores advanced concepts related to knowledge management and knowledge discovery in modern organizations. Material for the course is drawn from research papers and doctoral dissertations. Requires a high level of student participation, particularly in their critical reviews and presentation of relevant research materials.

INFO 790. Doctoral Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open only to Ph.D. students in business. Analyzes and critiques general theories, practices and functions in a specialized area of information systems research.

INFO 798. Thesis in Information Systems. 3 Hours.

Year course; 6 credits. Graduate students will work under supervision in outlining a graduate thesis and in carrying out the thesis.

INFO 799. Thesis in Information Systems. 3 Hours.

Year course; 6 credits. Graduate students will work under supervision in outlining a graduate thesis and in carrying out the thesis.

INFO 898. Dissertation Research in Information Systems. 1-12 Hours.

1-12 credits. Limited to Ph.D. in business candidates.

Management (MGMT)**MGMT 540. Management Theory and Practice. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. A foundation course that presents theories, principles and fundamentals applicable to contemporary management thought and productive activities.

MGMT 633. Issues in Labor Relations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The conceptual framework of labor relations; the interconnection between labor-management relations and the sociopolitical environment.

MGMT 634. Collective Bargaining and Labor Arbitration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The negotiation and administration of collective bargaining contracts; the handling of grievances.

MGMT 637. Advanced Human Resource Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MGMT 540 and MGMT 524. Provides exposure to the process of managing human resources; focuses on issues concerned with business decisions about acquiring, motivating and retaining employees. Topics may include HRM planning, recruitment, selection, training, performance management, compensation and strategic human resource management. Emphasis will be given to the development, implementation and assessment of human resource management policies and practices consistent with business, legal, environmental and strategic dynamics.

MGMT 641. Leading People and Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted students who have completed all M.B.A. foundation courses or equivalent, or by permission from the graduate studies in business office. An advanced course in management involving theories and models aimed at developing the managerial competencies needed to analyze, understand, predict and guide individual, group and organizational behavior.

MGMT 642. Business Policy and Strategy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: completion of five of the following courses – MGMT 641; MGMT 675; ACCT 608; ECON 610; FIRE 621 or FIRE 623; INFO 661; INFO 664; MKTG 671. Integration of principles and policies of business management from the fields of accounting, economics, marketing, finance, statistics and management in the solution of broad company problems and in the establishment of company policy. Emphasis on interaction of disciplines in efficient administration of a business. Course employs case analysis approach.

MGMT 644. International Business Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: ECON 500, MGMT 530, MGMT 540 and MKTG 570. Survey course for students interested in international and multinational management. Review of historical, governmental, monetary, and cultural issues affecting the transfer of resources and management knowledge across national boundaries; multinational business and management strategies; study of management practices in selected countries.

MGMT 649. Compensation Policy and Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 637. Analysis of the concepts and processes involved in compensation systems. Includes evaluation of the internal and external dimensions of compensation, policy issues involved, concepts, and forms of compensation, administration of compensation systems, and current and future issues.

MGMT 654. Negotiations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An advanced course in management using an experiential approach to explore the practice and theory of negotiation. Topics will include basic approaches to negotiation and conflict management, negotiating in teams, negotiating with agents, ethics in negotiations and international negotiation.

MGMT 655. Entrepreneurship. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Individual and corporate entrepreneurship in high and low technology enterprises. Develops an understanding of the role of entrepreneurship in management theories and practices. Students will develop comprehensive venture analysis plans for presentation.

MGMT 656. Best Practices in Leadership. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing. A seminar and experiential exercise course designed to raise the student's practical awareness of major leadership behavior patterns and strategies that promote effectiveness in organizations; raise awareness, flexibility and skill with the student's own personal leadership style; and help students practice, discuss and develop the ability to influence others over whom they may or may not exert positional authority.

MGMT 657. Corporate Entrepreneurship. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the Master of Business Administration or Master of Science in Business programs. Few companies are immune to the forces of creative destruction. The corporate longevity forecast for S&P 500 companies anticipates average tenure on the list to grow shorter over the next decade. This trend speaks to the critical need for businesses (large, medium and small) to constantly examine their business models and look for innovative ways to keep themselves relevant. Students will be exposed to a corporate entrepreneurship framework used to develop new business opportunities (products, services, business models, etc.) inside an existing organization. Students will use this framework to examine how firms create value and generate sustainable revenue growth through entrepreneurial thought and action. This heavily revolves around innovation, business model generation, concept design, in-depth research, new product development and branding. An understanding of opportunity recognition, creative solutions and innovation will be emphasized.

MGMT 680. Health, Safety and Security Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: MGMT 524; and MGMT 530 or 540. Study of design and development of an effective safety or risk-control program. Topics include organizational needs and assessment, program evaluation, design/implementation of critical program components, training, accident cost-accounting, cost containment. Also addresses management strategies, communication techniques, motivation and incentive programs and other special topics.

MGMT 682. Human Resource Staffing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 637. Addresses the activities and processes that affect the staffing function. Subjects include attracting, selecting, and retaining people who will facilitate the accomplishment of organizational goals. Designed for the future human resource professional who will be involved with designing, administering, revising, and evaluating selection programs and procedures.

MGMT 684. Issues in International Human Resource Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 637 or MGMT 641. Focuses on issues affecting the application of human resource management practices in an international environment. Examines current challenges in the selection, appraisal, development, compensation and maintenance of expatriates, repatriates, host country nationals and third-country nationals. Includes contextual factors of industrial relations systems, legal environment, demographics and culture.

MGMT 691. Topics in Management. 1-3 Hours.

Semester course; 1-3 lecture hours. 1, 2 or 3 credits. Study of current topics. Topics may vary from semester to semester.

MGMT 693. Field Project in Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Students will work under the supervision of a faculty adviser in planning and carrying out a practical research project. A written report of the investigations is required. To be taken at the end of the program.

MGMT 697. Guided Study in Management. 1-3 Hours.

Semester course; 3 lecture hours. 1, 2 or 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Graduate students wishing to do research on problems in business administration or business education will submit a detailed outline of their problem. They will be assigned reading and will prepare a written report on the problem. To be taken at the end of the program.

MGMT 702. Causal Analysis for Organizational Studies. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: two graduate courses in statistics or permission of instructor. Focuses on conceptual and statistical issues involved with causal analysis with nonexperimental and experimental data. Course covers basic and advanced confirmatory factor analysis and structural equation techniques, with an emphasis on organizational and psychological applications. Crosslisted as: PSYC 702.

MGMT 703. Advanced Topics in Research Methods for Organizational Studies. 1,2 Hour.

Continuous course; 3 lecture hours. 3 credits. Prerequisites: MGMT 632 or equivalent and permission of instructor. Students must enroll for two semesters. Extensive coverage of applications of methodological and statistical analyses to an array of disciplines related to organizational studies. Emphasizes the skills essential in designing, conducting and interpreting research. Course contact hours spread over fall, intersession and spring semesters. Credits allotted one in fall and two in spring. May be repeated once for credit as topics change each year.

MGMT 737. Seminar in Human Resources. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 637 or equivalent, or permission of instructor. Provides broad exposure to theory and research in the field of human resource management. Topics include strategic and operational human resource planning and staffing; employee relations, development and performance management; external factors such as legal and international environments; and compensation policy and practices.

MGMT 738. Special Focus in Human Resource Management: ____ 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 637 or equivalent, or permission of instructor. Provides exposure to specific advanced theoretical and methodological topics related to human resource management. Topics may include staffing, training and development, motivation (i.e., compensation and rewards), HRM metrics, and validity generalization. Topics vary depending upon instructor. See the Schedule of Classes for specific topics to be offered.

MGMT 743. Organizing Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 524 or equivalent, or permission of instructor. Surveys the foundations of management theory as well as more recent research and theory on the leadership through which work is organized and directed.

MGMT 745. Advanced Operations Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 645 or equivalent. Advanced discussion of topics in mathematical programming and network analysis as applied to organizational decision making. Includes network flows, integer, nonlinear, and dynamic programming, and multicriteria optimization. Emphasis on applications and the use of the computer for problem solving.

MGMT 746. Cognitive and Emotional Processes in Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 524 or equivalent. This course examines organizational life in terms of cognitive and emotional processes at the individual, group, and organizational level. Special attention will be given to how people perceive and evaluate each other.

MGMT 747. Seminar in Human Resources: Macro Foundations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 737 or equivalent, or permission of instructor. Provides broad exposure to theory and research of how firms can use human resource management practices to enhance individual and organizational performance. Topics include emerging theoretical perspectives related to HRM systems, human capital, contextual factors and other factors that influence the linkages between human resources and performance.

MGMT 749. History of Management Thought. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 540. Traces the history of management from its beginnings to current approaches and theories.

MGMT 750. Attitudes and Motivation in Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 524 or equivalent. Critical examination of classic and emerging research on attitudes and motivation in organizations, as well as their relationships to individual and organizational outcomes.

MGMT 757. Corporate Strategy and Long-range Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 642 or equivalent. Analysis and evaluation of current methods and research in the areas of corporate strategy and long-range planning.

MGMT 790. Doctoral Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open only to Ph.D. students in business. Analyzes and critiques general theories, practices and functions in a specialized area of management research.

MGMT 798. Thesis in Management. 3 Hours.

Year course; 6 credits. Graduate students will work under supervision in outlining a graduate thesis and in carrying out the thesis.

MGMT 799. Thesis in Management. 3 Hours.

Year course; 6 credits. Graduate students will work under supervision in outlining a graduate thesis and in carrying out the thesis.

MGMT 898. Dissertation Research in Management. 1-12 Hours.

1-12 credits. Limited to Ph.D. in business candidates.

Marketing (MKTG)**MKTG 622. Corporate Social Responsibility and Ethics. 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Examines corporate social responsibility, ethical decision-making and ethical leadership in business and other organizations from a managerial perspective. Topics include the stakeholder perspective, recognition of ethical issues, application of ethical frameworks to decision-making, and analysis of the consistency between organizational actions and ethical or CSR principles.

MKTG 656. International Marketing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisite: MKTG 671. Orientation to the international market place. Formulation of international marketing strategies for firms participating in global trade. Emphasis on international environment, multinational economic blocs, international competition and development of international marketing strategies.

MKTG 657. Market Planning Project. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisite: MKTG 671. This course is a comprehensive real-life, field-based research and strategic planning exercise. Students are matched with an organization that is interested in improving overall performance. Under the supervision of the instructor, the student team develops a global or domestic marketing plan for the client. The team functions as consultants to its assigned company.

MKTG 670. Essentials of Market Planning and Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to students enrolled in the Master of Management program. Presents and analyzes buyers and sellers in the marketplace, impact of external forces on marketing, customer-driven strategies and tactics, creation of market-driven competitive advantage, responsible and ethical marketing, Internet and global marketing.

MKTG 671. Marketing Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Detailed study of concepts and procedural alternatives in the delineation of the market target, the development and implementation of the marketing mix, and the control and analysis of the total marketing effort.

MKTG 672. Influencing Consumer Behavior. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of how consumers think, feel and act throughout the decision process. This course explores consumer behavior theories and practices that are relevant to influencing behavior through effective marketing.

MKTG 673. Marketing Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOS 543, SCMA 302, SCMA 524, STAT 541 or STAT 543; pre- or corequisite: MKTG 571. A discussion of the techniques of marketing research. Special emphasis will be given to marketing problem definition, determination of information needs and current methods of analysis of marketing data.

MKTG 674. Service Quality Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisite: MKTG 301 or MKTG 671. This course enables marketing students to develop a better understanding of service offerings from both a theoretical and practical perspective. Learning will focus on both private and public-sector service organizations. Students will learn how to analyze the design of service offerings, including operations, environment and people, and make recommendations for improving the offerings. The importance of internal and external customer feedback and continually measuring customer satisfaction/dissatisfaction will be highlighted as an integral part of managing service quality.

MKTG 675. Digital Marketing. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Focuses on the basic digital tools available to marketers. The strategic value of digital marketing to the organization as it relates to the buyer behavior model is explored through lecture, cases, guest speakers and a group project. The group project teams partners with local companies to gain practical experience with digital marketing.

MKTG 676. Social Media Research. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Pre- or corequisite: MKTG 671. Improves knowledge of tools and skills to analyze social media data with an emphasis on developing insights for marketing research, strategy and communication. Focuses on contemporary social media listening tools and techniques.

MKTG 678. Marketing Analytics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: SCMA 524 or STAT 541. Develops and sharpens students' analytical and statistical skills in preparation for advanced marketing decision-making. Analyses and statistical techniques covered include descriptive statistics, cross-tabulation, analysis of variance, regression and cluster analysis applied to marketing phenomena.

MKTG 679. Brand Strategy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will provide students with an understanding of how to formulate strategies for building, leveraging and growing strong brands in an increasingly dynamic and competitive environment. It will address a variety of relevant concepts, including customer and market analysis, brand positioning and brand equity. Students will consider how to design and implement effective brand-building programs and how to measure brand performance. Importantly, the course will emphasize the organizational and individual characteristics necessary for successful strategic brand management.

MKTG 690. Research Seminar in Marketing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. This course is designed to provide research experience for candidates not following the MKTG 798-799 program.

MKTG 691. Topics in Marketing. 1-3 Hours.

Semester course; 1-3 lecture hours. 1, 2 or 3 credits. Study of current topics. Topics may vary from semester to semester.

MKTG 693. Field Project in Marketing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Students will work under the supervision of a faculty adviser in planning and carrying out a practical research project. A written report of the investigations is required. To be taken at the end of the program.

MKTG 697. Guided Study in Marketing. 1-3 Hours.

Semester course; 3 lecture hours. 1, 2 or 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Graduate students wishing to do research on problems in business administration or business education will submit a detailed outline of their problem. They will be assigned reading and will prepare a written report on the problem. To be taken at the end of the program.

MKTG 701. Theory and Its Application in Marketing. 3 Hours.

Semester course; 1 lecture and 2 seminar hours. 3 credits. To help students identify their research interests, the course introduces marketing theories, models and their application in scholarly research.

MKTG 710. Marketing Strategy. 3 Hours.

Semester course; 1 lecture and 2 seminar hours. 3 credits. This course covers a range of strategic marketing management topics with a focus on theory, methods and models.

MKTG 720. Consumer Behavior, Judgement and Decision-making. 3 Hours.

Semester course; 1 lecture and 2 seminar hours. 3 credits. This course provides an interdisciplinary approach to the study of information processing, choice and consumer decision-making while exposing students to behavioral research methodologies.

MKTG 740. Advanced Topics in Marketing. 3 Hours.

Semester course; 3 seminar hours. 3 credits. This seminar emphasizes conceptual and methodological developments in specialized marketing topic areas.

MKTG 797. Doctoral Guided Study in Marketing. 1-3 Hours.

Semester course; 1-3 independent study hours. 1-3 credits. May be repeated for credit to a maximum of nine hours for seminars with different content. Focused inquiry for marketing doctoral students. Note: Students are required to submit a detailed outline of the proposed study topic for approval by the instructor.

MKTG 798. Thesis in Marketing. 6 Hours.

Year course; 6 credits. Graduate students will work under supervision in outlining a graduate thesis and in carrying out the thesis.

MKTG 799. Thesis in Marketing. 6 Hours.

Year course; 6 credits. Graduate students will work under supervision in outlining a graduate thesis and in carrying out the thesis.

MKTG 898. Dissertation Research in Marketing. 1-12 Hours.

Semester course; 1-12 dissertation hours. 1-12 credits. Enrollment is restricted to candidates for the Ph.D. in Business. Research directed toward completion of the requirements for a Ph.D. Graded as S/U/F.

Sport Leadership (SPTL)**SPTL 591. Topical Seminar. 1-3 Hours.**

Semester course; 1-3 seminar hours. 1-3 credits. May be repeated for a maximum of 6 credits. A seminar intended for group study by students interested in examining topics, issues or problems related to health, physical education, exercise science, recreation and sport. Crosslisted as: HEMS 591.

SPTL 603. Research and Analytics in Sport. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Designed to help graduate students acquire the fundamental skills of evaluating peer-reviewed research, while also facilitating the development of student research projects. Course offers an introduction to market research and analytics, both important aspects in today's sport environment and industry, and will help students determine and defend problems in sport from a statistical perspective, bringing more credibility to their stance.

SPTL 608. Sport and Entertainment Event Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The first semester of a two-course sequence designed to allow graduate students to acquire the fundamental skills needed to plan events in all areas of the sport and entertainment industry, including planning and event design, understanding financial contracts, facility and security risk management, marketing and promotions, and implementation and control methods. By the completion of the sequence (SPTL 608/SPTL 610), students will have designed, planned and implemented an actual event that will take place at the end of the spring semester.

SPTL 610. Sport and Entertainment Event Development. 3 Hours.

II Semester course; 3 lecture hours. 3 credits. Prerequisite: SPTL 608. Designed to allow graduate students to acquire the fundamental skills needed to plan events in all areas of the sport and entertainment industry, including planning and event design, understanding financial contracts, facility and security risk management, marketing and promotions, and implementation and control methods. By the completion of the two-course sequence (SPTL 608/SPTL 610), students will have designed, planned and implemented an actual event that will take place at the end of the spring semester.

SPTL 622. Sport Consumer Behavior. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course focuses on the importance of understanding consumer behavior within contemporary sport. Students will gain an appreciation for how understanding and influencing sport consumer behavior is a fundamental marketing/management strategy, and how an understanding of consumers (fans) enables sport marketers and managers to more effectively meet the needs of buyers in the market. The course explores psychological, social, situational and marketing factors that influence the selection and usage of sport products and services.

SPTL 623. Sport and the Environment. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course is designed to explore the relationship between sport and the environment. Specifically, the course will investigate the ways in which sport (participant and spectator) affects the natural environment, the ways the natural environment affects sport and the stewardship role sport can play with respect to environmental issues.

SPTL 625. Team Dynamics in Sport. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the sport leadership program. Acquaints the student with the need for groups within the sport industry. This course will also explore the transitions teams go through from forming through adjourning. Focuses on the different types of team and individual success while discussing typical pitfalls of teams and strategies to avoid them.

SPTL 630. Sociology of Sport. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the M.S.L. program. Provides a systematic study of human behavior as it occurs in and is influenced by social groups, institutions, organizations and societies. Provides an understanding of sport as a social phenomenon and examines principles that govern social behavior and sport. Identifies the consequences of various social structures and critically examines these consequences based on the student's own ethical and moral positions.

SPTL 632. Sport Business. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the M.S.L. program. Provides an in-depth examination of pertinent aspects of business and law as applied to the sports industry. Topics include contract and tort, risk and reliability, organization structure and management, budget and business plans, and facility management. Provides the basic principles of business and law necessary for successful entry into sports related careers.

SPTL 633. Marketing of Sport. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Will familiarize the student with practical aspects of sports marketing including the dynamic nature of sport marketing and the importance of branding. Through lecture and case-study analysis, the course will provide students with the understanding of the importance of marketing theory and fundamentals specific to the marketing of sport. Designed to introduce students to marketing within the sport industry, including understanding the unique aspects of sport as product, the sport consumer market and the sport product market.

SPTL 634. Foundations of Coaching. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the M.S.L. program. Acquaints the student with principles, techniques and functions related to coaching and administrative fundamentals for any sport. Special emphasis on communication, motivation, organization and team building for success. Provides an understanding and overview of multiple elements that contribute to successful and productive coaching of athletes and managing athletics programs.

SPTL 635. Leadership Models in Sport. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the M.S.L. program. Acquaints the student with principles, techniques and functions related to management and leadership in all organizations. Focuses on the impact of leadership on organizations and their members. Discusses key ingredients of successful management and visionary leadership.

SPTL 640. Sport Media and Communications. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. An examination of the converging worlds of journalism, public relations, marketing and advertising as expressed in the new commercial reality of sport. Students will be provided with a history of sports media and the changes the media has undergone in recent years. Students will learn the many reasons media relations are important as well as methods to make sure those relations are strong with sport entities. Students will also have the opportunity to be placed in the media chair and produce written material as a reporter covering a team or an athletic program.

SPTL 641. Sports Psychology. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. An overview of the discipline of sports psychology designed to facilitate an understanding and application of mental skills as well as to provide an understanding of other applied domains, such as life skills within sport psychology. Goal setting, relaxation, imagery, burnout and communication are some of the key issues examined.

SPTL 642. Sport Ethics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Offers an application of the tools of moral reasoning and ethics to the management of sports and recreation programs. This class places students in ethical decision-making situations within the sport industry and provides the tools necessary to effectively navigate these circumstances.

SPTL 643. Sport Law. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. An application of basic principles of law to the management of sports, events, teams, organizations, educational institutions and facilities. This course will involve the study of the application of various legal doctrines to a broad range of sports-related activities. Particular areas of the law that will be discussed include contracts, labor law, antitrust, taxation, torts, remedies, arbitration and constitutional law.

SPTL 644. NCAA Coaching. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Designed to prepare students for the daily responsibilities of assistant and head NCAA coaches by gaining knowledge and confidence through working with camps, managing a budget and developing an understanding of the NCAA rules and regulations. At the conclusion of the course, students will understand the many principles needed to be a successful coach at the collegiate level.

SPTL 645. Sales and Development. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Designed to provide students with an in-depth analysis of sales and fundraising management, emphasizing strategies and techniques, sales presentations, professional image, product/service knowledge, customer relations, sales ethics, and return-on-investment. Additional topics will explore various aspects of development including annual fund management, corporate and foundation relations, prospect research, special events, major gifts, capital campaigns and gift planning.

SPTL 646. Facilities and Event Development. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Designed to help graduate students acquire the fundamental skills needed to plan different types of events, from facility design to determining the nuts and bolts of event design and implementation.

SPTL 647. Global Sports Issues. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Designed to provide a systematic study of human behavior as it occurs in and is influenced by social groups, institutions, organizations and societies pertaining to sports beyond the United States. Through this course students will gain a better understanding of sport as a social phenomenon (economically, politically, religiously, educationally, etc.) throughout the world.

SPTL 648. Issues in College Athletics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course seeks to identify contemporary issues and challenges in intercollegiate athletics. A primary objective is that students be cognizant of issues and concerns in sport, which may have a direct bearing in their future involvement in sport at the collegiate level. In addition, students will be encouraged to think critically about the current state of intercollegiate athletics and provide practical solutions for the sustainable growth and prosperity of athletic departments, student-athletes and institutions of higher education.

SPTL 650. European Model of Sport. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An opportunity for students to get a first-hand examination of how sports principles and techniques are carried out overseas. Students will learn the global business of sport through class sessions, tours and events with top sport professionals in Europe. This class provides an excellent chance to gain access to a distant market and build contacts and networks, while growing culturally in the understanding of sport on a global scale.

SPTL 691. Topics in Sport Leadership. 1-3 Hours.

Semester course; 1-3 lecture hours (delivered online, face-to-face or hybrid). 1-3 credits. May be repeated for nine credits. Check with department for specific prerequisites. A course for the examination of specialized issues, topics, readings or problems in sport leadership.

SPTL 692. Independent Study. 1-3 Hours.

Semester course; 1-3 independent study hours. 1-3 credits. May be repeated for a maximum of 9 credits. Determination of the amount of credit and permission of the instructor and department chair must be procured prior to registration. Cannot be used in place of existing courses. An individual study of a specialized issue or problem in recreation.

SPTL 695. Externship. 1-6 Hours.

Semester course; 1-6 field experience hours. 1-6 credits. May be repeated for a total of 6 credits. Enrollment is restricted to sport leadership majors and requires permission of the fieldwork supervisor or executive director, and completion of 24 graduate credits. Plan of work designed by the extern with prior approval of the offering program. Off-campus planned experiences for advanced graduate students designed to extend professional competencies in recreation, parks and sport leadership. Directed by university faculty in cooperation with placement site directors.

SPTL 701. Seminar in Sport Research. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Must be taken for a total of 3 credits. Restricted to students in the sport leadership track of the Ph.D. in Education program. Provides students with a broad, comprehensive understanding of academic research as it relates to the sport industry. This course is designed to fully engage students in the research process, including exploration of journals in the area of sport management and leadership, developing a literature review, overview of the manuscript review process and collaboration with faculty within the university and across the country. Students will also learn to prepare for academic research presentations at regional and national conferences and submit first-author manuscripts for scholarly journals.

SPTL 702. Seminar in Sport Leadership and the Profession. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to students in the sport leadership track of the Ph.D. in Education program. The course is designed to provide students with a broad, yet comprehensive preparation for a career in academe and offer a general sense of university structure and of the breadth of opportunities in higher education. Students will also explore their vision of "being a professor" and discuss timely and pressing topics in the field of sport leadership and academia, as well as receive assistance in the job-search process.

Supply Chain Management and Analytics (SCMA)**SCMA 524. Statistical Fundamentals for Business Management. 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: BUSN 171*, BUSN 212**, SCMA 500 or MATH 200. Develops an ability to interpret and analyze business data in a managerial decision-making context. Applications are stressed in the coverage of descriptive statistics, contingency tables, probability, sampling, correlation, confidence interval estimation, hypothesis testing and regression analysis. Business-oriented computational software will be used for data visualization and analysis. This is a foundation course. *Formerly MGMT 171, SCMA 171; **formerly MGMT 212, SCMA 212.

SCMA 530. Fundamentals of the Legal Environment of Business. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The legal environment of business is examined in view of common law principles, statutory provisions and administrative regulations affecting various forms of business organizations and management obligations to the company, its owner and the public. Role of ethics and key commercial law areas are examined including Uniform Commercial Code Provisions.

SCMA 602. Global Supply Chain Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course explores supply, operations and logistics processes and how these processes are integrated with other functions within the firm and across organizations. The objective of this course is to provide students with knowledge of the fundamentals of supply chain management and how those concepts apply to business practice in a global setting.

SCMA 603. SAP ERP and Supply Chain Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course focuses on the concept of enterprise information systems as the application of information technology to support the integration of organizational processes. SAP ERP software applications will focus on the design, plan and control of supply chain management processes. Students will have extensive hands-on activities, assignments and cases using a live SAP ERP system.

SCMA 606. Supply Chain Innovation. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Students are introduced to cross-disciplinary principles pertaining to creativity, design, invention and innovation. The focus is learning and applying problem-solving methodologies to address complex, open-ended supply chain problems. Innovation from individual and team perspectives is addressed to hone more comprehensively students' problem-identification, information-gathering, conceptualization, evaluation and selection skills.

SCMA 615. Strategic Logistics Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Corequisite: SCMA 524 or verified equivalent. This course is intended to provide an overview of the logistics function within an organization – highlighting how logistics systems can be strategically designed while also demonstrating how they are managed and improved. Specifically, the course is designed to give exposure to both inbound (procurement) and outbound (distribution) logistics. In general, the course will have a strategic flavor to it where students will be exposed to, but will not have time to become proficient in, the array of techniques used by managers in the logistics function.

SCMA 632. Statistical Analysis and Modeling. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: BIOS 543, SCMA 302, SCMA 524, STAT 543 or ECON 501. Statistical analysis and modeling for decision analytics. Topics covered have an applied focus and may include logistic regression, bootstrap estimation, permutation tests, categorical data analysis, model selection, sparse methods and Bayesian methods. Statistical analysis of data will be conducted using business-oriented computational software.

SCMA 642. Decision and Risk Analytics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: BIOS 543, SCMA 301, SCMA 524 or STAT 543. Decision analytics uses diagrams and models to structure complex decisions, decomposing the alternatives, uncertainties and objectives to reveal the best strategy. The course will focus on gaining an understanding of decision analysis tools and software and facilitating decision-makers and stakeholders in building decision models. The probabilistic and statistical underpinnings of good decision-making and the psychology of bad decision-making will be covered. Students will develop solutions for case studies and complete a decision project.

SCMA 643. Applied Multivariate Methods. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: SCMA 524, STAT/BIOS 543 or ECON 501. Study of multivariate statistical methods frequently used in business and analytics problems including principal components, factor analysis, discriminant analysis, MANOVA, logistic regression and cluster analysis. The focus is on applying these techniques through the use of a computer package.

SCMA 646. Legal Foundations of Employment. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SCMA 530 or MGMT 637. Examines the laws concerning human resources in organizations. Equal Employment Opportunity, wage and hours laws, Equal Pay Act, the Employee Retirement Income Security Act, the Occupational Safety and Health Act and employee personal rights laws are emphasized.

SCMA 669. Developing and Implementing Forecasting Methods for Business. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: BIOS 543, ECON 501, SCMA 302, SCMA 524, STAT 541 or STAT 543. Forecasting methods and applications appropriate for managerial decision-making. Methods covered include moving average and exponential smoothing, seasonal adjustments, time series, forecast averaging, new-product forecasting, and combining managerial judgment and analytical forecasts. Particular emphasis is placed on developing and implementing forecasting techniques and other analytical tools in an interactive organization and appreciation of issues and caveats associated with each technique. Course includes data acquisition and teamwork along with effective consulting, communication and presentation skills.

SCMA 675. Operations Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: BIOS 543, SCMA 301, SCMA 524, STAT 541 or STAT 543. A systematic investigation of the concepts and issues in designing, operating and controlling productive systems in both manufacturing and services.

SCMA 677. Quality Management and Six Sigma. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: BIOS 543, SCMA 302, SCMA 524, STAT 541 or STAT 543. Concepts of quality management and Six Sigma: quality strategies, organizational quality assessment, Six Sigma process management tools and techniques, process control and improvement tools, the voice of the customer and the voice of the employee.

SCMA 690. Research Seminar in Supply Chain Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Approval of proposed work is required by graduate studies office in the School of Business. This course is designed to provide research experience for candidates pursuing a non-thesis option.

SCMA 691. Topics in Supply Chain Management and Analytics. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Study of current topics. Topics may vary from semester to semester.

SCMA 693. Field Project in Supply Chain Management and Analytics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Students will work under the supervision of a faculty adviser in planning and carrying out a community-engaged research project. A written report of the investigations is required.

SCMA 697. Guided Study in Supply Chain Management. 1-3 Hours.
Semester course; variable hours. 1-3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Graduate students will submit a detailed outline of their research problem. They will be assigned reading and will prepare a written report on the problem. To be taken at the end of the program.

School of Dentistry

Dental Biomedical Sciences (DEBS)

DEBS 501. Dental Gross Anatomy. 6.5 Hours.

Semester course; 4 lecture and 3 laboratory hours. 6.5 credits. A systematic dissection and study of the human body with clinical correlation and emphasis on the head and neck.

DEBS 502. Dental Neuroanatomy. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Through this course, students will develop broad-level knowledge of neuroanatomical structures and principles and the role of the nervous system. Dental clinical correlations will be used to illustrate the future clinical necessity for and application of this scientific background.

DEBS 503. Infection and Immunology. 3.5 Hours.

Semester course; 3.5 lecture hours. 3.5 credits. Enrollment restricted to dental students in the first professional year; others admitted with permission of instructor. A course on the fundamentals of microbiology and immunology with aspects on disease and treatment of interest to dentistry.

DEBS 511. Microscopic Anatomy. 5 Hours.

Semester course; 2.5 lecture and 5.5 laboratory hours. 5 credits. A study of the normal tissues and organs of the human body at the microscopic level, with emphasis on the histological organization and development of the oral cavity.

DEBS 512. Physiology and Pathophysiology. 5 Hours.

Semester course; 5 lecture hours. 5 credits. A comprehensive study of the function of mammalian organ systems, designed primarily for dental students.

DEBS 513. Dental General Pathology. 6 Hours.

Semester course; 3 lecture and 6 laboratory hours. 6 credits. Instruction in the basic principles regarding alteration of structure and function in disease and in the pathogenesis and effect of disease in the various organ systems.

DEBS 601. Dental Pharmacology and Pain Control I. 4 Hours.

Yearlong course; 4 lecture hours. 4 credits. This course covers the study of the effects of chemical agents on the structure and function of living tissues, which may be normal or pathological. Provides a basic understanding of pharmacological principles and the basic concepts of currently accepted theories of pain mechanisms and provides a scientific basis for the use of therapeutic agents in order that the future dentist will be able to safely administer drugs to control pain by parenteral, oral or inhalation routes. Students receive CO grading in the fall and letter grade and earned credit in the spring.

DEBS 701. Dental Pharmacology and Pain Control II. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: DEBS 601. The study of the effects of chemical agents on the structure and/or function of living tissues, which may be normal or pathological. Provides a basic understanding of pharmacological principles and the basic concepts of currently accepted theories of pain mechanisms and provides a scientific basis for the use of therapeutic agents in order that the future dentist will be able to safely administer drugs to control pain by parenteral, oral or inhalation routes.

Dental Special Topics (DENS)

DENS 501. Remediation in Dentistry D1. 1-7 Hours.

Semester course; 1-7 lecture hours. 1-7 credits. Enrollment is restricted to current dental students as directed by the Academic Progress Committee. This course is not part of the core D.D.S. curriculum. Students who must remediate a course, for any reason, will be enrolled in this course during their remediation period and credit hours will be assigned consistent with the course being remediated. This course is for remediation of D1 courses. A grade of pass/fail will be assigned at the completion of the remediation period.

DENS 503. Introduction to Behavioral Science in Dentistry. 1.5 Hour.

Semester course; 1.5 lecture hours. 1.5 credits. Enrollment is restricted to students in a School of Dentistry degree program. Course consists of online lectures, discussion board activities, assigned readings and interactive activities centering on understanding health disparities and access to care issues as they relate to patient-centered care among diverse populations. Graded as pass/fail.

DENS 508. Dental Materials I. 1 Hour.

Yearlong course; 1 lecture hour. 1 credit. This is the first in a series of four courses that provide the scientific foundations for understanding the factors guiding the use of biomaterials in dentistry. The main objectives of this course are to provide the student with knowledge of the general nature and composition of dental materials; the relationship of dental materials with the oral structures; the physical, mechanical, chemical, biological and aesthetic properties of dental materials; and indications for and proper use of dental materials. Special emphasis will be on those materials used in operative dentistry. Graded as CO in the fall semester with a letter grade and credit awarded in spring.

DENS 513. Foundations of Effective Interpersonal Skills During Patient Interactions I. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students in a School of Dentistry degree program. Course consists of online and face-to-face lectures, skill-building activities, student role-plays and a standardized patient assessment. Students will work both individually and in small groups for discussion and role-plays utilizing foundational motivational interviewing techniques. Graded as Pass/Fail.

DENS 515. Clinical Skills I. 1 Hour.

Semester course. 1 credit. Provides didactic information and practice opportunities to familiarize first-year dental students with patient management and selected clinical skills. The course runs concurrently with courses in periodontics and operative dentistry to provide the basis for initial entry into the dental clinic and patient care.

DENS 516. Clinical Skills II. 3.5 Hours.

Semester course; 2 lecture, 1 laboratory and 2 clinical hours (weekly). 3.5 credits. Prerequisite: DENS 515. Enrollment is restricted to admitted dental students. The second in a two-part series of courses designed to prepare dental students for entry into the clinical training environment. Students' learning experiences include didactic lectures, clinical practice and observation, and simple patient-based interactions and/or procedures performed while assisting more senior dental students.

DENS 522. Preclinical Restorative Lecture I. 4 Hours.

Yearlong course; 4 lecture hours (2 lecture credits each semester). 4 credits. This is the first in a three-course preclinical didactic series on restorative dentistry including operative dentistry and fixed prosthodontics. This two-semester didactic course is paired with a two-semester laboratory course. Information is presented regarding caries as a disease process, and students are presented with the knowledge and develop the skills necessary to treat the disease with noninvasive as well as invasive operative treatment techniques. Extensive didactic instruction and laboratory simulation experience is provided in tooth preparation and restoration. Experience is also provided concerning properties, chemistry and manipulation of the various direct dental restorative materials used to restore teeth to their correct anatomical and functional form. Graded as CO in the fall semester with a letter grade and credit awarded in spring.

DENS 523. Preclinical Restorative Lab I. 4.5 Hours.

Yearlong course; 7 laboratory hours. 4.5 credits. This is the first in a three course pre-clinical laboratory series on restorative dentistry including operative dentistry and fixed prosthodontics. This two-semester course consists of laboratory exercises, including conventional mannequin simulation sessions, and is paired with a two-semester lecture course. Information is presented regarding caries as a disease process, and students are presented with the knowledge and develop the skills necessary to treat the disease with noninvasive as well as invasive operative treatment techniques. Extensive didactic instruction and laboratory simulation experience is provided in tooth preparation and restoration. Experience is also provided concerning properties, chemistry and manipulation of the various direct dental restorative materials used to restore teeth to their correct anatomical and functional form. Graded as CO in the fall semester with a letter grade and credit awarded in spring.

DENS 524. Evidence-based Dentistry and Critical Thinking I. 1 Hour.

1 credit. The fundamentals of evidence-based dentistry will be taught. Students will gain the ability to identify, retrieve and critically appraise dental literature.

DENS 532. Preclinical Restorative Lecture II. 1.5 Hour.

Semester course; 1.5 lecture hours. 1.5 credits. This is the second in a three-course preclinical didactic series on restorative dentistry including operative dentistry and fixed prosthodontics. This one-semester didactic course is paired with a one-semester laboratory course. Information is presented regarding caries as a disease process, and students are presented with the knowledge and develop the skills necessary to treat the disease with noninvasive as well as invasive operative treatment techniques. Extensive didactic instruction and laboratory simulation experience is provided in tooth preparation and restoration. Experience is also provided concerning properties, chemistry and manipulation of the various direct dental restorative materials used to restore teeth to their correct anatomical and functional form.

DENS 533. Preclinical Restorative Lab II. 1.5 Hour.

Semester course; 4.5 laboratory hours. 1.5 credits. This is the second in a three-course preclinical laboratory series on restorative dentistry including operative dentistry and fixed prosthodontics. This one-semester course consists of laboratory exercises, including conventional mannequin simulation sessions, and is paired with a one-semester lecture course. Information is presented regarding caries as a disease process, and students are presented with the knowledge and develop the skills necessary to treat the disease with noninvasive as well as invasive operative treatment techniques. Extensive didactic instruction and laboratory simulation experience is provided in tooth preparation and restoration. Experience is also provided concerning properties, chemistry and manipulation of the various direct dental restorative materials used to restore teeth to their correct anatomical and functional form.

DENS 550. Update in Practice Administration. 1 Hour.

Semester course; 15 seminar hours. 1 credit. Lectures and seminar discussion on the business aspects of contemporary specialty dental practice, with emphasis on entry into practice, associateship contracts, financing arrangements, risk management and employee relations.

DENS 580. Biostatistics and Research Design in Dentistry. 2 Hours.

Semester course; 30 seminar hours. 2 credits. Must be taken for two consecutive semesters. Provides the advanced education student in dentistry an appreciation for the need for and uses of fundamental biostatistical methods in dental applications. Appropriate research designs for answering research questions of importance in dentistry will be examined. An array of biostatistical methods that are commonly used in the dental literature and by agencies such as the FDA to evaluate new dental products and methodologies are discussed.

DENS 591. Dental Special Topics I. 1-12 Hours.

Semester course; 1-12 lecture hours. 1-12 credits. May be repeated with different topics for a maximum of 24 credits. Explores specific topics in dentistry.

DENS 601. Remediation in Dentistry D2. 1-7 Hours.

Semester course; 1-7 lecture hours. 1-7 credits. Enrollment is restricted to current dental students as directed by the Academic Progress Committee. This course is not part of the core D.D.S. curriculum. Students who must remediate a course, for any reason, will be enrolled in this course during their remediation period and credit hours will be assigned consistent with the course being remediated. This remediation course is for remediation of D2 courses. A grade of pass/fail will be assigned at the completion of the remediation period.

DENS 603. Foundations of Effective Interpersonal Skills During Patient Interactions II. 2 Hours.

Yearlong course; 2 lecture hours. 2 credits. The two-semester course consists of online and face-to-face lectures, skill-building activities, student role-plays and a standardized patient assessment (spring). Students will work both individually and in small groups for discussion and role-plays of cases utilizing foundational motivational interviewing techniques. Students receive CO grading in the fall semester and a Pass/Fail grade upon completion.

DENS 604. Introduction to Oral Research. 0.5 Hours.

Semester course; .5 lecture hours. .5 credits. Enrollment is restricted to any dental student with a minimum GPA of 3.0 and in good academic standing. This course introduces students to oral research. Students will learn about different types of research and explore their personal research interests. Assignments will introduce students to experimental design and presenting research. Graded as pass/fail.

DENS 605. Writing an A.D. Williams Research Fellowship. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to dental students with a minimum GPA of 3.0 and in good academic standing. Students will be introduced to writing a fellowship proposal. Lectures and workshops will guide students through the process of applying for an A.D. Williams fellowship. Students will also begin their independent research. Graded as pass/fail.

DENS 606. Oral Research: Independent Study. 0.5-2 Hours.

Semester course; 1.5-6 research hours. .5-2 credits (3 research hours per credit). May be repeated for a maximum total of 16 credits. Enrollment is restricted to dental students with a minimum GPA of 3.0 and in good academic standing. Independent study and individual research experiences will be conducted under the guidance of a research mentor. Graded as pass/fail.

DENS 607. D2 Clinical Dentistry I. 1 Hour.

Semester course; 3 clinical hours. 1 credit. This course begins the transition of the second-year dental student to clinical patient care of their family of patients. Students will engage in weekly patient care through chairside assisting of their D3 or D4 vertical buddy. Graded as pass/fail.

DENS 608. Dental Materials II. 1 Hour.

Yearlong course; 1 lecture hour. 1 credit. The second in a series of four courses. These courses provide the scientific foundations for understanding the factors guiding the use of biomaterials in dentistry. The main objectives of this course are to provide the student with knowledge of the general nature and composition of dental materials; the relationship of dental materials with the oral structures; the physical, mechanical, chemical, biological and aesthetic properties of dental materials; and indications for and proper use of dental materials. Special emphasis will be on those materials used in prosthodontic dentistry. Graded as CO in the fall semester with a letter grade and credit awarded in spring.

DENS 610. Fundamentals of Oral and Maxillofacial Radiology. 2 Hours.

Semester course; 2 lecture hours. 2 credits. This course will introduce students to the principles, theory and techniques of diagnostic imaging.

DENS 611. Introduction to Professionalism, Ethics and Ethical Decision-making. 1 Hour.

Semester course. 1 credit. Provides a review of the foundation of ethical principles, concepts of professionalism, professional student behavior and responsibilities, ethical issues guiding dentistry, and the development of an ethical decision-making model.

DENS 617. D2 Clinical Dentistry II. 2 Hours.

Semester course; 6 clinical hours. 2 credits. This course continues the transition of the second-year dental student to clinical patient care of their family of patients. Students will engage in weekly patient care through chairside assisting of their D3 or D4 vertical buddy. Graded as pass/fail.

DENS 619. Evidence-based Dentistry and Critical Thinking II. 1 Hour.

1 credit. The fundamentals of evidence-based dentistry will be taught. Students will gain the ability to identify, retrieve and critically appraise dental literature.

DENS 621. Dental Occlusion. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Consists of lectures which expand on the basic concepts that were presented in the fundamentals of occlusion course. Focuses on the examination, diagnosis and treatment planning of various occlusal problems. The student will learn the skills needed to analyze the dental occlusion of patients and to plan successful occlusal therapy, including restorative procedures and fixed prosthodontics treatment.

DENS 622. Dental Occlusion Lab. 1.5 Hour.

Semester course; 4 laboratory hours. 1.5 credits. Consists of labs which expand on the basic concepts that were presented in the fundamentals of occlusion course. Focuses on the examination, diagnosis and treatment planning of various occlusal problems. The student will learn the skills needed to analyze the dental occlusion of patients and to plan successful occlusal therapy, including restorative procedures and fixed prosthodontics treatment. Graded as pass/fail.

DENS 627. D2 Clinical Dentistry III. 6.5 Hours.

Semester course; 9 clinic hours. 6.5 credits. This course serves as the start of the clinic-intensive portion of the D.D.S. program. Students will be assigned their own panel of patients for whom they will be responsible for management, diagnosis, treatment planning, clinical care and care coordination for the duration of dental school until graduation. Students will also rotate through specialty area clinics for the care of their own patients and other patients receiving care in the clinics. This is a multidisciplinary course incorporating clinics within each department in the School of Dentistry. Graded as pass/fail.

DENS 628. Introduction to Dental Public Health. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course will introduce dental students to issues related to the role of the dental professional at a local and state level, including dental public health, health equity, health literacy, oral health disparities, the role of publicly funded dental programs and the dental safety net.

DENS 630. Orthodontic-Periodontic-AEGD Conference. 0.5 Hours.

Semester course; 8 seminar hours. 1 credit. Must be taken every semester of the program. Discusses treatment planning and analysis of patients requiring combined orthodontic, periodontic and restorative care. Presents topics of interest to orthodontists, periodontists and general dentists. Graded S/U/F.

DENS 632. Preclinical Restorative Lecture III. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This is the third in a three-course preclinical didactic series on restorative dentistry including operative dentistry and fixed prosthodontics. This one-semester didactic course is paired with a one-semester laboratory course. Extensive didactic instruction and laboratory simulation experience is provided in tooth preparation and restoration. Experience is also provided concerning properties, chemistry and manipulation of the various direct dental restorative materials used to restore teeth to their correct anatomical and functional form.

DENS 633. Preclinical Restorative Lab III. 1 Hour.

Semester course; 3 laboratory hours. 1 credit. This is the third in a three-course preclinical laboratory series on restorative dentistry including operative dentistry and fixed prosthodontics. This one-semester course consists of laboratory exercises, including conventional mannequin simulation sessions, and is paired with a one semester-lecture course. Extensive didactic instruction and laboratory simulation experience is provided in tooth preparation and restoration. Experience is also provided concerning properties, chemistry and manipulation of the various direct dental restorative materials used to restore teeth to their correct anatomical and functional form.

DENS 642. Fundamentals of Treatment Planning. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Open only to second-year D.D.S. students. Designed to build upon the student's prior exposure to discipline-based treatment planning concepts. Students will develop an integrated, multidisciplinary approach to urgent and oral disease control phase patient treatment planning. The course will also cover the use of information technology applications to document treatment plans and strategies for effectively communicating treatment plans to patients. Graded P/F.

DENS 651. Preclinical General Practice Dentistry Lab. 5 Hours.

Semester course; 200 laboratory hours. 5 credits. Admission into VCU International Dentist Program required. Designed to prepare and transition a class of internationally trained dentists into the third year of dental school at VCU. All aspects of preclinical dentistry will be covered in this basic preparatory laboratory course. Graded P/F.

DENS 652. Preclinical General Practice Dentistry Lecture. 9 Hours. Semester course; 144 lecture hours. 9 credits. Admission into VCU International Dentist Program required. Designed to prepare and transition a class of internationally trained dentists into the third year of dental school at VCU. All aspects of preclinical dentistry will be covered in this basic preparatory lecture course. Graded P/F.

DENS 653. Clinical General Practice Dentistry Lecture. 6 Hours. Semester course; 96 lecture hours. 6 credits. Admission into VCU International Dentist Program required. Comprises clinical experiences prior to the third year of professional study. This course is designed to enhance the student's clinical experience in patient management, treatment planning, utilization of dental auxiliaries, consultation with other health care professionals and referral to appropriate dental specialists. Specialty subjects and techniques will be combined to form a general dentistry model for patient care. Guidance from faculty will encourage the student to synthesize and integrate materials, methods and techniques from previous courses into a logical and systematic approach to the delivery of oral health care. Small-group seminars will be provided to enhance the student's transition to dental health care at VCU. Graded P/F.

DENS 654. Clinical General Practice Dentistry Lab. 5 Hours. Semester course; 200 laboratory hours. 5 credits. Enrollment requires admission into the VCU International Dentist Program. Prerequisite: DENS 652. Comprises clinical experiences prior to the third year of professional study. This course is designed to enhance the student's clinical experience in patient management, treatment planning, utilization of dental auxiliaries, consultation with other health care professionals and referral to appropriate dental specialists. Specialty subjects and techniques will be combined to form a general dentistry model for patient care. Guidance from faculty will encourage the student to synthesize and integrate materials, methods and techniques from previous courses into a logical and systematic approach to the delivery of oral health care. Small-group seminars will be provided to enhance the student's transition to dental health care at VCU. Graded pass/fail.

DENS 655. Preclinical General Practice Dentistry for Internationally Trained Dentists. 6 Hours. Yearlong course; 6 lecture hours. 6 credits. Designed to support the integration of a class of internationally trained dentists into the second year at the VCU School of Dentistry, this course addresses special topics of concern for this cohort. The course will cover core didactic material and laboratory activities and will strengthen areas that have been previously identified as opportunities for growth in this student population. Students receive CO grading in the fall and a pass or fail grade and earned credit in the spring.

DENS 660. Interdisciplinary Care Conference. 0.5 Hours. Continuing course; 7 hours. 1 credit. Must be taken every year of the program. Provides a forum for formal presentation and group discussion of the diagnosis, treatment planning, delivery and prognosis of interdisciplinary dental care. Designed for continuing enrollment for two academic semesters; graded CO in the fall and a final grade of Pass or Fail in the spring.

DENS 662. Advanced Restorative and Digital Dentistry Lecture. 1 Hour. Semester course; 1 lecture hour. 1 credit. Extensive didactic instruction and laboratory simulation experience is provided in different restorative techniques with focused education on digital dentistry. Experience is also provided concerning CAD/CAM techniques, CAD/CAM materials, esthetic dentistry and intraoral photography. This course is constructed in a way that simulates dental CE courses and is paired with a laboratory course.

DENS 663. Advanced Restorative and Digital Dentistry Lab. 1 Hour. Semester course; 3 laboratory hours. 1 credit. This course consists of laboratory exercises using conventional mannequin simulation, modern dental materials/equipment and digital dentistry technologies. Extensive laboratory simulation experience is provided in different restorative techniques with focus on digital dentistry. Experience is also provided concerning CAD/CAM techniques, CAD/CAM materials, esthetic dentistry and intraoral photography. The course is constructed in a way that simulates dental CE courses and is paired with a didactic course. Graded as pass/fail.

DENS 680. Graduate Dental Clinic. 4 Hours. Semester course; 12 clinic hours. 4 credits. May be repeated for credit. Enrollment is restricted to students enrolled in the M.S.D. program. This course provides supervised experiences in advanced clinical skills. Students will enhance their skills in diagnosis and treatment planning, patient communication, professional and ethical care, and collaboration with other health care providers. Sections of the course will address specialty-specific treatments. Graded as pass/fail.

DENS 691. Dental Special Topics II. 1-12 Hours. Semester course; 1-12 lecture hours. 1-12 credits. May be repeated with different topics for a maximum of 24 credits. Explores specific topics in dentistry.

DENS 699. Thesis Guidance. 1-2 Hours. Semester course; 18-36 seminar hours. 1-2 credits. Must be taken every semester of the program. The graduate student selects a research project topic, conducts the necessary background literature review, develops a protocol, obtains the necessary materials, instruments and human/animal use approvals as necessary, collects and analyzes the data, presents the findings in the form of a master's thesis, and prepares a manuscript for publication.

DENS 700. Basic Sciences and Graduate Dentistry. 3 Hours. First year; spring course; 45 hours. 3 credits. Advanced level survey of topic areas related to the principles and practices of dentistry including: oral pathology, biochemistry and physiology, infection and immunity, pharmacology, biomaterials and genetics.

DENS 701. Remediation in Dentistry. 1-7 Hours. Semester course; variable contact hours. Variable credits. This course is not part of the core D.D.S. curriculum. Students who must remediate a course, for any reason, will be enrolled in this course during their remediation period and credit hours will be assigned consistent with the course being remediated. A grade of pass/fail will be assigned at the completion of the remediation period.

DENS 702. Dental Clinics. 1-12 Hours. Semester course; variable hours, clinical contact. 1-12 credits. May be repeated for credits. Restricted to students enrolled in D.D.S. program. This course is designed for students who need to remediate clinical experiences, make up clinical experiences or are off cycle with clinical work for any other reason. Credit hours, learning objectives and exact expectations/responsibilities will be identified in an individualized education plan for each student as determined by the school's deans for clinical education and academic affairs. Graded pass/fail.

DENS 704. Academic Dental Career Exploration Elective. 1 Hour.

Semester course; 3 laboratory hours. 1 credit. Exact contact hours will vary by student and their self-designed learning plan. Enrollment restricted to students in the D.D.S. program with permission of the course director. This is an elective course for D2, D3 or D4 dental students who are interested in learning more about academic dental teaching and/or research careers. The course matches each student with a faculty mentor who provides insight into the day-to-day life of an educator or researcher. This elective is modeled on the ADEA Academic Dental Careers Fellowship Program. Graded as Pass/Fail.

DENS 705. CAD/CAM Senior Selective. 0.5 Hours.

Semester course; 0.5 clinic hours. 0.5 credits. Clinic time may be weekly, in block rotation or variable schedule. Students must enroll in this course for two consecutive semesters. This is a selective course with focused education on digital dentistry. Experience is also provided concerning CAD/CAM techniques, CAD/CAM materials and intra-oral photography. This course is constructed in a way that simulates dental CE courses. Graded as Pass/Fail.

DENS 706. Laser Senior Selective. 0.5 Hours.

Semester course; 0.5 lecture hour. 0.5 credits. Students must enroll in this course for two consecutive semesters. This elective course is offered to dental students who demonstrate high academic achievement and are interested in expanding their practical knowledge and experience in laser applications in dentistry. The goal of the course is to provide dental students opportunities for the integration and application of theoretical, evidence-based and clinical knowledge to the individual's practice of laser dentistry in a controlled, student-centered environment. This course is aimed to provide additional discipline-specific treatment experiences and expand upon previously learned ethical and patient management skills. The course will enhance the general dentist's knowledge regarding applications of various lasers for dental procedures and to provide hands-on simulation experience in applying techniques and procedures suitable for judicious use in general dental practice. The course consists of didactic components, small-group seminars, model-based simulations and clinical assisting. Upon completion of this course, students will have a scientific and clinical basis for understanding various dental lasers and their applications for dental and surgical procedures. Graded as Pass/Fail.

DENS 707. Dental Sleep Medicine Senior Selective. 0.5 Hours.

Semester course; .25 lecture and 0.5 clinical hours. 0.5 credit. Students must enroll in this course for two consecutive semesters. The course provides exposure to the discipline of dental sleep medicine and will introduce students to sleep and how it relates to dental sleep medicine. Students will also be introduced to the treatment of obstructive sleep apnea, including hands-on fabrication of appliances and delivery. This select course will also present side effects to the students, as well as how to manage them and follow-up care for oral appliance therapy for OSA. The goal of this course is to have the students obtain knowledge in the scope of dental sleep medicine and to encourage further training if they want to implement this in future practice. Graded as Pass/Fail.

DENS 708. Dental Materials III. 0.5 Hours.

Yearlong course; 0.5 lecture hours. 0.5 credits. The third in a series of four courses. These courses provide the scientific foundations for understanding the factors guiding the use of biomaterials in dentistry. The main objectives of this course are to provide the student with knowledge of 1) the general nature and composition of dental materials; the relationship of dental materials with the oral structures; the physical, mechanical, chemical, biological and aesthetic properties of dental materials; and indications for and proper use of dental materials. Special emphasis will be on applying dental materials knowledge to clinical practice. Student-led seminars will be adopted, wherein students will be divided into groups and a specific topic will be assigned to each group. These kinds of seminars will improve the students in terms of critical-thinking, working in teams and presentation skills. Graded as CO in the fall semester with a letter grade and credit awarded in spring.

DENS 710. Selective in Advanced Interpersonal Skills. 1 Hour.

Semester course; 0.5 lecture and 0.5 clinic hour. 1 credit. Enrollment is subject to selection criteria and permission of the course director. This is a one-semester elective course which applies the philosophy and skills of prior program course work in an authentic patient setting. The course consists of in-clinic observation and classroom sessions. Students will receive feedback on patient interactions and opportunities to build off of specific patient interactions or behaviors over the course of the semester. Students will work both individually and in small groups for discussion and role-plays of cases utilizing foundational motivational interviewing techniques. Graded as Pass/Fail.

DENS 718. Dental Materials IV. 0.5 Hours.

Yearlong course; 0.5 lecture hours. 0.5 credits. The fourth in a series of four courses. These courses provide the scientific foundations for understanding the factors guiding the use of biomaterials in dentistry. The main objectives of this course are to provide the student with knowledge of the general nature and composition of dental materials; the relationship of dental materials with the oral structures; the physical, mechanical, chemical, biological and aesthetic properties of dental materials; and indications for and proper use of dental materials. Special emphasis will be on applying dental materials knowledge to clinical practice and helping students to make independent decisions on materials choice in clinical dentistry, thus preparing them for life after dental school. Graded as CO in the fall semester with a letter grade and credit awarded in spring.

DENS 727. D3 Clinical Dentistry. 8 Hours.

Semester course; 24 clinic hours. 8 credits. Clinic time may be weekly, in block rotation or variable schedule. This course serves as a continuation of the clinic-intensive portion of the D.D.S. degree program. Students will continue to treat their own panel of patients for whom they are responsible for management, diagnosis, treatment planning, clinical care and care coordination for the duration of dental school until graduation. Students will also rotate through clinical specialty area clinics for the care of their own patients and other patients receiving care in the specialty clinics. Off-site clinical experiences also begin during this semester. This is a multidisciplinary course incorporating clinics within each department in the School of Dentistry as well as external clinic rotation sites. Graded as pass/fail.

DENS 730. Dental Practice Management III. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course is part of a series. The series will prepare the dental graduate for making decisions about the type of practice to pursue, planning to establish or purchase a practice and, ultimately, managing it once in operation. Topics covered are those appropriate to the third-year dental student and may include, but are not limited to, marketing a practice, selecting the right location, ergonomics and managing the dental office. Graded as Pass/Fail.

DENS 735. Patient Management and Professional Conduct I. 5 Hours.

Yearlong course; 5 clinical hours. 5 credits. Designed for third-year dental students to understand and practice the concepts of ethical conduct, patient management, risk management and professional responsibility. This course is based upon the application of the VCU School of Dentistry Code of Professional Conduct, the ADA Principles of Ethics and Code of Professional Conduct, and the School of Dentistry's Patient Bill of Rights in the clinical setting and is designed to help the dental student strive to do what is right for their patients, now and into the future. Course graded as CO with no credit for fall semester; pass/fail grade and credit assigned for spring semester.

DENS 740. Dental Practice Management IV. 1 Hour.

Semester course; 1 credit. The fourth in a series of four courses required over the duration of the four-year DDS curriculum. The series will prepare the dental graduate for making decisions about the type of practice to pursue, planning to establish or purchase a practice and, ultimately, managing it once in operation. Topics covered are those appropriate to the senior dental student and may include, but are not limited to, writing a business plan and understanding the current economy and its impact on dental practice. Graded as P/F.

DENS 745. Patient Management and Professional Conduct II. 5 Hours.

Yearlong course; 5 clinical hours. 5 credits. Designed for fourth-year dental students to understand and practice the concepts of ethical conduct, patient management, risk management and professional responsibility. This course is based upon the application of the VCU School of Dentistry Code of Professional Conduct, the ADA Principles of Ethics and Code of Professional Conduct, and the School of Dentistry's Patient Bill of Rights in the clinical setting and is designed to help the dental student strive to do what is right for their patients, now and into the future. Course graded as CO with no credit for fall semester; pass/fail grade and credit assigned for spring semester.

DENS 752. Clinical General Practice Dentistry. 13 Hours.

Yearlong course; 19.5 clinic hours. 13 credits. Clinic time may be weekly, in block rotation or variable schedule. Enrollment is restricted to fourth-year dental students. Course encompasses all clinical patient care instruction within the School of Dentistry group practices. This course is designed to enhance the student's clinical experience in patient management, treatment planning, utilization of dental auxiliaries, consultation with other health care professionals and referral to appropriate dental specialists. Students receive CO grading in the fall and a letter grade and earned credit in the spring.

DENS 753. D4 Treatment Planning Seminar. 1 Hour.

Yearlong course; 1 lecture hour. 1 credit. This course is the capstone treatment planning experience within the D.D.S. curriculum. Students will independently develop and apply a five-phase treatment planning approach to a clinical patient while providing sound justification for diagnoses and treatment planning decisions. Active patients of record will serve as clinical case studies. This course renders a CO in the fall semester and a letter grade in spring.

DENS 762. Clinical Service-learning. 4 Hours.

Yearlong course; 6 clinic hours. 4 credits. Clinic time may be weekly, in block rotation or variable schedule. A course-based, credit-bearing educational experience in which students participate in an organized service activity that meets community-identified needs. During the course, students are assigned rotations in clinical practice settings in underserved areas. In these settings, students are exposed to patients of varied ethnic, socioeconomic and demographic backgrounds, as well as special patient populations not typically encountered in the School of Dentistry clinics. Students have the opportunity to make oral health care more accessible to marginalized groups while continuing clinical education. Throughout this unique learning experience students are exposed to the benefits of potential practice in public health dentistry. Students will reflect on the service activity to increase understanding and application of course content and to enhance a sense of civic responsibility. Course graded as CO with no credit for fall semester; letter grade and credit assigned for spring semester.

DENS 763. Clinical Externship. 0.5 Hours.

Semester course; 1.5 clinic hours. 0.5 credits. May be repeated, but this is an elective course that does not count toward degree requirements. Externships are short-term professional learning experiences. This course is designed to provide externships for motivated students who want to gain professional experience beyond general dental education and determine interest in pursuing a specialty. Externships may include general dentistry or dental specialties in educational, governmental or other clinical settings. Graded as Pass/Fail.

DENS 770. Community Dental Health/Dental Public Health. 1 Hour.

Semester course; 1 lecture hour (delivered online). 1 credit. This course uses examples and issues in dentistry and dental public health as a strategy for understanding health policy, the market for dental care and public health program development at the local, state and national levels. Graded as Pass/Fail.

DENS 780. Functional Occlusion: From TMJ to Smile Design Selective. 1.5 Hour.

Yearlong course; 1 lecture and 1 laboratory hour. 1.5 credits. Enrollment restricted to selected D4 dental students and AEGD residents. The course consists of lectures and clinic/laboratory components, which expand on the basic concepts that were presented in core D.D.S. curriculum. Students receive CO grading in the fall and Pass/Fail grade and earned credit in the spring.

DENS 781. Predictable Restorative Outcomes With Complex Wear Cases Selective. 1 Hour.

Semester course; 0.75 lecture and 0.25 laboratory hours. 1 credit. Enrollment is restricted to fourth-year D.D.S. students. The course seeks to prepare motivated dental students with advanced skills in diagnosis, treatment planning and treatment of occlusal disease. The goal of the course is to expand on their pre-doctoral occlusal knowledge. Graded as Pass/Fail.

DENS 790. Selective: Applications of 3-D Printing in Dentistry. 1 Hour.

Yearlong course; 1 lecture and .5 clinic hours. 1 credit. Enrollment is restricted to students admitted to D.D.S. program and selected by course faculty. The course has three components: 1) an online self-learning module on basic principles of 3-D printing and its applications in biological science and health science, as well as principle and workflow for implant-guided surgery, 2) a workshop on implant treatment planning using commercially available software and 3-D printing of models and surgical guide and 3) a patient-based observation experience in implant-guided surgery. The course is designed for students to use the most up-to-date digital technology to diagnose and treat real clinical cases. Students receive CO grading in the fall and pass/fail grade and credit are awarded in spring.

DENS 791. Dental Special Topics III. 1-12 Hours.

Semester course; 1-12 lecture hours. 1-12 credits. May be repeated with different topics for a maximum of 24 credits. Explores specific topics in dentistry.

Endodontics (ENDO)**ENDO 522. Introduction: Specialty of Endodontics. 2 Hours.**

Semester course; 96 laboratory hours. 2 credits. Restricted to first-year students. Utilizes laboratory exercises to review basic concepts and introduce the more complex technical procedures required to practice the clinical specialty of endodontics.

ENDO 530. Advanced Oral Pathology. 1 Hour.

Semester course; 13 seminar hours. 1 credit. Provides through a series of seminars, an in-depth knowledge of those specific areas of oral pathology that apply to endodontics.

ENDO 532. Management of Medical Emergencies in the Dental Office. 1 Hour.

Semester course; 20 seminar hours. 1 credit. Provides through a series of seminars, an in-depth level of knowledge in the management of medical emergencies in the dental office.

ENDO 560. Endodontic Therapy Lectures. 3.5 Hours.

Semester course; 58 lecture hours. 3.5 credits. Restricted to first-year students. Presents a series of lectures on clinical endodontic topics in order to familiarize the students with clinical endodontic procedures either in conjunction with or prior to the "Endodontic Topic Literature Reviews" on these specific clinical topics.

ENDO 622. Principles of Endodontics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Covers the basic principles of endodontics in preparation for clinical endodontics.

ENDO 623. Principles of Endodontics Lab. 1.5 Hour.

Semester course; 4 laboratory hours. 1.5 credits. This lab course teaches the basic technical skills of endodontics in preparation for clinical endodontics.

ENDO 650. Endodontic Topic Literature Review. 3.5 Hours.

Semester course; 58 seminar hours. 3.5 credits. May be repeated for credit. Must be taken every semester of the program. Reviews topic literature pertaining to the scientific basis for endodontic procedures and the materials and techniques utilized in the clinical practice of endodontics. Discusses content of the reviewed literature and critically evaluates by means of abstracts and study questions.

ENDO 652. Endodontic Clinical Seminars. 1.5 Hour.

Semester course; 28 seminar hours. 1.5 credits. May be repeated for credit. Must be taken every semester of the program. Requires students to present a seminar once each month in which difficult diagnostic cases, patient management problems and complex treatment cases are critiqued and treatment options discussed.

ENDO 654. Endodontic Management of the Medically Compromised Patient. 1 Hour.

Semester course; 14 seminar hours. 1 credit. Must be taken for two consecutive semesters. Provides students, through a seminar series, with an in-depth level of knowledge in the endodontic management of the medically compromised patient.

ENDO 656. Endodontic Current Literature Review. 1 Hour.

Semester course; 18 seminar hours. 1 credit. Must be taken every semester of the program. Provides a review of current journal literature that pertains to the scientific basis for endodontic procedures, materials and techniques currently being used in the clinical practice of endodontics. Discusses and critically evaluates the content of the reviewed literature. Requires written abstracts of all reviewed articles.

ENDO 680. Clinical Endodontics. 1-12 Hours.

Semester course; 3-36 clinic hours. 1-12 credits. May be repeated for credit. Prerequisite: ENDO 522. Enrollment is restricted to students in the M.S.D. program. This course provides clinical training in diagnosis, treatment and outcome assessment for all aspects of endodontics with an emphasis on non-surgical, retreatment and surgical endodontics. Must be taken both fall and spring of the first and second years of the program for a total of four credits. May be taken without credit in additional semesters as needed to complete clinical training.

ENDO 700. Senior Selective in Advanced Clinical Endodontics. 0.5 Hours.

Semester course; 0.5 clinic hours. 0.5 credits. Clinic time may be weekly, in block rotation or variable schedule. Students must enroll in this course for two consecutive semesters. The course is designed to enhance the student's clinical experience in the field of endodontics, to include patient management, treatment planning, endodontic treatment modalities, consultation with other health care professionals and referral to appropriate dental specialists. Emphasis is placed on the management of common and advanced clinical endodontic problems that may be encountered in the general practice of dentistry. Guidance from faculty will encourage the student to synthesize and integrate techniques taught in previous endodontic courses and labs into a logical and systematic approach to the delivery of quality endodontic care to the patients. Graded as pass/fail.

ENDO 731. Endodontic Therapy. 1 Hour.

Semester course; 1 lecture contact hour. 1 credit. An application course designed for the student to gain experience and demonstrate proficiency in the application of clinical endodontic knowledge to the diagnosis and management of complex clinical endodontic problems. Emphasis is placed on differential diagnosis and management of clinical endodontic problems. This course builds on the principles of diagnosis and treatment of disease of the pulp and periradicular tissues and injuries of the dental pulp. This course continues to place emphasis on the prevention of disease and maintenance of the normal pulp-dentin complex.

ENDO 739. Clinical Endodontics III. 1.5 Hour.

Yearlong clinical course. 2 clinic hours. 1.5 credits. Designed to develop clinical skills and provide experience in the diagnosis, treatment planning, treatment, prognosis, follow-up care and clinical patient management in cases involving the pulp and periradicular tissues. Emphasis is placed on the management of common clinical problems that may be encountered in the general practice of dentistry. This course emphasizes and elaborates on the rationale and treatment techniques presented in the D-2 didactic and laboratory course. Students receive CO grading in the fall and a letter grade and earned credit in the spring.

ENDO 749. Clinical Endodontics IV. 1.5 Hour.

Yearlong course; 2 clinic hours. 1.5 credits. Clinic time may be weekly, in block rotation or variable schedule. This course is designed to enhance the student's clinical experience in the field of endodontics, to include patient management, treatment planning, endodontic treatment modalities, consultation with other health care professionals and referral to appropriate dental specialists. Emphasis is placed on the management of common clinical endodontic problems that may be encountered in the general practice of dentistry. The course will run the fall and spring semester of the dental student's fourth year. Guidance from faculty will encourage the student to synthesize and integrate techniques taught in previous endodontic courses and labs into a logical and systematic approach to the delivery of quality endodontic care to the patients. Students receive CO grading in the fall and a letter grade and earned credit in the spring.

Oral and Craniofacial Molecular Biology (OCMB)**OCMB 600. Oral Biology Clinical/Laboratory Rotations. 2 Hours.**

Semester course; 6 laboratory hours. 2 credits. Enrollment is restricted to graduate students enrolled in the in oral health research program. Students will participate in clinical/laboratory rotations. Students will work with mentors and gain practical experience in dentistry and dental research. Graded S/U/F.

OCMB 701. Oral Microbiology and Disease. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students in the oral health research/biology graduate programs or by permission of the instructor. A comprehensive introduction to the oral microbiome including tissue and bone development, oral microbial systems, and microbial-induced oral diseases and treatments.

OCMB 702. Infection, Immunology and Oral Cancer. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students in oral health/biology research graduate programs or by permission of the instructor. This course is designed for students entering the oral biology graduate program to gain a basic understanding of systemic diseases and immune responses caused by oral microbes with a focus on the causes and treatments of head and neck cancer.

OCMB 703. Research Topics in Oral Biology. 1 Hour.

Semester course; 1 seminar hour. 1 credit. Restricted to students enrolled in the oral health research graduate program or by permission of instructor. This course will provide an in-depth discussion of current research in head and neck diseases. Students will be expected to critically evaluate relevant literature, discuss approaches to solving research topics and begin to identify possible areas of research for their dissertation. Graded as Pass/Fail.

OCMB 704. Oral Biology Seminar Series. 1 Hour.

Semester course; 1 seminar hour. 1 credit. This course will consist of a series of seminars by invited speakers addressing research topics in selected areas of oral health research and a series of student-led journal clubs. Graded P/F.

OCMB 705. Oral Biology Directed Research. 1-15 Hours.

Semester course; 1-15 laboratory research hours. 1-15 credits. Restricted to students enrolled in the oral health research graduate program or by permission of the instructor. This course will provide practical laboratory experience in participating laboratories. Graded Satisfactory/Unsatisfactory/Fail.

OCMB 706. Proposal Preparation. 1 Hour.

Semester course; tutorials and lectures. 1 credit. Restricted to students enrolled in the oral biology graduate program or by permission of the instructor. This course will provide students with the opportunity to draft an NIH application. Graded P/F.

OCMB 707. Research Skills and Career Development. 1 Hour.

Semester course; tutorials and workshops. 1 credit. Restricted to students enrolled in the oral health research graduate program or by permission of the instructor. This course will provide students with the opportunity to develop skills required to conduct and communicate their research, including assessing literature and managing databases, poster and oral presentations, finding research funding, preparing for writing the thesis, and exploring career opportunities outside academia. Students receive CO grading throughout enrollment with a pass/fail grade and credit earned during the final semester.

OCMB 710. Post-candidacy Doctoral Research. 9 Hours.

Semester course; 9 research hours. 9 credits. May be repeated for credit. Enrollment is restricted to students who have been admitted to doctoral candidacy in a Ph.D. program in the School of Dentistry. Students will participate in supervised discipline-specific research related to their dissertation topic. Students must have approval from their current degree program director to register. This course can be approved as a substitution for any post-candidacy degree requirement. Graded as Satisfactory/Unsatisfactory.

OCMB 791. Special Topics in Oral Biology Research. 1-9 Hours.

Semester course; 1-9 lecture hours. 1-9 credits. May be repeated for credit with different topics. Lectures in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of the research training. Graded as Pass/Fail.

Orthodontics (ORTH)**ORTH 532. Biomechanics: Theoretical Basis for Tooth Movement. 1 Hour.**

Semester course; 15 lecture/seminar hours. 1 credit. Introduces physical science of mechanics and engineering statics as applied to orthodontic force systems. Emphasizes equilibrium and the biological manifestation of force systems applied to the dentition and craniofacial skeleton.

ORTH 620. Orthodontic Clinic for Non-orthodontic Graduate Students. 1 Hour.

Semester course; 30 clinical sessions. 1 credit. Must be taken every semester of the program. Allows residents to diagnose and treat limited orthodontic problems with special emphasis on the primary and mixed dentitions. Includes, but is not limited to, anterior and posterior crossbites, space and tooth loss, transient or definitive crowding and tooth irregularities, oral habits, ectopic and other tooth eruption problems.

ORTH 623. Orthodontics Lecture. 2 Hours.

Semester course; 2 lecture contact hours. 2 credits. An introduction to orthodontics meant to provide second-year dental students with a basic understanding of the diagnosis and treatment of orthodontic problems. The emphasis will be on understanding basic, universally applicable orthodontic concepts rather than on learning specific details relating to particular treatment mechanisms or appliances. This is consistent with current trends in the specialty, which recognize that orthodontic solutions are often attainable by many routes, with a common goal of maximizing the functional, esthetic and stable end result. There will be an overview of growth and development, emphasizing how favorable or unfavorable growth may influence orthodontic diagnosis and treatment. A detailed description of the development of occlusion will also be presented with an emphasis on recognizing and diagnosing abnormalities related to tooth eruption and craniofacial growth.

ORTH 650. Literature Review. 2 Hours.

Semester course; 30 seminar hours. 2 credits. Must be taken every semester of the program. Reviews classical articles in areas of special orthodontic interest. Establishes the state-of-the-art and existing information base. Gives special attention to research methodology and conclusions reached.

ORTH 652. Growth and Development. 2 Hours.

Semester course; 30 lecture/seminar hours. 2 credits. Must be taken every semester of the program. Discusses the increases in size and complexity that occur in the craniofacial region including variations in proportionality and related variations in facial form and dental occlusion. Provides special emphasis on compensations in skeletal and soft tissue structures. Examines the basis for prediction of change.

ORTH 654. Orthodontic Diagnosis and Treatment Planning. 2 Hours.

Semester course; 30 seminar hours. 2 credits. Must be taken every semester of the program. Considers and discusses available and theoretical options for clinical management of variations in facial form and dental occlusion.

ORTH 656. Current Literature. 2 Hours.

Semester course; 30 seminar hours. 2 credits. Must be taken every semester of the program. Presents in a journal-club-format evaluation of current information in orthodontics and related disciplines. Includes special emphasis on research methodology and the contributions of current research to advances in orthodontics.

ORTH 658. Analysis of Orthodontic Treatment. 1.5 Hour.

Semester course; 22.5 seminar hours. 1.5 credits. Must be taken every semester of the program. Analyzes cephalometric and other objective measures of the outcomes of orthodontic therapy. Reviews treatment objectives with respect to actual changes effected in patients. Delineates changes resulting from therapy from normal variations in craniofacial development.

ORTH 660. Orthognathic Conference. 1 Hour.

Semester course; 15 seminar hours. 1 credit. Must be taken every semester of the program. Presents patients requiring coordinated orthodontic and oral surgery care. Emphasizes long- and short-term biologic stability of alterations in the structure and function of the craniofacial skeleton with increased emphasis on facial form and dental occlusion.

ORTH 662. Craniofacial Anomalies. 1 Hour.

Semester course; 15 lecture/seminar hours. 1 credit. Must be taken every semester of the program. Discusses the etiology and embryologic basis of congenital and acquired deformities in the craniofacial structures. Emphasizes syndromes with craniofacial manifestations and the diagnosis and treatment planning for patients with facial clefts.

ORTH 680. Orthodontic Clinic. 1-12 Hours.

Semester course; 1-12 clinic hours (three hours per credit). 1-12 credits. Enrollment is restricted to students enrolled in the M.S.D. program. Students will learn the clinical management of orthodontic patients. Involves supervised experiences in treatment of a complete spectrum of normally occurring orthodontic problems in an environment simulating private practice. Must be taken both fall and spring of the first and second years of the program for a total of 10 credits. May be taken without credit in additional semesters as needed to complete clinical training. Graded as pass/fail.

ORTH 700. Senior Selective in Orthodontics. 2 Hours.

Semester course; 1 seminar and 1 clinic hour. 2 credits. Prerequisites: ORTH 623, ORTH 733, and ORTH 739. Enrollment requires permission of the course director. Students must enroll in this course for two consecutive semesters. A clinical and didactic course designed for students who wish to gain advanced knowledge of orthodontics in an environment simulating a practice setting. The course will include participation in seminars, clinical activities and hospital rotations for craniofacial patients. The course will provide an excellent preparation for students entering the private practice of dentistry or students seeking graduate education in the field of orthodontics. A maximum of four students will be chosen to participate in this selective each year. Graded as pass/fail.

ORTH 733. Orthodontic Therapy. 1 Hour.

Semester course; 1 lecture contact hour. 1 credit. Consists of didactic lectures, a continuation of ORTH 623.

ORTH 739. Clinical Orthodontics III. 1 Hour.

Yearlong course; 2.5 hour clinic sessions. 1 credit. The purpose of this clinical course is to give the student practical, hands-on, orthodontic diagnosis and treatment experience to supplement the didactic material learned in preclinical orthodontic courses. The student will learn how to diagnose orthodontic problems so that normal developmental processes, minor occlusal discrepancies with simple solutions and more complex problems requiring referral to a specialist may be differentiated. Diagnosis and treatment of cases requiring limited orthodontic therapy will be the focus of the course during the junior year when students will rotate through the orthodontic clinic in eight-week block rotations. Students receive CO grading in the fall and pass/fail grade and credit are awarded in spring.

Pediatric Dentistry (PEDD)**PEDD 511. General Anesthesia Rotation. 3 Hours.**

Semester course; 40 clinical sessions. 3 credits. Teaches general anesthesia with special emphasis in pediatrics. Allows students to become knowledgeable in pre-operative evaluation, risk assessment, assessing the effects of pharmacologic agents, venipuncture techniques, airway management, general anesthetic induction and intubation, administration of anesthetic agents, patient monitoring, prevention and management of anesthetic emergencies, recovery room management, postoperative appraisal and follow-up.

PEDD 512. Growth and Development. 1 Hour.

Semester course; 16 lecture/seminar hours. 1 credit. Lecture format provides foundational knowledge on the growth and development of the head and neck to include oral embryology and development of the dentition.

PEDD 514. Introduction to Pediatric Dentistry. 2 Hours.

Semester course; 30 lecture hours. 2 credits. Introduces material in pediatric dentistry. Involves didactic, clinical and laboratory portions.

PEDD 572. Pediatric Dental Emergency Service. 2.5 Hours.

Semester course; 30 clinical sessions. 2.5 credits. Must be taken for two consecutive semesters. Graduate students are scheduled for emergency services on a weekly basis. Offers experience in the assessment and management of orofacial trauma, dental pain and infections.

PEDD 612. Seminar Series: Pediatric Dentistry and Medicine. 2 Hours.

Semester course; 30 lecture/seminar hours. 2 credits. Must be taken every semester of the program. Provides an arena for students to present seminars in either a clinical area or medical conditions of interest to pediatric dentists. Gives students practical experience in giving formal presentations and provides him/her with information related to clinical subject area(s) with medical conditions about which pediatric dentists should be knowledgeable.

PEDD 620. Pediatric Medicine Rotation. 1.5 Hour.

Semester course; 40 clinical sessions. 1.5 credits. Requires students to obtain and evaluate medical histories, parental interviews, system-oriented physical examinations, clinical assessments of healthy and ill patients, selection of laboratory tests and evaluation of data, evaluation of physical, motor and sensory development, genetic implications of childhood diseases, the use of drug therapy in the management of diseases and parental management through discussions and explanations.

PEDD 622. Introduction to Pediatric Dentistry. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Designed to develop the student's knowledge of diagnosis, treatment planning and basic skills for management of the pediatric dental patient. The course is the first of two didactic courses given to the dental student for pediatric dentistry.

PEDD 640. Clinical Teaching. 2 Hours.

Semester course; 25 clinical sessions. 2 credits. May be repeated for credit. Must be taken every semester of the program. Lectures and clinical instruction involving contact with third and fourth-year dental students. Provides teaching experience in diagnosis and treatment planning, restorative preparations and management of children's behavior.

PEDD 650. Literature Review. 2 Hours.

Semester course; 30 lecture/seminar hours. 2 credits. Must be taken every semester of the program. Reviews literature related to all aspects of the pediatric patient. Emphasizes the ability students to discuss the content of the articles and to critically evaluate it. Stresses the integration of new material with previously discussed literature and collateral material. Uses the reading list from the American Board of Pediatric Dentistry.

PEDD 654. Treatment Planning Seminar. 1 Hour.

Semester course; 16 lecture/seminar hours. 1 credit. May be repeated for a total of four credits. Must be taken every semester of the program. Provides diagnosis and treatment planning of the child, adolescent and special patient. Follows up on records on completed cases, which also are presented and evaluated. Discusses the techniques employed and the justification of the treatment.

PEDD 656. Current Literature Review. 1 Hour.

Semester course; 16 lecture/seminar hours. 1 credit. May be repeated for credit. Discusses articles from recent publications relating to all aspects of pediatric dentistry. Covers and critically reviews the Policies and Guidelines of the American Academy of Pediatric Dentistry.

PEDD 680. Pediatric Dental Clinic. 1-4 Hours.

Semester course; 120 clinical sessions. Variable for 1-4 credits. Must be taking both fall and spring of the first and second years of the program for 4 credits each semester. May be taken in additional semesters as needed to complete clinical training; credit will vary based on circumstances. Provides for the clinical management of pediatric dental patients. Provides experiences in the treatment of infants, preschool children, adolescent and special patients. Stresses pharmacological and non-pharmacological techniques and behavior management.

PEDD 700. Senior Selective in Pediatric Dentistry. 1 Hour.

Semester course; 4 clinical hours per week. 1 credit. Prerequisites: successful completion of PEDD 611 and PEDD 733 and permission of the course director. This is a clinical course that provides students with more advanced experiences and techniques in pediatric dentistry.

PEDD 701. Selective in Special Care Dentistry. 1 Hour.

Semester course; 4 clinical hours/week. 1 credit. Prerequisites: D4 standing and selection by course faculty. This course is designed to give the interested student clinical exposure to the comprehensive dental care of individuals who have special health care needs. Graded as pass/fail.

PEDD 730. Special Care Dentistry. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment restricted to dental students with D3 standing. This course is designed to enhance the dental student's understanding of the complexities of providing care for individuals with special health care needs.

PEDD 733. Advanced Pediatric Dentistry. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Designed to supplement and reinforce the student's knowledge of diagnosis, treatment planning and basic skills for management of the pediatric dental patient. This includes a review of basic pediatric clinical procedures and introduction to the treatment of pediatric patients with special needs.

PEDD 739. Clinical Pediatric Dentistry III. 0.5 Hours.

Yearlong course; 24 clinical hours. .5 credit. Clinical rotation course designed to introduce the student to the basics of clinical pediatric dentistry and to prepare the student for PEDD 749. Students receive CO grading in the fall and a letter grade upon completion.

PEDD 749. Clinical Pediatric Dentistry IV. 1 Hour.

Semester course; 48 clinical hours. 1 credit. Enrollment is restricted to students who have successfully completed all prior courses in pediatric dentistry and D4 class standing. This course is offered as a two-week clinical rotation during the senior year of the dental curriculum. Students will build upon and refine the skills developed during the D3 clinical experience. Pediatric dentistry is a unique experience because of the young patient population and psychological skills are centrally important to delivering patient care. The course has a strong emphasis on developing behavioral, communication and patient-management skills.

Periodontics (PERI)**PERI 508. Physical Diagnosis. 2 Hours.**

Semester course; 30 lecture hours. 2 credits. Provides lectures and hands on experience in physical diagnosis, history taking, general physical examination and review of major organ systems.

PERI 511. Anesthesiology Rotation. 1.5 Hour.

Semester course; 45 clinical sessions. 1.5 credits. Provides students with experience in general anesthesia under the direction of the dental anesthesiologist. Emphasizes operating room procedures, airway management, intravenous technique, anesthetics and resuscitative procedures. Includes clinical management of conscious sedation cases.

PERI 512. Conscious Sedation. 2 Hours.

Semester course; 30 lecture/seminar hours. 2 credits. Reviews concepts of parental conscious sedation techniques to include anatomy and physiology of the respiratory, cardiovascular and central nervous system, drug pharmacology, intravenous technique, prevention, recognition and management of complications, management of emergencies, physiologic monitoring and equipment, basic life support and advanced cardiac life support.

PERI 514. Introduction to Periodontics. 3 Hours.

Semester course; 48 lecture/seminar hours. 3 credits. Provides students with an introduction to the clinical practice of periodontics. Emphasizes diagnosis, etiology, prognosis, treatment planning, initial therapy, therapeutic approaches, suturing techniques, oral hygiene and dental photography.

PERI 515. Internal Medicine Rotation. 1.5 Hour.

Semester course; 45 clinic sessions. 1.5 credits. Provides students with experience in internal medicine under the direct supervision of the Department of Internal Medicine. Emphasizes hospital procedures and management of the medically-compromised patient.

PERI 520. Principles of Periodontics. 2 Hours.

Semester course; 30 lecture/seminar hours. 2 credits. Must be taken for two consecutive semesters. Reviews the principles of the basic science of periodontology, including anatomy of the periodontium, classification, etiology, diagnosis, scaling and root planning, and treatment planning. Reviews the indications and contraindications for management of complex periodontal problems. Reviews the principles of non-surgical and surgical techniques.

PERI 525. Diagnosis of Periodontal Diseases. 1 Hour.

The first in a four-part series of didactic courses designed to prepare the dental student for the clinical diagnosis and management of periodontal diseases. Through this course, students will develop a fundamental understanding of how to assess patients for periodontal disease and how to develop a specific diagnosis. Enrollment is restricted to admitted dental students.

PERI 526. Etiology and Pathogenesis of Periodontal Diseases. 1.5 Hour.

1.5 credits. The second in a four-part series of didactic courses designed to prepare the dental student for the clinical diagnosis and management of periodontal diseases. Through this course, students will build upon their knowledge of diagnosis and develop their understanding of the causes, mechanisms and development of periodontal disease. Enrollment is restricted to admitted dental students.

PERI 552. Implantology. 1,2 Hour.

Semester course; 16 lecture/seminar hours. 1 credit. Covers the historical review of dental implants, including biologic principles, techniques and systems; diagnosis, interdisciplinary considerations, treatment planning and indications and contraindications for implants; wound healing for implants, including osseointegration, surgical techniques and implant maintenance. Provides a hands-on technique laboratory.

PERI 619. Clinical Pathology Rotation. 0.5 Hours.

Semester course; 21 clinic sessions. 0.5 credit. Provides instruction in patient assessment, biopsy technique, assessment of tissue preparations and review of oral histologic slide materials.

PERI 627. Non-Surgical Periodontal Therapy. 1.5 Hour.

The third in a four-part series of didactic courses designed to prepare the dental student for the clinical diagnosis and management of periodontal diseases. Through this course, students will add to their skill set a conceptual knowledge of non-surgical treatment options for periodontal disease. Enrollment is restricted to admitted dental students.

PERI 630. Medicine: Oral Medicine Seminar. 1.5 Hour.

Semester course; 26 seminar hours. 1.5 credits. May be repeated for credit. Must be taken every semester of the program. Emphasizes diagnosis, pathogenesis, oral manifestations and management of systemic diseases. Reviews the management of the medically-compromised patient, including laboratory procedures, pharmacology, hematology and reviews of the cardiovascular, respiratory, endocrine and neurologic systems. Discusses and critically evaluates medical and oral medicine topics relative to management of the periodontal patient.

PERI 650. Periodontal Literature Review. 3 Hours.

Semester course; 48 seminar hours. 3 credits. Must be taken every semester of the program. Reviews the periodontal literature from early classic articles to current publications pertaining to the scientific basis for periodontal procedures. Reviews the concepts of diagnosis, etiology, epidemiology, pathogenesis, therapy, maintenance of periodontal diseases and implantology. Discusses content of the literature by means of abstracts and study questions.

PERI 654. Treatment Plan: Case Presentations. 1 Hour.

Semester course; 12 seminar hours. 1 credit. Must be taken every semester of the program. Emphasizes the interpretation the medical and dental histories, radiographic and clinical findings, diagnosis, etiology, prognosis, treatment planning, therapy and supportive periodontal care. Discusses the content of reviewed cases by written and oral presentations. Requires the student to assimilate and interpret clinical findings.

PERI 656. Current Literature Review. 3 Hours.

Semester course; 36 seminar hours. 3 credits. May be repeated for credit. Must be taken every semester of the program. Provides an in-depth review of contemporary periodontal literature. Discusses content of the reviewed literature by means of abstracts and discussion.

PERI 680. Clinical Periodontics. 0.5-12 Hours.

Semester course; 1.5-36 clinic hours. 0.5-12 credits. Enrollment is restricted to students in the M.S.D. program. Provides supervised training in periodontics. Provides the student with the experience in the treatment and management of patients with various types and severities of periodontal diseases. Emphasizes diagnosis, treatment planning, prognosis, scaling and root planing, non-surgical and surgical techniques. Provides experience in the treatment of advanced periodontal cases and more complex surgical techniques including preprosthetic, orthodontic, periodontal plastic and mucogingival procedures, guided tissue regeneration, guided bone regeneration and implant surgical techniques. Must be taken for seven credits in the fall and 8.5 credits in the spring of the third year of the program for a total of 15.5 credits. May be taken for additional semesters as needed to complete clinical training, but additional credits will not apply towards degree completion. Graded as P/F.

PERI 700. Advanced Periodontal Selective. 0.75 Hours.

Semester course; 0.25 lecture and 0.5 clinic hours. 0.75 credits. This course is offered to dental students who demonstrate high academic achievement and are interested in expanding their practical knowledge and experience in periodontal surgical procedures. It is designed to enhance the general dentist's knowledge regarding indications, diagnosis and treatment planning of periodontal surgical procedures and to provide hands-on experience in applying techniques of surgical periodontal procedures suitable for judicious use in general dental practice. Graded as pass/fail.

PERI 719. Specialty Practice Management. 0.5 Hours.

Semester course; 22 seminar hours. 0.5 credit. Must be taken for two consecutive semesters. Provides the student with experience in office management. Requires visits to specialty offices to familiarize the student with contemporary modes of practice administration and patient management.

PERI 733. Surgical Periodontal Therapy. 1 Hour.

1 credit. The fourth in a four-part series of didactic courses designed to prepare the dental student for the clinical diagnosis and management of periodontal diseases. Through this course, students will complete their didactic exploration of periodontal diseases with a conceptual knowledge of surgical treatment options for periodontal diseases. Enrollment is restricted to admitted dental students.

PERI 739. Clinical Periodontics III. 5 Hours.

Yearlong course; clinical contact hours. 5 credits. The primary objective of the department is to provide an educational experience that will enable the dental student to meet the periodontal needs of present and future patients. These objectives necessitate student awareness of the biology of the periodontium and pathology of gingival and periodontal diseases; the ability to examine, diagnose and develop a treatment plan for the patient with significant periodontal disease; and an understanding of the implications of periodontal diagnosis and treatment on the oral and general health of the patient. The student should also be competent in plaque control, scaling, root planing and other procedures ordinarily included in presurgical phases of therapy. The student should be familiar with the entire scope of periodontal therapy, understanding the rationale and indications for surgical treatment and anticipated results.

PERI 749. Clinical Periodontics IV. 1 Hour.

Yearlong course; 1 clinic session per week. 1 credit. This final clinical course in periodontics provides competency assessment of the dental student as an entry-level dentist in the diagnosis and management of patients with periodontal diseases. Students receive CO grading in the fall and a pass or fail grade and earned credit in the spring.

PERI 780. Advanced Assessment and Management of Periodontal Diseases. 4 Hours.

Semester course; 4 seminar and 2 clinic hours. 4 credits. May be repeated. Designed to present periodontal literature from early classic articles to current publications pertaining to the scientific basis of periodontal diagnosis, etiology, epidemiology, pathogenesis, prognosis, and indications for and expected outcomes of periodontal therapies. Emphasis is placed on the interpretation of medical and dental histories, radiographic and clinical findings, prognosis, treatment planning, and nonsurgical and surgical techniques utilized for the management of periodontal diseases. Graded as Pass/Fail.

PERI 781. Advanced Dental Implantology. 3 Hours.

Semester course; 4 seminar and 1 clinic hours. 3 credits. May be repeated. This course is designed to present the literature from early classic articles to current publications pertaining to the scientific basis of dental implants, including simple to complex site preparation. Emphasis is placed on patient assessment, diagnosis, interdisciplinary considerations, treatment planning, surgical techniques, wound healing and osseointegration, and implant maintenance. Graded as Pass/Fail.

PERI 782. Research in Periodontics. 7 Hours.

Semester course; 2 lecture and 5 laboratory hours. 7 credits. This course is designed to provide an introduction to research study design, use of biostatistical methods, critical appraisal of published articles and writing of scientific manuscripts. Emphasis is placed on identifying research questions, conducting literature reviews, developing research protocols, collecting and analyzing data, and presenting research findings. Includes practical experience conducting a research project. Graded as Pass/Fail.

PERI 783. Advanced Research in Periodontics. 1-10 Hours.

Semester course; 0-10 laboratory hours. 0-10 credits. May be repeated for the duration of a research project. This course is designed to emphasize identifying research questions, conducting literature reviews, developing research protocols, collecting and analyzing data, and presenting research findings. Includes practical experience conducting a research project. Graded as Pass/Fail.

School of Education

Administration and Supervision (ADMS)

ADMS 500. Workshops in Education. 1-3 Hours.

Semester course; 1-3 credits, repeatable for maximum of six credits. Designed to focus on a single topic within a curriculum area, the workshop offers graduate students exposure to new information strategies and materials in the context of a flexible instructional framework. Activities emphasize a hands-on approach with direct application to the educational setting.

ADMS 600. Public School Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An overview of the theory and practice of public school administration. Emphasis on the governance of education and leadership roles of school boards, superintendents, principals and supervisors. Leadership theories and characteristics of effective management systems related to student discipline and academic performance, school safety, internal and external communications, and coordination with outside agencies. Appropriate field-based project relating theory to practice will be required.

ADMS 601. Processes of Instructional Leadership. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines processes of instructional leadership in schools. Primary focus on developing school leadership skills necessary to provide a positive working environment through collaboration and team-building, as well as professional opportunities including supervision and evaluation of instruction. Focus will be on best practices that lead to school cultures that build communities of learning. Appropriate field-based project relating theory to practice will be required.

ADMS 602. Seminar in Elementary School Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Problems and issues in elementary school leadership. Major responsibilities of the elementary school principal. Enrollment limited to specialists in administration.

ADMS 603. Seminar in Secondary School Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Problems and issues in secondary school leadership. Major responsibilities of the secondary school principal. Enrollment limited to specialists in administration.

ADMS 605. Organizational Theory, Structure and Culture in Educational Settings. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of organizational theory, structure and culture relating to schools. Emphasis on conceptual understandings needed for practical implementation.

ADMS 606. Organizational Behavior and Change in Educational Settings. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of organizational concepts and practices in educational contexts. Emphasis on both conceptual understandings and specific professional skills relating to diagnosis and development.

ADMS 607. Principles of Educational Leadership. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Develop understandings for school leaders of effective leadership in organizations, personal leadership styles and modifying leadership styles. Leadership with respect to vision building, organizational communications, motivating others and group problem solving will serve as major areas of study. Lecture, individual study, group work and fieldwork will serve as major means of course delivery.

ADMS 610. School and Community Relations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides a conceptual and philosophical framework for evaluation and development of practices involved in implementing desirable school and community relations programs that focus on unique needs of communities. Special emphasis given to skills necessary to identify significant issues, assess current practice and engage in the processes involved in building and maintaining exemplary school-community programs. Appropriate field-based project relating theory to practice will be required.

ADMS 611. School Law. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Legal aspects of school administration that include constitutional and statutory provisions and court decisions. Relationship of legal aspects to governance of schools in Virginia will be emphasized. Appropriate field-based project relating theory to practice will be required.

ADMS 612. Diversity in Higher Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course provides a foundational understanding of diversity, inclusion and social justice issues in higher education and college environments. Students will gain knowledge to enhance administrative practice and policy-making in higher education related to issues of diversity, inclusion and equity.

ADMS 615. Developmental Theories in Higher Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Comprehensive study of traditional and nontraditional college students with an emphasis on identification of development needs.

ADMS 616. Higher Education Policy, Law and Finance. 3 Hours.

Semester course; 3 seminar hours (delivered online, face-to-face or hybrid). 3 credits. This course is designed to provide students with a basic understanding of the legal, financial and political environment within higher education. To do this, students will gain knowledge related to historical and current influences on how policy is shaped and strategies on how to navigate this process as a higher education professional. It is expected that students will emerge from this class more knowledgeable about how their decisions and actions as professionals align with legal and political environments that they will work in. Class discussions and learning materials will assist in an understanding of financial structures and policies that shape higher education at the campus, state and federal level. Students will acquire an awareness of formal and informal power structures within educational organizations and how policy is implemented at varying levels. All students will have opportunities to learn how to develop and communicate policy decisions to relevant stakeholders.

ADMS 618. Leadership for Change and Improvement. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Students will reflect on the past, critically review current reality in schools or organizations and creatively predict the nature of schooling or organizational effectiveness in the future in light of the responsive role of the leader. Other constructs presented include change as an educational or organizational paradigm, the use of data to inform changes for improvement, and the leader as a change agent. In addition, students will assess their school or organization for change readiness.

ADMS 619. Higher Education Administration. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Higher education in social and historical contexts; organization and administration of colleges and universities.

ADMS 620. Improving School Programs and Performance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduction to principles of leadership for the improvement of school programs and performance. Participants discuss current literature and models of school improvement with an emphasis on identification, selection and measurement of appropriate student and school performance indicators. An understanding of school culture and change, the importance of planning for change, and the role of data in the process of change are topics included. Appropriate field-based project relating theory to practice will be required.

ADMS 621. Management of School Operations and Support Programs. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Developing understanding and practices of the school principal with respect to key elements of managing school operations and support programs. Special attention will be given to goal setting for programs, securing, organizing and managing human, material and financial resources. Attention will be given to cost/time-effective practices and accountability.

ADMS 622. Understanding Diversity and Leading for Social Justice. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. In this course, participants will engage in conversations related to diversity in schools or organizations. Students will explore the critical role of education or organizational leadership in a rapidly changing democratic society. Participants will reflect on how culture impacts leadership beliefs and practice as well as explore strategies for establishing equitable environments that support the needs of all stakeholders.

ADMS 624. Principals as Human Resource Agents. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The course examines the management of human resources in schools and school divisions. Legal issues, division policies, ethical considerations and professional interpersonal relationships are explored, along with evaluation of personnel. Students will participate in problem-solving in specific human resources cases and will critically examine human resource situations in their own contexts.

ADMS 625. Leadership for Individualized Learning. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course represents a holistic approach to leadership for meeting needs of learners across the continuum with a focus on students with disabilities and to include gifted students and English-language learners. The constructs presented include legal and historical frameworks, equity issues, traditional and emerging policies and practices, models of instructional delivery, and roles and responsibilities of personnel.

ADMS 627. Enhancing and Supporting Instruction. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The focus is to learn ways to enhance and support instruction that improves student achievement. The content includes effective instruction, supervision, evaluation, professional development, diverse learners and capacity-building through the development of professional learning communities, as well as using data and curriculum alignment strategies to improve student performance.

ADMS 629. The Business of Schools. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course presents financial considerations such as funding, revenue and expenditure audits; maintenance of a safe and productive learning environment; crisis management and media relations; physical plant management; meeting management; communication with internal and external publics; time management; and the ability to effectively navigate political waters. The approach to these constructs will be both diagnostic and prescriptive.

ADMS 630. Understanding and Engaging School Communities. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Students will explore the broad social, economic, political and demographic shifts that have transformed metropolitan schools and communities over the past half century. Based on a deeper understanding of the complex forces that influence society and democracy, students will develop leadership skills that focus on building relationships and communicating effectively with internal and external schools and/or communities.

ADMS 632. Administration and Supervision of Special Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examination of instructional practices and legal issues related to providing school programs for students with special needs. Appropriate field-based project relating theory to practice will be required.

ADMS 633. Multiple Dimensions of Leadership. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course provides participants with the opportunity to understand their own unique beliefs and dispositions regarding leadership as well as to understand the roles and responsibilities of leaders, including the ethical dimensions of leadership. Various leadership models and theories are presented and explored.

ADMS 634. College Environments. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course will provide students with foundational knowledge regarding different environmental theories applicable to higher education settings.

ADMS 635. Critical Issues in Urban Higher Education. 3 Hours.

Semester course; 3 seminar hours (delivered online, face-to-face or hybrid). 3 credits. Students will explore urban higher education through a social, historical and political lens. Students will develop an understanding of the ways education policy shapes the practice of education, particularly for institutions in urban environments. Further, this course examines the relationship between schools and the larger society in which they exist and examines the interplay of social systems within urban environments. Through a combination of field experiences and scholarly reflection, students will use inquiry and analysis to investigate the contributions of urban-serving and urban-located institutions.

ADMS 636. Crisis Leadership in Higher Education. 3 Hours.

Semester course; 3 seminar hours (delivered online, face-to-face or hybrid). 3 credits. Higher education leaders are expected to respond, provide direction, and make strategic decisions during times of crisis. Whether emergencies related to students and staff or weather-related disasters, various types of crises threaten the viability and function of higher education institutions. Colleges and universities face a growing number of challenges that require a leadership response, including: campus shootings, flooding, vandalism influenced by racism, student activism, and athletic scandals. Each of these challenges can impact single and multiple stakeholders, requiring clear communication, appropriate planning and training for entry-/mid-level administrators. This course investigates relevant research about crises, crisis management, and effective leadership within higher education and other postsecondary settings. Additionally, this course considers the importance of decision making for administrators and what influences their decisions in managing varying levels of crises in higher education.

ADMS 637. Special Mission Institutions. 3 Hours.

Semester course; 3 seminar hours (delivered online, face-to-face or hybrid). 3 credits. In this course, students will be introduced to diverse institutional types – historically black colleges and universities, tribal colleges, Hispanic-serving institutions, Asian American and Native Pacific Islander-serving institutions, single-sex institutions, military colleges, work colleges, for-profit institutions and community/junior colleges. Students will gain knowledge regarding the historical, social, economic and political backgrounds of different institutions of higher education with unique missions to serve students, faculty and communities. This class encourages students to think outside of traditional institutions to consider the importance of mission, purpose and function of various higher education institutions. Further, students will be able to utilize qualitative research methods to engage conduct original research on special mission institutions.

ADMS 638. Community Colleges. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The history, philosophy and emerging missions of the community college will be studied in this course. The core content will focus on governance, administration, faculty and students, curriculum and services, funding, public affairs, and the presidency.

ADMS 639. Enrollment Management in Higher Education. 3 Hours.

Semester course; 3 seminar hours (delivered online, face-to-face or hybrid). 3 credits. In this course, students will be introduced to the theory and practice of enrollment management by higher education institutions. Students will engage in critiques of the effects of institutional enrollment practices on students, institutions, public policy and the public interest. Through readings and course discussion, students will be able to engage with contemporary and controversial topics that influence higher education, including, but not limited to, access and equity, college rankings, bias and discrimination, standardized testing, financial aid, selective admissions, and enrollment management tools.

ADMS 640. Human Resource and Fiscal Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. A study of theories and policies related to resource projection and management in schools and school divisions. Finance topics include budget, purchasing and accounting, and procedures for obtaining equipment and materials. Human resource topics include staffing requirements, hiring, evaluation and dismissal procedures, and staff-personnel relationships. Appropriate field-based project relating theory to practice will be required.

ADMS 641. School Personnel Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of the personnel function in educational organizations. Designed to explore techniques and problems of staff-personnel relationships in contemporary education.

ADMS 643. The Community School. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The development and utilization of the community school concept will be examined. Communitywide use of school facilities and the involvement of the total community in the learning process will be studied. Emphasis will be placed on the physical plant design, organizational structure, staffing and curriculum of the community school. The utilization of the community school to implement "lifelong learning" will be stressed.

ADMS 647. Educational Technology for School Leaders. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of the impact of technology – particularly Web-based technologies – on K-12 instruction, from pedagogical considerations and associated tool choices to more pragmatic leadership issues of planning, funding and faculty development. This course is designed for administrators, teacher leaders and other interested professionals who are or intend to be leaders in technology.

ADMS 651. Topics in Education. 1-3 Hours.

Semester course; 1-3 credits, repeatable for maximum of nine credits. Prerequisite: Check with department for specific prerequisites. A course for examination of specialized issues, topics, readings or problems in education.

ADMS 655. Student-Centered Policy and Collaboration. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Students will explore the school/community ecology to understand the influences on and the potential for a more equity-oriented and culturally relevant K12 public education system. Students will explore the role of public K12 governance and advocacy for policy change, cross-sector collaboration and social entrepreneurship to increase their knowledge and application of the skills and conditions needed to advance equity, opportunity and achievement. The course will focus on organizational and community leadership that values stakeholders as equal partners to improve decision-making and policy oriented toward student success, particularly for historically marginalized populations.

ADMS 656. Human Dimensions of Leadership: Empathy, Trust and Care in Organizations. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Effective, culturally responsive and sustaining leadership practices and approaches are grounded in humanistic relationship management with a clear understanding of human behavior and social processes. This course is about people in education-related organizations. It is designed to help leaders incorporate human dimensions of leadership focused on empathy, trust and care in organizational and community-based leadership. Course content is derived from contemporary theory, research and practice in educational, community-based and organizational behavior and leadership such as organizational theory and management; community cultural wealth; ecological/systems theory/models; community theories (sense of community, social capital, environmental psychology); and critical social and race theory, social justice and social determinants of well-being.

ADMS 657. Educational Leadership and Civil Rights. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course will examine the evolution of civil rights in the U.S. educational system from historical, legal, policy and social science perspectives. Students will explore the grassroots organizing that supports landmark civil rights victories, as well as leadership across crucial spheres such as law and policy. The purpose of the course is to develop students' understanding of how key civil rights principles have been advanced and contested in schools. The class will do this with an ultimate goal of developing leadership capacity to respond to contemporary civil rights challenges related to education.

ADMS 658. Community-Based Action Research for Education Stakeholders. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course introduces students to a research approach that engages school and/or community stakeholders. The course focuses on action-based research designs with a thoughtful and critical focus on community-based participatory action research and related approaches, such as participatory action research, youth participatory action research and community-engaged research. The course will explore this work as it occurs in school- and community-based settings, as well as within research-practice partnerships. Collectively, these approaches offer students not just a set of methods, but seek to equip them with the skills and insights to fundamentally change the relationship between researchers and research participants and the power dynamics of the knowledge production process. The course attends to the following questions: How can research help with addressing real-world problems in education? How can data collection and knowledge creation through praxis be participatory in a truly democratized, co-owned and emancipatory process? And, how can educational stakeholders use action research as a means to transcend disciplinary boundaries in order to positively impact social and educational change? Crosslisted as: EDUS 658.

ADMS 659. Leadership in the "New Demography": Immigration Theory and Politics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. As schools and communities experience significant demographic shifts, it is critically important for school and community-based leaders to interrogate the history, theories, politics and debates of immigration, particularly in relation to U.S. schooling and education. Doing so requires an examination of competing theories of race, immigration and identity, as well as notions of transnationalism, integration and citizenship. This course considers these issues from a culturally responsive lens with a keen focus on schools and communities.

ADMS 660. Higher Education Internship. 3 Hours.

Semester course; 3 field experience hours. 3 credits. This course provides field experiences to help students prepare for leadership roles in diverse college environments or other institutions which provide adult learning opportunities. The internship consists of work experiences in a higher education institution or in an adult education setting under supervision of a practicing professional and university supervisor. Graded as Pass/Fail. This course includes site-based requirements.

ADMS 670. Administrative Internship I. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course must be taken as one of the first courses in the first semester of enrollment. The course serves as an orientation to the internship experience, which is an integral component throughout the master's and/or post-master's program of studies. Students will learn the specifics of the entire internship component of the program, such as the 320 internship hours required, the scope of internship work, and the variety of experiences needed and means by which all internship experiences are to be documented throughout the program. Students will develop their individual internship plans, which will guide them through their internship experiences throughout their entire program. This plan will include specific field experiences in each required course as well as plans that will be executed in Administrative Internship II and Administrative Internship III, such that a total of 320 hours of experiences are accrued and documented by the end of the program. Graded as S/U/F. This course includes site-based requirements.

ADMS 671. Administrative Internship II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisites: full admission status; no grades of Incomplete; evidence provided of meeting technology standards and completing child abuse/neglect recognition training; meet university's Graduate School academic requirements for graduation; adviser/department head approval of internship application; successful completion of ADMS 670. This course is to be taken in the semester immediately before Internship III. This course focuses on emerging topics from the students' internship experiences with emphases on leadership skills, professional dispositions and management. Field-based internship experiences developed in ADMS 670 are continued such that a total of 320 hours of experiences will be accrued and documented by the end of the entire program. A culminating experience taken at the end of the program, this course is designed for students to have opportunities to synthesize the essential knowledge and skills necessary to be a school leader. Reflection and refinement of skills and knowledge will be part of student-developed professional portfolio that could be used in securing a leadership position in a school system. Integration of theory and practice will take place in the internship as evidenced by documented experiences in a school/school district setting supervised by an approved professional and university instructor. Course will include seminars, selected readings, projects, discussion and other culminating activities. Graded as S/U/F. This course includes site-based requirements.

ADMS 672. Principalship Seminar and Internship. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: Full admission status; no grades of Incomplete; evidence provided of meeting technology standards and completing child abuse/neglect recognition training; meet university's Graduate School academic requirements for graduation; adviser/department head approval of internship application. A culminating experience taken at the end of program designed for students to have opportunities to synthesize the essential knowledge and skills necessary to be a school leader. Reflection and refinement of skills and knowledge will be part of student-developed professional portfolio that could be used in securing a leadership position in a school system. Integration of theory and practice will take place in internship of at least 120 hours in a school/school district setting supervised by an approved professional and university instructor. Course will include seminars, selected readings, projects, discussion and other culminating activities.

ADMS 675. Administrative Internship III. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: successful completion of ADMS 670 and 671. This course is continuation of the experiences in ADMS 670 and 671 and of seminar topics related to developing a personal portfolio and resume as well as interviewing skills. It provides a culminating review and professional reflection of the internship experiences. As part of successful completion of this course, 320 hours of documented internship experiences must be completed by the end of the program. Graded as S/U/F. This course includes site-based requirements.

ADMS 700. Externship. 1-6 Hours.

Semester course; 1-6 credits. May be repeated for a maximum of 9 credits. Prerequisite: Permission of department. Plan of work designed by extern with prior approval of the offering department. State certification or equivalent may be required for some externships. Off-campus planned experiences for advanced graduate students designed to extend professional competencies, carried out in a setting, under supervision of an approved professional. Externship activities monitored and evaluated by university faculty.

ADMS 701. Education Policy Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines a set of applied research practices undertaken within a diverse community of scholars and analysts and that have implications for education. Explores processes involved in developing and implementing educational policy. Emphasis is given to the roles of federal and state governments in policymaking with attention to problems encountered in implementing educational policies. Focuses on research approaches relevant to policy research.

ADMS 702. Educational Administration: Contemporary Theory and Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Study of recent developments in administrative theory and the application of these theories to contemporary and future educational issues and problems.

ADMS 703. Leadership for Social Justice and Equity in Education. 3 Hours.

Semester course; 3 lecture/seminar hours. 3 credits. Students will study and engage in dialogue related to the critical role of education in a democratic society in a rapidly changing and increasingly complex world. Through a focused discussion of theories and concepts such as democratic schools, social justice, critical theory and power, feminism, critical race theory, and difference/normalization, students come to understand the possible roles education can play in society and their need to continuously reflect on their own vision for leadership in public schools.

ADMS 704. Education Finance Policy and the Equitable Distribution of Resources. 3 Hours.

Semester course; 3 lecture hours. 3 credits. In addition to a traditional examination of some of the aspects of the economic, legal, financial and budgeting policies affecting the equitable distribution of education resources in the U.S., the social justice implications associated with several established theories and policies in the field of education finance are examined. Specific topics include the historical and philosophical perspectives of U.S. education finance; education finance reform litigation; conceptions and measurements of equity, adequacy and efficiency in school finance designs; the role of federal, state and local governance in equitable education finance in the U.S.; and the resource needs and organizational and fiscal implications of serving special populations in U.S. schools.

ADMS 705. Planning Educational Facilities. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Study of the theory, principles, criteria, procedures and practices of planning educational facilities and the modernization, maintenance and operation of existing facilities.

ADMS 706. Leadership Perspectives on Learning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores contemporary leadership perspectives on learning. This general theme is refined into three focus areas of current theory and practice: perspectives on what it means to learn, the ways in which digital technology factors into teaching and learning, and perspectives on the future of the formal K-12 learning enterprise.

ADMS 707. The Politics of Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examination of how the political structure of public education determines the nature of schooling. Study of political theory of education, macropolitics of education and schooling from micropolitical perspective leading to synthesis and development of critical understanding of the politics of education.

ADMS 708. Equal Educational Opportunity in the 21st Century Metropolis: Toward a Policy Framework. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course provides an overview of the economic, political and demographic shifts that have transformed metropolitan school systems over the past half century. Emphasis is given to the trajectory of education policy and leadership in light of these altered metropolitan spaces. Participants will evaluate the successes and pitfalls of contemporary and historical reforms as they relate to the distribution of educational opportunity across the urban/suburban/exurban divide. Culminating activities help students develop a framework for future policy efforts with a focus on the Richmond metro area.

ADMS 709. U.S. Educational Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will promote a critical examination and evaluation of the major strands of educational policy over the past half century.

ADMS 710. Current Topics in Educational Leadership and Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides advanced study on selected topic or emerging issue in U.S. educational policy or leadership.

Adult Education (ADLT)**ADLT 601. Adult Learning and Development. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. An examination of the research findings from the applied behavioral sciences that affect adult learning throughout the lifespan, including psychological, social and physical attributes of adults as learners. Explores the philosophical and theoretical foundations of the field, including schools of thought and associated theorists. Emphasis on the effects of age on learning, the importance of self-image and factors affecting adult motivation for learning. Addresses different learning styles, application of adult learning theories to practice and the relationship of adult learning to adult development.

ADLT 606. Design and Delivery of Adult Learning Programs. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides a comprehensive understanding of the design, development and delivery process necessary to create a program, course or workshop for adult learners. Emphasis is on actual design of an adult learning experience from initial stages of needs assessment to concluding evaluation and assessment of effectiveness, including development of instructional strategies and methods for delivery.

ADLT 610. Consulting Skills In Adult Learning Environments. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An introduction to the consultation skills necessary to effect change when the educator is in a position of influence, rather than direct control or management responsibility. Presents historical and theoretical models of change, facilitation skills necessary for introducing and sustaining change, strategies for dealing with resistance, and ethical issues involved in consultation. Students gain practical experience by conducting an intervention as the major project assignment in the course.

ADLT 612. Learning in Groups and Teams. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores fundamentals of learning in groups and teams, including effects of leadership, group member roles and processes, performance, development, goals, and culture. Examines group theory, models and practices of collective learning. Addresses the situated nature of learning, effects of social context and the concepts inherent in sustaining communities of practice.

ADLT 620. Human Resource Development Overview. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an overview of the HRD field to include theories, practices and emerging concepts. Emphasis is on roles, functions and responsibilities of the HRD practitioner in supporting the strategies, mission and goals of the enterprise, whether public, private or nonprofit.

ADLT 623. Organizational Learning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the theoretical basis for organizational learning and the practices inherent in developing a learning organization. Examines organizational culture and socialization; systems thinking; organizations as interpretative systems; the leader's role in creating, sustaining and changing culture; strategies for enhancing collective learning; distributed cognition; and strategies for knowledge management.

ADLT 625. Change Strategies for HRD Practitioners. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Develops skills in change intervention strategies by employing the theoretical frameworks of organization development and organization transformation to address critical organizational issues and problems. Explores the HRD practitioner's role in facilitating organizational change through action research, action science, action learning and large-scale, whole-system interventions. Examines the differing roles and ethical issues for improving organizational effectiveness with special attention to organizational culture and a systems perspective of change.

ADLT 632. Understanding Social Foundations and Contemporary Issues in American Higher Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the purpose of higher education and whether this purpose has changed over time, exploring the reasons for change; studies how the academy is responding to social pressures; and explores scenarios for future change. Crosslisted as: EDUS 632.

ADLT 636. Capstone Seminar in Action Learning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: Restricted to students who have completed all other foundation and core courses or are taking this course in conjunction with the final specialty track courses in the M.Ed. in Adult Learning program; permission of adviser required. An integrative end-of-program course that utilizes skills and knowledge gained in all earlier courses, including philosophical and theoretical assumptions of adult learning and strategies for creating effective individual and collective learning environments. Students consult with a community-based, educational, nonprofit or for-profit organization using action learning methods of inquiry to solve a real organizational problem. Requires synthesis of knowledge and expertise in all aspects of adult learning and demonstrated proficiency in research and evaluation skills appropriate for the master's degree level. An end-of-semester presentation and consulting report are provided to the organization's leaders.

ADLT 640. Theory and Practice of eLearning and Digital Media in Adult Learning. 3 Hours.

Semester course; 3 lecture hours (delivered online or hybrid). 3 credits. Provides learners with a theoretical foundation and rationale for the successful integration of eLearning into formal and informal adult learning environments. This course begins with an overview of educational theory and social constructivist teaching philosophy before addressing the fundamental issues that instructional designers should consider when designing, delivering and assessing eLearning in adult learning environments. Students will also explore the use of digital media to enhance adult learning. Through hands-on experience with tools, examination of emerging media formats and the evaluation of course learning products, students will learn to create, critique and explore a variety of digital media to support learning in a variety of instructional contexts. Special emphasis will be placed on using digital technology tools to support communication, knowledge building and learning in both formal and informal adult learning settings.

ADLT 642. Design Challenges in Creating eLearning for Adults. 3 Hours.

Semester course; 3 lecture hours (delivered online or hybrid). 3 credits. Prerequisites: ADLT 640 and ADLT 643; or permission of instructor. Provides learners who have developed a deep understanding of the theoretical and philosophical underpinnings of instructional design in eLearning environments and a fluency in developing content using new freely available digital media tools through prerequisite courses. This course provides students with an opportunity to undertake a major project in online learning design.

ADLT 643. Advanced Instructional Design for Adult Learning. 3 Hours.

Semester course; 3 lecture hours (delivered online or hybrid). 3 credits. Prerequisite: ADLT 640. The focus of this course is to understand and explore how to enhance learning through online instruction. This class will focus on designing instruction for adult learners for online learning. Students will be introduced to a variety of instructional design models and other systems and tools they will encounter in the workplace. They will also have the opportunity to evaluate online learning activities and instructional designs to determine if they are effective for adult learning in the workplace. Additional focus will be on evaluating the effectiveness of online learning initiatives and creating evaluations.

ADLT 650. Adult Literacy and Diversity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Surveys the field of adult literacy and its many purposes, definitions, contexts and ideologies by exploring relationships between literacy and learning in numerous contexts, from corporate HRD programs to refugee communities. By applying analytical tools of critical theorists to raise awareness of the ideological nature of adult learning, and by examining contexts and foundations of adult literacy, the course takes up epistemological, ethical and instructional issues that relate to all aspects of adult learning.

ADLT 670. Curriculum Design in Health Professions Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to faculty teaching in medicine and health care professions. Introduces adult learning principles and practices for the design and assessment of courses, units and individual lessons within a health professions education curriculum in both preclinical and clinical settings.

ADLT 671. Theory and Practice of Adult Learning for Health Professions Educators. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to faculty teaching in medicine and health care professions. Provides an overview of the major adult learning theories that are applicable to health professions education and explores how these form the basis for teaching and learning in medicine. Examines behavioral, cognitive, social, experiential and transformative learning orientations for relevance in health professions education. Emphasis is on how knowledge is constructed and organized in the development of expertise.

ADLT 672. Instructional Strategies for Teaching in Health Professions. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to faculty teaching in medicine and health care professions. Designed to provide health professions educators with knowledge and skills practice in teaching effectively in large and small groups using discussion-based strategies, team-based learning, process-oriented guided inquiry learning and problem-based learning, as well as other active learning methods. Learners design and implement a small-group learning strategy appropriate for a health professions educational setting.

ADLT 673. Teaching as Scholarship in Health Professions Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to faculty teaching in medicine and health care professions. Orients the health professions educator to basic design principles for conducting research that contributes to the scholarship of teaching and learning in health professions education using qualitative, quantitative or mixed methods. Examines basic research paradigms, problem identification, question development, selection of methodology, IRB preparation and requirements for journal submission and publication.

ADLT 674. Performance Feedback and Simulation in the Medical Education Curriculum. 2 Hours.

Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to faculty teaching in medicine and health care professions. Introduces medical educators to the use of simulated learning experiences in preparing health care professionals for patient care. The emphasis is on acquiring skills to develop and lead simulation exercises and on developing facilitation skills needed to provide effective feedback to debrief the activity. Requires hands-on observation and participation in simulation at the VCU Center for Human Simulation and Safety.

ADLT 675. Group and Team Facilitation for Medical Educators. 2 Hours. Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to faculty teaching in medicine and health care professions. An introduction to the nature of learning in groups and teams. The course explores basic issues fundamental to all groups such as leadership, goals, group member roles, stages of group and team development, issues in team performance and an understanding of how institutional culture shapes group behavior.

ADLT 676. Digital Media Technologies for Teaching in Medicine. 2 Hours. Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to faculty teaching in medicine and health care professions. Introduces digital media technologies to bring state-of-the-art teaching and learning strategies into the medical education curriculum. Explores Web 2.0 tools including wikis, blogs, podcasts and other emerging media, as well as the evaluation of digital media technologies to support learning in the preclinical or clinical curriculum. Emphasis is on building student engagement and community through participatory strategies for learning.

ADLT 677. Reflective Practice in Medical Education. 2 Hours. Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to faculty teaching in medicine and health care professions. Introduces the concept of reflective practice for medical educators, including the educator's role in developing trainees as reflective practitioners and the role of reflection in one's own professional development. Includes the concept of narrative medicine as a reflective practice that enables a more holistic understanding of patients and their illnesses, with application for the education of medical professionals.

ADLT 688. Lifespan Issues for Adults with Learning and Behavioral Disabilities. 3 Hours. Semester course; 3 lecture hours. 3 credits. Explores the literature, research, issues and best practices for the population of individuals with learning disabilities and behavior disorders (including ADHD) beyond the school-age years. Focus on disabilities as they are manifested in a variety of settings and contexts in which adults with learning and behavior disorders function. These include areas such as employment, post-secondary education, community, family and leisure. In addition, social-emotional functioning and daily living challenges will be interspersed in the course material. Course goal is to develop understanding and the skill of critical reflection about persons with learning disabilities and behavior disorders in their adult years.

ADLT 702. Seminal Readings in Adult Learning Literature. 3 Hours. Semester course; 3 lecture hours. 3 credits. A seminal readings course to explore some of the prominent classics in adult learning literature. Designed for doctoral students in adult learning and other disciplines in which knowledge and understanding of the theoretical underpinnings of adult education is desirable as a foundation for effective pedagogy/andragogy. While prior participation in a master's-level adult learning theories class may be beneficial, it is not a prerequisite.

Counselor Education (CLED)

CLED 501. A Survey of the Counseling and Human Services Professions. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An introductory course for any student interested in pursuing a career as a counselor or human services professional. Students will explore their personal motivation and interest in a counseling or human services profession as well as integrate professional concepts with personal style.

CLED 520. Diversity Issues in Counseling. 3 Hours. Semester course; 3 lecture hours. 3 credits. This course provides an overview of diversity in age, religion, race, ethnicity, socioeconomic status, sexual orientation and gender identity in society. Students will examine how human relationships are influenced from a multicultural perspective.

CLED 600. Professional Orientation and Ethical Practice in Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: admission to counselor education program or permission of instructor. An introductory course for all students in counselor education that provides an overview of the counseling profession and explores ethical and legal standards in the counseling field. The course focuses on ethical standards of professional organizations, federal and state legal mandates and the application of ethical and legal considerations in counseling practice.

CLED 601. Theories of Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: admission to counselor education program or permission of instructor. Selected theories upon which counseling is based, with particular attention placed on the research underlying the theories. Primary focus on providing students with a theoretical foundation upon which to base their personal counseling approaches.

CLED 602. Techniques of Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires admission to counselor education program or permission of instructor. Theory and practice of counseling with emphasis on skill development.

CLED 603. Group Procedures in Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisites: CLED 600, CLED 601 and CLED 602. Analyzes the theories and practice of group work, the relationship of group activities to counseling, and specific skills in group techniques.

CLED 604. Practicum: School Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLED 603; and CLED 613 or CLED 622. Seminar and supervised field experience in individual and group counseling and classroom group guidance.

CLED 605. Career Information and Exploration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLED 600 and 601. Designed to provide the potential counselor with an understanding of theoretical approaches to career development in grades K-adult. Emphasis will be given to the relationship between counselor and student(s) in the career development process. A review of occupational, educational and personal/social information resources will be made.

CLED 606. Assessment Techniques for Counselors. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLED 600 and 601. Principles and techniques involved in selecting, scoring and interpreting standardized and nonstandardized assessment instruments used by counselors.

CLED 607. Multicultural Counseling in Educational Settings. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: instructor approval. A study of personal, social, political, affective and behavioral considerations of diversity. Multicultural competencies including awareness, knowledge and skills in counseling are emphasized. Efforts will be made to provide school counselors and postsecondary student affairs professionals with practical skills, strategies and techniques for use when working with students and families from a variety of cultural backgrounds.

CLED 608. Practicum: College Student Development and Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLED 603, CLED 605 and CLED 660; and CLED 620 or CLED 631. Seminar and supervised field experience in student services in postsecondary educational settings.

CLED 609. Couples and Family Counseling Practicum. 3 Hours.

Semester course; 3 practicum hours. 3 credits. Prerequisites: CLED 640, CLED 641, CLED 644 and CLED 645. Enrollment is restricted to counselor education students. This course will provide counseling and leadership experiences for advanced counselor education students. The goal of the course is to integrate concepts and skills and provide a clinically oriented experience with supervision. The material presented in class will focus on basic competencies and techniques necessary to counsel and will be delivered through lecture, discussions and supervised practical application which takes place in a local school or agency. The practicum consists of a minimum of 100 hours, with 40 hours being direct service, which is a combination of classroom guidance, individual and small-group counseling.

CLED 610. Counseling in Elementary and Middle Schools. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLED 600 and 601. An intensive study of school counseling programs for children and young adolescents. Emphasizes the role of elementary and middle school counselors in developmental guidance. Methods for classroom guidance will be discussed.

CLED 612. Wellness Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the counselor education program or with permission of the instructor. A survey course that introduces various theories and strategies that support wellness, holistic health and development. Topics include counselor and client wellness, trauma-informed wellness practices, stress, coping and resilience.

CLED 613. Data-driven Comprehensive School Counseling Programs. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students admitted to counselor education program or with permission of instructor. Considers the history of the profession, current issues and future trends. Addresses professional organizations and ethical guidelines and will focus on the role of school counselors in becoming advocates for students and leaders in the school environment.

CLED 615. Lifespan Development: A Gender Perspective. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Overview of human development theories and the impact of cultural gender messages on the developmental process.

CLED 620. Student Development Services in Higher Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisites: CLED 600 and CLED 601 or by permission of instructor. An overview of the organization and management of student services in postsecondary institutions. Areas such as admissions, career services, academic advising, residential life, financial aid, student development services, student union programming and management, and student activities are reviewed.

CLED 621. Secondary School Counseling Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CLED 600 and 601. An advanced course designed to provide a means for intensive study of secondary school counseling. The approach will be to integrate professional knowledge and skills from various disciplines as they relate to the work of the secondary school counselor.

CLED 622. School Counseling Services. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students admitted to counselor education program or with permission of instructor. Focuses on the organization, administration and delivery of school counseling services in pre-K-12 schools.

CLED 630. Clinical Supervision in the Counseling Profession. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Selected theories upon which clinical supervision in the counseling field is based, with particular attention placed on the research underlying the theories. Primary focus on providing students with a theoretical foundation upon which to base their supervision practice.

CLED 631. American College and University. 3 Hours.

3 credits. Examines historical and contemporary foundations of American higher education through the study of leading developments and of contemporary issues relating to the curriculum, aims and objectives and current directions of American colleges, universities and other institutional settings of higher education. Crosslisted as: EDUS 631.

CLED 633. Academic Leadership in Higher Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Analyzes how leadership in higher education is similar to and different from leadership in other organizational settings; explores challenges for leadership (such as access, cost and social responsiveness) and examines emerging leadership roles at various levels of the academic organization. Crosslisted as: EDUS 633.

CLED 640. Marriage, Couples and Family Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course provides students with an overview of the processes and theories involved with counseling couples and families. The focus is on preparing students to think systemically and to learn about family concepts, development, dynamics, theories, assessments and techniques. Counseling experience and feedback from the instructor and classmates will be provided. Students will use critical reflection throughout the semester while meeting the requirements of this course.

CLED 641. Advanced Family Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CLED 640. This course is designed to present the application of family counseling theory through systemic concepts, techniques and interventions utilized during family counseling sessions. The major emphasis is on basic relational processes (e.g., healthy family functioning, communication and conflict). In addition, the course addresses systemic perspectives for treatment planning and intervention for contemporary issues such as violence, addictions and abuse. Mock counseling experience and feedback from the instructor and classmates will be provided. Students will use critical reflection throughout the semester while meeting the requirements of this course.

CLED 642. Organization and Administration of Guidance Services. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of organizational principles and procedures necessary for the effective administration of guidance services. Consideration is given to procedures used in establishing guidance programs or modifying existing ones (or both), including the study of various community resources that can contribute to more efficient guidance services.

CLED 644. Sexuality Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CLED 640. This course is designed to present a foundational understanding for human relationships and sexuality, including sexual issues. Students will use critical self-reflection throughout the semester to examine their awareness, experience and values related to sexuality and the potential influence to counseling efforts.

CLED 645. Couples Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CLED 640. This course is designed to present the application of couple and marital counseling theory through systemic concepts, techniques and interventions utilized during couples counseling sessions. The major emphasis is on basic relational processes (e.g., healthy couple functioning, communication, intimacy and conflict). In addition, the course addresses systemic perspectives for treatment planning and intervention for contemporary issues such as violence, addictions and abuse. Mock counseling experience and feedback from the instructor and classmates will be provided. Students will use critical reflection throughout the semester while meeting the requirements of this course.

CLED 650. Addiction Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is an entry-level graduate course that provides counselors and other human service workers with an overview of the addictive process. Theories of addiction counseling and application of these theories will comprise a significant part of this course, particularly with how they apply to work with individuals, couples, families and groups. Co-occurring disorders, such as process addictions and mental illnesses will also be addressed. Students will develop conceptual knowledge, practical skills and self-awareness concerning the etiology of addiction, assessment strategies (including the use of wraparound assessment and intervention services), wellness strategies for facilitating optimal development and preventing clinician burn-out, and diagnosis and treatment planning. This will be accomplished through assigned readings, seminar discussions, videotapes, lectures, case presentations, guest speakers and student assignments.

CLED 660. Mental Disorders, Diagnosis and Treatment Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisite: CLED 603. The course examines the history, paradigms, theory and practice of mental health diagnosis, with primary emphasis on the identification of issues related to thinking (cognition), feeling (affect) and acting (behavior) upon which diagnoses are based. The purpose of this course is for students to become familiar with the study of mental disorders and learn the system of classification of mental disorders, the DSM-5.

CLED 672. Internship. 1-6 Hours.

Semester course; variable hours. 1-6 credits. Must be repeated for a total of at least six credit hours. Enrollment requires completion of all other CLED courses required for program. Seminar and supervised field instruction experience for counselors in K-12 settings or professionals in postsecondary settings. Designed to extend professional competencies under supervision of an approved licensed professional school counselor (K-12 settings) or approved student services professional (postsecondary settings). A total of 600 clock hours is required.

CLED 720. Counselor Education Doctoral Seminar I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to students admitted to counselor education concentration of the Ph.D. in Education program. Theories and skills of leadership, advocacy models, advocacy action planning and social change theories. Models and methods of program evaluation are examined and evaluations designed and implemented as part of leadership and advocacy efforts. Students demonstrate the ability to provide or contribute to leadership efforts of professional organizations/programs and to advocate for the counseling profession and its clientele.

CLED 721. Counselor Education Doctoral Seminar II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to students admitted to counselor education concentration of the Ph.D. in Education program. Instructional theory, counselor education methods and multicultural pedagogy, and the roles, responsibilities and activities of counselor educators. Students demonstrate course design, delivery and evaluation methods. Students also develop their professional writing skills and demonstrate the ability to write for journals, newsletters, presentation proposals and grant proposals related to the teaching and training of counselors.

CLED 730. Advanced Counseling Theories and Practicum. 3 Hours.

Semester course; 3 lecture hours and 100 on-site hours. 3 credits. Pre- or corequisite: CLED 720. Restricted to students admitted to counselor education concentration of the Ph.D. in Education program. Theories pertaining to the principles and practice of counseling, systems work, consultation and responding to crises, disasters and other trauma-causing events. Students demonstrate, at an advanced level, effective application of multiple counseling theories and interventions across diverse populations and settings, as well as advanced case conceptualization. This course includes a supervised 100-hour doctoral-level practicum.

CLED 740. Supervision in Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CLED 730; pre- or corequisite: CLED 721. Restricted to students admitted to counselor education concentration of the Ph.D. in Education program. Purposes, theoretical frameworks, models, roles of relationship, and practices of counselor/ clinical supervision. Students develop and demonstrate the application of theory and skills of clinical supervision as they refine their personal style of supervision.

CLED 750. Advanced Group Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CLED 740. Restricted to students admitted to counselor education concentration of the Ph.D. in Education program. Therapeutic factors of group work, theories of group work, including group counseling, evaluation of group work, group leadership characteristics, styles and behaviors. Students will demonstrate advanced group work skills and the ability to evaluate group climate, group leadership, group process and group outcomes.

CLED 760. Advanced Career Counseling and Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: CLED 740; pre- or corequisite: CLED 750. Restricted to students admitted to counselor education concentration of the Ph.D. in Education program. Principles and practice of career counseling, career counselor supervision and career program development beyond the beginning level. Students will demonstrate advanced career counseling work with a client, and beginning-level career counseling supervision. Part of this course includes developing and writing an article for publication based upon a theory-based career intervention structured in social justice and advocacy.

CLED 770. Advanced Leadership in Social Justice and Advocacy for Counselor Educators. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students admitted to the counselor education and supervision track of the Ph.D. in Education program or requires permission of the instructor. An overview of social justice frameworks in U.S. educational, community and agency settings, emphasizing theoretical approaches, social change and advocacy important to counselor educators, counseling leaders and other helping professionals. Focus will include engaging in social justice activism through implementing a community-based project in counseling or a related field, with impact at the individual, institution, policy and/or political levels.

CLED 810. Counselor Education Doctoral Internship in Teaching. 1-3 Hours.

Semester course; 1-3 field experience hours. 1-3 credits. May be taken for a total of six credits. Enrollment is restricted to students admitted to counselor education concentration of the Ph.D. in Education program. Supervised teaching experiences in counselor education and supervision. Internship is at the discretion and approval of the doctoral adviser and is based on student experience, training and career goals. The setting, goals, site supervisor and plan for the internship must be approved by the doctoral adviser. Students receive weekly supervision from their site supervisor and group supervision from a counselor education faculty member. Graded S/U/F.

CLED 811. Counselor Education Doctoral Internship in Research. 1-3 Hours.

Semester course; 1-3 field experience hours. 1-3 credits. May be taken for a total of six credits. Enrollment is restricted to students admitted to counselor education concentration of the Ph.D. in Education program. Supervised research experiences in counselor education and supervision. Internship is at the discretion and approval of the doctoral adviser and is based on student experience, training and career goals. The setting, goals, site supervisor and plan for the internship must be approved by the doctoral adviser. Students receive weekly supervision from their site supervisor and group supervision from a counselor education faculty member. Graded S/U/F.

CLED 815. Transdisciplinary Research in the Study of Mental Health and Wellness. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Enrollment is restricted to doctoral-level students or by permission of the instructor. This course is designed to advance student learning on transdisciplinary science as it relates specifically to mental health and wellness and expand their understanding of the role of research in the addressing of social problems through an ecological lens. This course will also serve as an opportunity for students to practice transdisciplinary research skills; exercise critical evaluation of transdisciplinary research methods; and employ critical reflection to address research questions with a transdisciplinary approach. Content of this course will include an examination of philosophy, philosophical principles and traditional and current theoretical understanding of transdisciplinary research in mental health and wellness. Students will examine the rationale behind and the consequences of their notions of community mental health and wellness concerns, and explore the conditions that influence human behavior and change factors associated with mental health and wellness. Students will use critical reflection throughout the semester while meeting the requirements of this course.

Early Childhood Special Education (ECSE)**ECSE 500. Language/Communication Intervention for Young Children with Disabilities. 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Undergraduate students must have permission of the instructor prior to registration for this course. This course emphasizes how children learn to communicate and how to facilitate communication development. The course includes examination of language development, language differences and disorders, language facilitation, and relationship of language to literacy. Course content and assignments include information about evidence-based practices and promote critical reflection and problem-solving skills.

ECSE 501. Principles of Infant/Early Childhood Mental Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: ECSE 201, ECSE 202 and ECSE 303; or SEDP 501 or ECSE 541; or permission of instructor. Enrollment is restricted to students with a minimum of 60 credit hours (junior or senior standing) or graduate students. Non-degree seeking students may enroll in this course with permission of instructor. This course provides an introduction to issues related to infant and early childhood mental health. Parent-child attachment, risk, resilience, assessment and intervention strategies will be discussed through the lens of relationship-based practice.

ECSE 541. Infants and Young Children With Special Needs. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Course offered online. Undergraduate students must have permission of the instructor prior to registration for this course. This course focuses on the foundations for early intervention and education, with emphasis on early intervention research, typical and atypical development, family and community contexts for development, professional standard and current policy issues.

ECSE 542. Family/Professional Partnerships. 2 Hours.

Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Undergraduate students must have permission of the instructor prior to registration for this course. Theory and practice relevant to working with families of children with disabilities. Family-centered services and cultural sensitivity are emphasized. Provides an overview of family processes and reactions to having a child with a disability, strategies for helping family members support and work with their children, available community resources and legal rights of families and children with disabilities.

ECSE 601. Assessment of Infants and Young Children with Disabilities. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides knowledge and practical applications for the identification, placement and assessment for program planning and evaluation of children with disabilities ages birth through five.

ECSE 602. Instructional Programming for Infants and Young Children with Disabilities. 3 Hours.

Semester course; 3 lecture hours; 3 credits. Offered in hybrid format. This course provides the knowledge, skills and methods necessary to deliver effective education to infants, toddlers and preschoolers with disabilities and their families. The course includes readings, discussions and activities on topics central to understanding the conceptual and theoretical foundations underlying current educational curricula and methods. The course emphasizes blending recommended practices from early childhood education and early childhood special education, family-centered service delivery, cultural competence, inclusive placements, and research-based intervention. Course content and assignments promote critical reflection, collaborative decision-making and problem-solving skills to be used in planning and implementing programs for young children with special needs and their families.

ECSE 603. Integrated Early Childhood Programs I. 2 Hours.

Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Examines the needs, opportunities, resources and barriers to early intervention and inclusive early childhood programs in Virginia and local communities. State and federal laws and policies, research-based practices and local models will be studied to understand the context for systems change. A planning process that includes funding mechanisms, staffing patterns, curricula service models, family participation options, resource coordination and program evaluation procedures will be emphasized.

ECSE 604. Early Literacy and Augmentative Communication. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Designed to increase the professional knowledge and skills of early childhood special educators to meet the literacy needs of young children with disabilities through the use of technology.

ECSE 605. Integrated Early Childhood Programs II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: ECSE 603. Examines the needs, opportunities, resources and barriers to early childhood intervention and inclusive early childhood programs in Virginia and local communities. State and federal laws and policies, research-based practices, and local models will be studied to understand the context for systems change. A planning process that includes funding mechanisms, staffing concerns, curricula service models, family participation options, resource coordination and program evaluation procedures will be emphasized.

ECSE 641. Interdisciplinary Methods in Early Intervention. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course focuses on the nature and characteristics of major disabling and at-risk conditions for infants and young children and the influence of interdisciplinary teamwork in service delivery. Emphasis is given to the medical aspects of young children with disabilities and the management of neurodevelopmental and motor disabilities. Review of adaptive equipment and its safe use, as well as selection and implementation of appropriate assistive technology will be covered. The importance and role of collaborative planning teams that include families and professionals from various disciplines, including health care, will be discussed. Essential teamwork skills will be learned and students will reflect on the application of those skills in practice.

ECSE 672. Internship in Early Development and Intervention. 1-6 Hours.

Semester course; 1-2 field experience hours. 1-2 credits. May be repeated for a maximum of six credits. Designed to provide practical experience in different community programs that serve young children (birth to 5) from various cultural and linguistic backgrounds, who are at risk for or have developmental disabilities, and their families. These observation, participation and service-learning experiences are distributed across the graduate program, linked to other core content courses documented via portfolios and aligned with professional standards. This course includes site-based requirements.

ECSE 700. Externship. 1-6 Hours.

Semester course; 1-6 field experience hours. 1-6 credits. May be repeated for a maximum of nine credits. Enrollment requires permission of the department. Plan of work designed by extern with prior approval of the offering department. State certification or equivalent may be required for some externships. Off-campus planned experiences for advanced graduate students designed to extend professional competencies, carried out in a setting, under supervision of an approved professional. Externship activities monitored and evaluated by university faculty. This course includes site-based requirements.

Education (EDUC)**EDUC 697. Collaborative Scholarship. 3 Hours.**

Semester course; 3 research hours (delivered online, face-to-face or hybrid). 3 credits. This research course is designed to develop, apply and refine the research/scholarship skills and interests of students under the guidance and supervision of a faculty mentor. Activities will be monitored and evaluated by university faculty. Graded S/U/F.

EDUC 700. Externship. 1-6 Hours.

Semester course; 1-6 practicum hours. 1-6 credits. May be repeated for a maximum of 9 credits. Enrollment requires permission of department. Plan of work designed by extern with prior approval of the offering department. State certification or equivalent may be required for some externships. Off-campus planned experiences for advanced graduate students designed to extend professional competencies, carried out in a setting, under supervision of an approved professional. Externship activities monitored and evaluated by university faculty.

EDUC 797. Directed Research. 1-9 Hours.

Semester course; 1-9 variable hours. 1-9 credits. Enrollment restricted to students who have completed first-year Ph.D. courses in education or by permission of program director. The course provides doctoral students the opportunity to do hands-on research prior to the dissertation project that is relevant to their substantive area or individual learning needs. The topic and specific project will be initiated by the student and implemented in collaboration with a School of Education faculty member. A proposal for a directed research course must be submitted that specifies how the student will gain experience, knowledge and skills in one or more aspects of conducting a research project. Graded S/U/F.

EDUC 798. Thesis. 1-6 Hours.

Semester course; 1-6 variable hours. 1-6 credits. May be repeated for a maximum of 6 credits. A research study of a topic or problem approved by the student's supervisory committee and completed in accordance with acceptable standards for thesis writing. Graded S/U/F.

EDUC 899. Dissertation Research. 1-9 Hours.

Semester course; 1-9 variable hours. 1-9 credits. May be repeated. A minimum of 6 semester hours required. Enrollment restricted to students who have successfully completed comprehensive examinations. Dissertation work under direction of dissertation committee. Graded as S/U/F.

Educational Leadership (EDLP)

EDLP 641. Independent Study. 1-6 Hours.

Semester course; 1-6 independent study hours (delivered online, face-to-face or hybrid). 1-6 credits. May be repeated for a maximum of nine credits. Determination of the amount of credit and permission of the instructor and department chair must be procured prior to registration. An individual study of a specialized issue, problem or topic in leadership. Study is conducted under the guidance of a VCU faculty mentor who assists the student in planning and implementing the course of study.

EDLP 700. Learning Networks. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Exploration of characteristics of effective leaders, team members and organizations. Personal inventories related to leadership skills; team-building and team-participation skills; learning preferences; preferences for processing information and for decision-making. Results of inventories are analyzed, combined with learned theories and applied to practice.

EDLP 702. Organizational Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Critical analysis of equity issues and leadership actions in a specific context. Application of theory and research approaches to an organizational setting.

EDLP 704. Legal Perspectives. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Study of the U.S. legal system, legal opinions and the impact of laws and policy on educational sectors. Critical analysis of legal and policy issues. Application of legal understandings to a specific identified issue.

EDLP 705. Policy and Ethics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Study and analysis of leadership and organizational issues from policy and ethics perspectives.

EDLP 708. Leadership and Crisis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Study of leadership with a focus on crisis management, trauma-informed practice, leadership presence and communication strategies.

EDLP 709. Equity and Leadership. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Explores theory and research regarding diversity, equity, inclusion, social justice and decolonization in organizational contexts.

EDLP 711. Data and Leadership I. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Introduction for scholar-practitioners to quantitative approaches on gathering and analyzing data, such as measurement principles, secondary database analysis and survey design. Emphasis on consumption of research, communicating about research and using research to inform practice and policy.

EDLP 712. Culture Change. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Study of theory and research about organizational structures, culture and change. Emphasis on assessment and analysis of organizational structures and culture, developing inclusive cultures, and implementing change processes.

EDLP 713. Data and Leadership II. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Introduction for scholar-practitioners to qualitative approaches to gathering and analyzing data, such as interviews, focus groups, document analysis and observation. Emphasis on consumption of research, communicating about research and using research to inform practice and policy.

EDLP 714. Systems Change. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Study of theory and research about systems and systems change utilizing principles of improvement science. Emphasis on analyzing root historical and institutionalized issues at the core of a system's ability to change, and generating theories of change and coherent strategies that address diverse elements of the system.

EDLP 715. Professional Writing. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Develop skill sets to become scholar-practitioners. Focus on what it means to be a scholar-practitioner; critical review and synthesis of literature sources and of scholarly sources and practical knowledge; translation of research and theory to practice and policy to effectively communicate writing across various audiences.

EDLP 716. Principles for Professional Writing II. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Study of scholarly writing styles and report formats appropriate to various audiences. Development of comprehensive written product suitable for distribution in student's setting. Focus is on conveying themes and drawing conclusions from scholarly research.

EDLP 717. Data Visualization. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Study of data analytics relevant to communicating effectively about data and their implications for leadership decisions. Focus on styles and methods of writing related to conveying results of data analyses, including development of graphs, tables, charts and figures, and presentation materials.

EDLP 718. Budgeting and Finance. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Study of finance systems, budgeting and cost analysis. Analysis and development of budgets using equity, efficiency, legal and ethics perspectives. Understanding of cost analysis principles and techniques. Application of theory to practical, real-life contexts.

EDLP 790. Capstone Development. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Supervised research. Client-based project. Designed to develop and refine the skills applicable to the preparation of an acceptable description of a capstone project. Development of background, review of research, project objectives and methods for gathering data, in consultation with capstone chair and client.

EDLP 798. Capstone Plan Implementation. 3-6 Hours.

Semester course; 3-6 research hours (delivered online, face-to-face or hybrid). 3-6 credits. Prerequisite: EDLP 790. Supervised research. Client-based project. Conducting of research related to project developed in the prerequisite course, with guidance from capstone project chair and client. Study of data management processes. Development of interim reports for capstone committee and client. Graded as S/U/F.

EDLP 799. Capstone Completion. 3-6 Hours.

Semester course; 3-6 research hours (delivered online, face-to-face or hybrid). 3-6 credits. Prerequisite: EDLP 798. Supervised research. Client-based project. Continuation of capstone implementation. Focus on developing conclusions and recommendations based upon data analyses. Presentation of capstone project to capstone committee and client. Graded as S/U/F.

Educational Studies (EDUS)**EDUS 500. Workshop in Education. 1-3 Hours.**

Semester course; 1-3 credits. Repeatable to 6 credits. Designed to focus on a single topic within a curriculum area, the workshop offers graduate students exposure to new information strategies and materials in the context of a flexible instructional framework. Activities emphasize a hands-on approach with direct application to the educational setting.

EDUS 514. Parent-child Relations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A methods course in parent-child communications and problem solving. Designed to enable parents and professionals to understand and relate more effectively with children.

EDUS 594. Topical Seminar. 1-3 Hours.

Semester course; variable hours. 1-3 credits. May be repeated for a maximum of 6 credits. A seminar intended for group study by students interested in examining topics, issues or problems related to teaching and learning.

EDUS 601. Philosophy of Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of basic philosophies that have contributed to the present-day educational system. Attention will be given to contemporary philosophies and their impact on educational aims and methods.

EDUS 602. Adolescent Growth and Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Contemporary learning theories and their implications for teaching the adolescent learner. Emphasis will be placed on specific problems of adolescent growth and development as they relate to the learning situation.

EDUS 603. Seminar in Child Growth and Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Intensive study of child growth and development and application of this knowledge. Emphasis on current research.

EDUS 604. Adult Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An introductory study of adult development from the life cycle perspective with implications for educators working with adults. Emphasis will be placed on major physiological, psychological, sociological, and anthropological factors that make adults distinct from earlier developmental levels.

EDUS 605. Child and Adolescent Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines theory and practical applications of the research about the cognitive, social and physical development of children and adolescents. Emphasizes issues that affect students in school environments.

EDUS 606. Review of Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated for a maximum of 9 credits. Application of research findings to a specific educational area of study. Emphasis is on the consumption and utilization of research findings rather than the production of research evidence.

EDUS 607. Advanced Educational Psychology. 3 Hours.

Semester course; 3 lecture hours (delivered online, hybrid or face-to-face). 3 credits. Application of the principles of psychology to the teaching-learning process. Discussion will focus on the comprehensive development of individual learning experiences and educational programs from the point of view of the PK-12 educator and administrator.

EDUS 608. Educational Statistics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. An introductory-level statistics class focusing primarily on techniques of inferential analysis. The course focuses on basic concepts in quantitative design and analysis for educational research, probability theory, null hypothesis significance testing, inferential statistics including the t-test and analysis of variance, and applications of statistics to applied problems in education.

EDUS 609. Learning and Motivation in Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines perspectives on learning and motivation in school settings.

EDUS 610. Social Foundations of Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of significant social issues involved in the development and operation of schools and other educational institutions and processes.

EDUS 612. Education and the World's Future. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An examination of education as it relates to future changes in other areas: population, energy, transportation, family, etc. The course will consist of readings dealing with educational change as well as a series of modules where students will engage in future exercises, games and projects.

EDUS 613. Educational Change. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Developing the skills for planned program change through the use of systematic inquiry, systems analysis and systems approaches through systems concepts. Provides opportunities for students to develop "mini (classroom) changes" or "macro (school district) changes" through the use of systems.

EDUS 614. Contemporary Educational Thought. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will be devoted to a critical examination of educational ideas and programs emanating from contemporary writings on education. Students will be encouraged to develop critical skills of analysis in examining such writings utilizing historical and philosophical perspectives.

EDUS 617. Advanced Educational Psychology for Secondary Teachers. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Application of the principles of psychology to the teaching-learning process in the secondary classroom. Discussion will focus on the comprehensive development of individual learning experiences and educational programs from the point of view of the educator and administrator. Crosslisted as: PSYC 657.

EDUS 620. Human Development in Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines issues in human development as they relate to the education of youth and young adults.

EDUS 621. Motivation in Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines issues in motivation as they relate to teaching and learning.

EDUS 631. American College and University. 3 Hours.

3 credits. Examines historical and contemporary foundations of American higher education through the study of leading developments and of contemporary issues relating to the curriculum, aims and objectives and current directions of American colleges, universities and other institutional settings of higher education. Crosslisted as: CLED 631.

EDUS 632. Understanding Social Foundations and Contemporary Issues in American Higher Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the purpose of higher education and whether this purpose has changed over time, exploring the reasons for change; studies how the academy is responding to social pressures; and explores scenarios for future change. Crosslisted as: ADLT 632.

EDUS 633. Academic Leadership in Higher Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Analyzes how leadership in higher education is similar to and different from leadership in other organizational settings; explores challenges for leadership (such as access, cost and social responsiveness) and examines emerging leadership roles at various levels of the academic organization. Crosslisted as: CLED 633.

EDUS 639. Race, Ethnicity and Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A cross-disciplinary examination of issues related to race, ethnicity and cultural diversity in education. This course works under the premise that race is an essential social category of analysis for the policies and everyday practices experienced in U.S. society. Students will review a variety of historical and contemporary theories of race from early foundations of race theory to relevant contemporary theories and methodological approaches to research and problem resolution strategies. Crosslisted as: TEDU 639.

EDUS 641. Independent Study. 1-6 Hours.

Semester course; 1-6 credits. May be repeated for a maximum of 9 credits. Determination of the amount of credit and permission of the instructor and department chair must be procured prior to registration. Cannot be used in place of existing courses. An individual study of a specialized issue or problem in education.

EDUS 651. Topics in Education. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for 9 credits. Check with department for specific prerequisites. A course for the examination of specialized issues, topics, readings or problems in education.

EDUS 658. Community-Based Action Research for Education Stakeholders. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course introduces students to a research approach that engages school and/or community stakeholders. The course focuses on action-based research designs with a thoughtful and critical focus on community-based participatory action research and related approaches, such as participatory action research, youth participatory action research and community-engaged research. The course will explore this work as it occurs in school- and community-based settings, as well as within research-practice partnerships. Collectively, these approaches offer students not just a set of methods, but seek to equip them with the skills and insights to fundamentally change the relationship between researchers and research participants and the power dynamics of the knowledge production process. The course attends to the following questions: How can research help with addressing real-world problems in education? How can data collection and knowledge creation through praxis be participatory in a truly democratized, co-owned and emancipatory process? And, how can educational stakeholders use action research as a means to transcend disciplinary boundaries in order to positively impact social and educational change? Crosslisted as: ADMS 658.

EDUS 660. Research Methods in Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, hybrid or face-to-face). 3 credits. Designed to provide an introductory understanding of educational research and evaluation studies. Emphasizes fundamental concepts, procedures and processes appropriate for use in basic, applied and developmental research. Includes developing skills in critical analysis of research studies. Analyzes the assumptions, uses and limitations of different research designs. Explores methodological and ethical issues of educational research. Students either conduct or design a study in their area of educational specialization.

EDUS 661. Educational Evaluation: Models and Designs. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EDUS 660 or permission of instructor. A comprehensive review of the major evaluation theories and models including their focus, assumptions, designs, methodologies and audiences in educational policy making and program development. Designed for students to gain an understanding of alternative procedures of educational evaluation, an in-depth knowledge of at least one theoretical approach to evaluation and skills in interpretation of evaluation studies for policy and in developing an evaluation design for their area of specialization.

EDUS 662. Educational Measurement and Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an understanding of basic concepts of educational measurement and evaluation. Includes development, interpretation and use of norm-referenced and criterion-referenced measures, standardized instruments and qualitative assessments applicable to a wide variety of educational programs and settings. Students study in-depth measurement and/or evaluation procedures in their specialization.

EDUS 663. Applied Multivariate Statistics in Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EDUS 608 or equivalent. Examines multivariate statistical analysis and evaluation research methods with application to educational research. Emphasizes advanced regression, including moderator and mediator analysis, logistic regression, repeated measures ANOVA, factor analysis, cluster analysis and introductions to multilevel modeling and structural equation modeling as they are applied in the field of educational research.

EDUS 664. Multilevel Modeling in Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EDUS 608 or equivalent. Examines multilevel statistical analysis and evaluation research methods with application to educational research. Emphasizes both cross-sectional and longitudinal multilevel models, as well as cross-classified and generalized linear models as they are applied in the field of educational research.

EDUS 665. Assessment Issues and Design for Classroom Practice and Education Policy. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course explores all aspects of assessment that a teacher encounters in prek-12 educational settings and in doing so provides a strong foundation for emerging educational researchers and evaluators in the area of assessment. Classroom discussion will focus on current assessment theories, dimensions of assessment literacy and assessment strategies used to monitor and measure student learning in today's classrooms -- including students with and without disabilities and English language learners, as well as accounting for students' diverse cultural backgrounds and experiences. Assessments at all stages of instruction (before, during and after), including formal and informal assessments and their applications in, and for, inclusive educational settings will be discussed. Particular attention will be paid to the ways in which teachers can gather and use assessments to make decisions to support effective instruction and intervention to support student growth and learning. Specifically, the course will explore the relationships among content standards, instruction and assessment, as well as ways to use a variety of assessments to monitor student progress. The course emphasizes making valid inferences from assessments in a variety of formats, understanding the legal and policy context of assessment, and the implications for appropriate grading practices and decision-making.

EDUS 667. Applied Structural Equation Modeling in Education. 3 Hours.

Semester course; 3 lecture hours (delivered face-to-face or hybrid). 3 credits. Prerequisite: EDUS 663 or equivalent. Enrollment is restricted to students enrolled in the Ph.D. in Education program. Students are expected to have some basic knowledge of multiple regression and multivariate data analysis. Most of the statistical methods in this course are an extension of regression and multivariate models. This course provides students with an understanding of basic concepts and statistical procedures of structural equation modeling in educational research. Students will learn to perform analyses in Mplus and R. These analyses will allow the class to examine the interrelationships among variables based on the proposed theoretical model and simultaneously handle measurement error issues and statistical biases. The analyses cover path analysis, measurement models (exploratory and confirmatory factor analysis), SEM with continuous and categorical variables, multi-group SEM, measurement invariance, latent growth models, latent class analysis and multilevel SEM.

EDUS 668. Applied Machine Learning in Education Research. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: EDUS 608 or equivalent. This is an advanced-level course tailored for graduate students in education and related social science disciplines who are interested in integrating machine learning techniques in their research. Students will delve deep into core machine learning algorithms, data processing techniques and applications specific to education research challenges. The course will combine the technical rigor of machine learning with the nuances and needs specific to educational research. With a blend of individual mentorship, peer feedback and practical applications, students will be empowered to not just understand, but to apply these techniques to their research, producing work that stands up to academic scrutiny and has the potential for real-world impact.

EDUS 672. Internship. 1-6 Hours.

Semester course; 1-6 credits. May be repeated for a maximum of 12 credits. Prerequisite: Permission of adviser. Study and integration of theory with practice in clinical or off-campus settings supervised by an approved professional and university faculty. May include seminars, selected readings, projects and other activities designed and evaluated by supervising faculty.

EDUS 673. Democracy, Equity and Ethics in Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course is designed to engage participants in a critical exploration of education issues and inequities within sociocultural, historical and philosophical contexts. Students will examine the relationship between an increasingly diverse society and democracy in education. The course will also develop strategies for participants to understand the ethical obligations of educational professionals and to become active agents for democratic, equity-oriented schools.

EDUS 690. Academic Writing and Publishing. 3 Hours.

Semester course; 3 seminar hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment requires permission of the instructor. The purpose of this course is to assist doctoral students in developing and refining a journal article manuscript for publication. The course is designed to be individualized to specific student needs and goals. The primary aim of the course is to facilitate and provide feedback on each student's manuscript in preparation for submission. Graded S/U/F.

EDUS 701. Urban Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of urban education from historical and contemporary perspectives. This course includes study of the educative effect of urban environments; the development of public and private urban educational systems; the influence of social, political, and economic factors on urban educational programs; and the impact of theories, proposals, and practices on alternative futures.

EDUS 702. Foundations of Educational Research and Doctoral Scholarship I. 3 Hours.

3 lecture hours. 3 credits. This interdisciplinary seminar is the first part of a two-semester sequence. Students will learn about the nature of scholarly inquiry and the worth of situating research within its wider social and political contexts. Course will deal with limitations of knowledge and knowing and aid students in understanding major themes in the field of epistemology. Emphasis will be given to the nature and structure of knowledge and evidence, justification of beliefs, beliefs about "truth," naturalized epistemology and the role of skepticism in inquiry and advanced study. EDUS 702 and 703 are continuous courses.

EDUS 703. Foundations of Educational Research and Doctoral Scholarship II. 3 Hours.

3 lecture hours. 3 credits. Prerequisite: EDUS 702. This interdisciplinary semester is the second part of a two-semester sequence. Students will deepen their understanding of scientific inquiry and apply an understanding of epistemology to a critical analysis of various philosophies of research and paradigms that exist (e.g.: positivism, constructivism, etc.). Emphasis will be placed on the relationships among research, politics, policy and ethics. Examples will be drawn from research on urban issues and deal with issues such as race, class and gender in education. EDUS 702 and 703 are continuous courses.

EDUS 706. Educational Theory and Praxis in Historical and Contemporary Contexts. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This seminar focuses on philosophies of education with particular attention paid to ways of thinking about seminal ideas and their relationships to education and social, institutional, economic and cultural change in the U.S. It considers how broader social phenomena affect the purposes and structures of educational institutions as well as how educational change affects wider society. Additionally, it highlights challenges for social change within and through public schools given institutional, social and political influences. Key topics include: schooling for democracy; progressivism, pragmatism and education; eco-education; behaviorism and social utopias; multiculturalism/pluralism; contemporary political educational discourse; and the roles of theory/philosophy in education. This course offers opportunity for students to engage with theories of social change that place education/schooling at the center. It provides space for students to develop a philosophical framework for their work as well as a means to deepen their understandings of educational research, policy and theory. Finally, this course requires students to begin to put their ideas into action in educational and other social contexts by means of a community engagement/organization component. The worth of engaging with and not just learning about the curriculum, culture and change is a core value of the program and in this course we will work hard to both study about and participate in the overlapping worlds of theory/academia and education-related social action.

EDUS 707. Socio-cultural Perspectives on Schooling, Society and Change. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This seminar focuses on the critical analysis of contemporary schooling in the U.S. and investigates how educational institutions work from a sociological-cultural perspective. The structure of schooling is analyzed through such topics as the social organization of schooling, stratification within and among schools, youth culture and student peer groups, curriculum and the stratification of knowledge, and equality of educational opportunity as mitigated by such factors as social class, race, ethnicity and gender. Discussions about current social theories and debates in education are combined with lessons drawn from social justice-based research on the politics of schooling and institutional transformation. In sum, the course provides a framework for informed participation in debates on controversial educational issues at the macro level, including school reform and educational policy, thereby equipping future curriculum and instruction leaders with the tools they need to affect change.

EDUS 710. Quantitative Research Design. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: EDUS 608 or equivalent. An examination of quantitative research designs and concepts commonly utilized in conducting research in applied educational settings. Fundamental principles of research are extended to cover such topics as experimental designs, quasi-experimental designs, observational designs, secondary data analysis, advanced analysis of variance designs and multiple regression analysis.

EDUS 711. Qualitative Methods and Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: graduate-level statistics course, and EDUS 660 or equivalent, or permission of instructor. Examines qualitative research designs and inductive analysis, including research traditions, problems formulation in fieldwork, purposeful sampling, interactive data collection strategies, research reliability and validity. An interdisciplinary approach is used. Students conduct a small field study in their specialization.

EDUS 712. Mixed Methods Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: graduate-level statistics course, EDUS 660 and EDUS 711 or equivalents, or permission of instructor. Examines mixed methods research designs, including the major philosophical perspectives of mixed methodology, as well as the challenges and strategies for data collection and analysis procedures across designs.

EDUS 713. Critical Methods in Educational Research for Justice and Equity. 3 Hours.

Semester course; 3 lecture hours (delivered face-to-face or hybrid). 3 credits. Prerequisites: EDUS 710 and EDUS 711, or equivalents, or with permission of the instructor. Enrollment is restricted to students enrolled in the Ph.D. in Education program. This course focuses on critical educational research in the scholar-activist model. Through engaging with critical theoretical frameworks, critical empirical research and research methods, this course prepares students to produce research and scholarship for social justice and equity in education.

EDUS 714. Qualitative Data Analysis. 3 Hours.

Semester course; 3 seminar hours (delivered face-to-face or hybrid). 3 credits. Prerequisite: EDUS 711 or equivalent. Enrollment is restricted to students enrolled in the Ph.D. in Education program. This graduate seminar surveys methods of text analysis. The focus of the course is on developing skills that students can use to do systematic analysis of textual data, including written, text, photos, and audio or video data. This course will explore a range of inductive and deductive approaches and will cover analytic skills that cut across traditions, including theme identification, code definition and construction of codebooks, as well as teamwork in text analysis. Advanced topics covered will include grounded theory, classical content analysis and word-based analysis. This course is also designed as a practicum in qualitative data collection and analysis, which will include participant interviewing.

EDUS 720. Seminar in Cognition and School Learning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines topics in cognition that explain students' learning such as expertise, problem solving, cognitive strategies instruction and development of the knowledge base. Supportive instructional techniques will also be considered.

EDUS 721. Advanced Seminar in Social Processes in Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the theoretical/conceptual and empirical bases of various social processes and their relationship to educational outcomes. The content covered is designed to provide students with a survey of literature and research on a number of topics that examine these relationships from individual, contextual/environmental and policy perspectives. Current developments with regard to research methodologies in these areas will also be considered.

EDUS 780. Researching Lived Experience: Post Phenomenology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EDUS 711, NURS 770, SWKD 704, SBHD 638 or equivalent basic qualitative research course or with permission of the instructor. This advanced qualitative research course focuses on “sensitive” approaches to the study of lived experience (phenomenology) before it is reduced by reflection to words and even before lived experience is felt or emerges as “an experience” (posthumanism). In this course, cherished qualitative notions – validity, experience, subjectivity, coding, thematic analysis, identity, voice, language, etc. – are interrogated, and rigor is invested in an open style of wondering, engaging, writing and creating that transcends the authority of an author acting on its own. The course is conceptually grounded in continental philosophy. Lively philosophical passages and research studies – drawn from feminism, affect theory, critical theory and other fields – are augmented with activities that keep concepts vibrant, immediately useful and dynamically in play throughout the semester. Crosslisted as: TEDU 780.

EDUS 790. Educational Research Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides doctoral students with opportunities to investigate research areas related to their doctoral studies. Students and instructor will critique student conducted literature reviews and preliminary research proposals.

EDUS 795. Professional Seminar in Educational Issues. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Limited to students in Ph.D. in Education program. Interactive seminar discusses contemporary educational issues based on research in the historical, philosophical, psychological, sociological, political and economic foundations of education. Includes active participation by students as well as guest lectures by scholars from various academic disciplines.

EDUS 890. Dissertation Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of director of doctoral studies. Designed to develop and refine the skills applicable to the preparation of an acceptable draft of a dissertation prospectus.

English/English Education (ENED)**ENED 601. Young Adult Literature. 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Examination of literature written for young adults, literature appropriate for young people in middle schools and high schools. Focuses on the content, characteristics and teaching of such literature. Crosslisted as: ENGL 601.

Interdisciplinary Developmental Disability Studies (IDDS)**IDDS 600. Teamwork in Serving Persons With Developmental Disabilities. 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides information and activities on models of teamwork, group decision making, team process, leadership and communication and how they influence services for persons with disabilities and their families; content/discussion focuses on the roles and functions of individuals from various disciplines (including parents) as team members; includes case studies and simulations of interdisciplinary teamwork in action.

IDDS 601. Resilience: Models, Research and Applications. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Overview of resilience models and research across the life span in diverse populations. Interdisciplinary emphasis on applying this overview to prevention and intervention programs at individual, family, school, community and societal levels.

IDDS 602. Leadership in Developmental Disabilities. 2 Hours.

Semester course; 2 lecture hours. 2 credits. A team-taught seminar in leadership development with particular emphasis on issues related to children with developmental disabilities.

IDDS 603. Clinical and Community Services for Children with Neurodevelopmental Disabilities. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Team-taught by faculty from the Leadership Education for Neurodevelopmental Disorders (LEND) program using problem-based learning. Students will learn the interdisciplinary approach to services for children with neurodevelopmental disabilities with an emphasis on evidence-based practices, the medical home and sources of community support.

IDDS 604. Interdisciplinary Studies in Developmental Disabilities: LEND Seminar I. 4 Hours.

Semester course; 4 seminar hours (delivered online, face-to-face or hybrid). 4 credits. Enrollment is restricted to students who have applied to and been accepted as a trainee or fellow in the Va-LEND program. Provides information and activities on models of teamwork, group decision-making, interdisciplinary team process, communication strategies and leadership skills. Focus is on how teamwork and leadership influence services for children with developmental disabilities and their families.

IDDS 605. Interdisciplinary Studies in Developmental Disabilities: LEND Seminar II. 4 Hours.

Semester course; 4 seminar hours (delivered online, face-to-face or hybrid). 4 credits. Enrollment is restricted to students who have applied to and been accepted as a trainee or fellow in the Va-LEND program. Students will learn the interdisciplinary approach to services for children with neurodevelopmental disabilities with an emphasis on research and evidence-based practices, pertinent legislation, the medical home and sources of community support.

IDDS 672. Practicum in Disability Leadership. 1-4 Hours.

Semester course; 1-4 practicum hours. 1-4 credits. May be taken for a total of 4 credits. Study and integration of interdisciplinary practice in clinical or off-campus settings. Supervised by interdisciplinary faculty. Includes interdisciplinary clinical practice, family mentorship experience, disability policy activities, leadership project and professional development activities specific to leadership education for developmental disabilities. Trainees will have an opportunity to function as both team members and team leaders in addressing the needs of children with disabilities or other special health care needs and their families. This course includes site-based requirements.

IDDS 691. Special Topics in Developmental Disabilities. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Prerequisite: Permission of graduate faculty adviser, course faculty coordinator, and director of preservice training at the Virginia Institute for Developmental Disabilities. Explores specific interdisciplinary content and issues in the field of developmental disabilities and examines the practice approaches of multiple disciplines.

IDDS 692. Directed Study in Developmental Disabilities. 1-4 Hours.

Variable hours. 1-4 credits. Prerequisite: Permission of graduate faculty adviser and director of preservice training at the Virginia Institute for Developmental Disabilities. Provides an independent study in a specific area of interdisciplinary practice in developmental disabilities developed under the supervision of a member of the graduate faculty.

Reading (READ)**READ 600. Analysis and Correction of Reading Problems. 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: TEDU 561 or permission of instructor. An analysis of factors relating to reading difficulty. Diagnostic testing procedures and instructional strategies appropriate for the reading specialist in clinical and classroom settings will be emphasized.

READ 601. Psycholinguistics and Language Arts Curriculum. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An investigation of the psychological processes involved in language behavior and the relationship of these processes to the teaching of the basic communication skills.

READ 602. Literacy for Adults. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An examination of methods, strategies and techniques appropriate for teaching adult readers functioning at levels ranging from beginning to college level. Assessment issues, basic reading concepts, skills, and adult reading methods and materials are analyzed. Focus is on adapting teaching techniques for use with adults in various academic and life settings.

READ 605. Organizing and Implementing Reading Programs. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Integrates reading theory with program implementation. Analyzes the role of reading specialist as related to program design, assessment, supervision, instruction, and resource responsibilities. Includes specific field-based requirements.

READ 672. Internship. 1-6 Hours.

Semester course; 1-6 field experience hours. 1-6 credits. May be repeated for a maximum of 12 credits. Prerequisites: READ 600 and TEDU 561. Study and integration of theory with practice in clinical or off-campus settings supervised by an approved professional and university faculty. May include seminars, selected readings, projects and other activities designed and evaluated by supervising faculty. This course includes site-based requirements.

READ 691. Topics in Reading. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Examines recent trends and topics within the field. Includes review of pertinent research, examination of policy issues and investigation of historical movements. Clinical application is included as appropriate.

READ 700. Externship. 1-6 Hours.

Semester course; 1-6 field experience hours. 1-6 credits. May be repeated for a maximum of 9 credits. Prerequisite: READ 605. Plan of work designed by extern with prior approval of the offering department. State certification or equivalent may be required for some externships. Off-campus planned experiences for advanced graduate students designed to extend professional competencies, carried out in a setting, under supervision of an approved professional. Externship activities monitored and evaluated by university faculty. This course includes site-based requirements. Graded as Pass/Fail.

Special Education and Disability Policy (SEDP)**SEDP 501. Characteristics of Individuals with Disabilities: ____ 3 Hours.**

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course prepares candidates to understand how exceptionalities can interact with multiple domains of human development to influence an individual's learning in home, school, community and throughout life. Candidates will gain an understanding of the characteristics between and among individuals with and without exceptionalities. Course content focuses on the identification and characteristics of individuals with exceptionalities as defined under the Individuals with Disabilities Education Improvement Act. This course also provides information on educational, psychosocial and behavioral interventions that serve as adaptations to the general curriculum and/or home/social expectations. Candidates gain an understanding of the impact of related medical conditions and differentiated evidence-based interventions on the development and learning of young children and/or students with or at risk for disabilities. In addition, candidates gain understanding of child abuse recognition and prevention, with particular focus on issues and strategies unique to working with young children and students with disabilities. Throughout this course, candidates will consider beliefs, traditions and values across and within cultures that influence relationships among and between young children, students and their families. Further, this course will emphasize the importance of interdisciplinary collaboration for promoting the well-being of individuals with exceptionalities across a wide range of settings and collaborators. This course is offered in multiple sections to accommodate specific program requirements across the concentrations offered in the M.Ed. in Special Education. See the Schedule of Classes for specific sections to be offered each semester. The SEGE section of the course is specifically designed to meet the VDOE requirement 8VAC20-543-500: special education general curriculum K-12; the E CSE section is specifically designed to meet the VDOE requirement 8VAC20-543-490: special education early childhood (birth through age 5); the ADCR section is specifically designed to meet the VDOE requirements for 8VAC20-543-460: special education adapted curriculum K-12.

SEDP 502. Supervision Seminar I. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course emphasizes effective techniques to use when working with special education and general education teachers, instructional assistants, parent and students with disabilities. Participants will examine the different roles of the special educator. Class members are encouraged to introduce topics for discussion based on their teaching experiences. Problem-solving strategies will be developed to address the issues raised during class. The course will provide the special educator with an understanding of the Individualized Education Program process from fostering consensus to developing the IEP. Emphasis will be placed on understanding the impact of the student's disability in accessing the general curriculum. Developing a data-driven IEP based on standards will also be emphasized.

SEDP 503. Supervision Seminar II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course emphasizes effective techniques to use when working with special education and general education teachers, instructional assistants, parent and students with disabilities. Participants will examine the different roles of the special educator. Class members are encouraged to introduce topics for discussion based on their teaching experiences. Problem-solving strategies will be developed to address the issues raised during class. The course will provide the special educator with an understanding of how to implement mandates in the classroom as related to the state assessment program. Participants will learn why there is an emphasis on the development of standards-based IEPs and how they are integrated in daily classroom instruction. Participants will also learn about the different SOL participation options and how to use criteria to determine the appropriate option.

SEDP 505. Theory and Practice of Educating Individuals with Special Needs. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Not for certification or endorsement in special education. In-depth study of past and current philosophies and approaches to serving students with special needs in educational settings. Attends to specific ways school services and classroom practices of general education teaching can assist in meeting these needs in today's schools through collaboration and inclusion.

SEDP 531. Educational Foundations for Collaboration and Universally Designed Learning. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Focuses on providing candidates with the knowledge of the foundation for educating students with disabilities, as well as the principles and processes for collaboration and consultation with educational colleagues, community professionals and families. Covers the historical, philosophical and sociological foundations underlying the role, development and organization of public education in the U.S. Discussions and readings will focus on creating and maintaining inclusive schools, effective communication strategies for building successful collaborative teams and universally designed instructional strategies to use in co-taught classrooms.

SEDP 532. Understanding Autism Spectrum Disorder. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course presents an introduction to autism spectrum disorder. The course will include a discussion of the core behavioral and secondary characteristics and how they impact the individual across the lifespan, from infancy through adulthood. Family concerns and considerations will be discussed in the context of age, development and need for support. The course will also describe the qualities of intervention strategies and will outline ways to evaluate practices and make sound intervention decisions.

SEDP 533. Assessment of Individuals with Disabilities: _____. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course is designed to provide knowledge and practical applications of screening and assessment of young children and students at risk for and with disabilities/delays. Teacher candidates will be prepared to make professional decisions regarding the screening, assessment and ongoing evaluation of young children and students with disabilities. Teacher candidates will gain knowledge of measurement principles and practices to administer assessments and interpret results. This course will emphasize examination of both formal and informal assessments and their use in data-driven decision-making related to educational placement, intervention planning and IEP/IFSP development. This course is offered in multiple sections to accommodate specific program requirements across the concentrations offered in the M.Ed. in Special Education. See the Schedule of Classes for specific sections to be offered each semester. The SEGE section of the course is specifically designed to meet the VDOE requirement 8VAC20-543-500: special education general curriculum K-12; the ECSE section is specifically designed to meet the VDOE requirement 8VAC20-543-490: special education early childhood (birth through age 5); the ADCR section is specifically designed to meet the VDOE requirements for 8VAC20-543-460: special education adapted curriculum K-12.

SEDP 600. Language/Communication Intervention for Young Children and Individuals With Severe Disabilities. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment requires permission of the instructor. An intensive study of the developmental sequence of language/communication acquisition and intervention strategies for individuals with severe language delays or deficits, severe intellectual disabilities and/or other severe multiple disabilities.

SEDP 601. Instructional Methods and Programming for Individuals with Disabilities: _____. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course provides the knowledge, skills and methods necessary to plan and deliver effective instruction to individuals with disabilities. Course content is focused on how to collaborate with families and other professionals to deliver instruction that improves the outcomes of young children and students. Teacher candidates will develop skills to plan and deliver instruction in a variety of educational settings and learning environments. This course builds teacher candidates' cultural competence and emphasizes the use of recommended practices and evidence-based interventions to support the social, emotional and/or academic growth of individuals with disabilities. This course is offered in multiple sections to accommodate specific program requirements across the concentrations offered in the M.Ed. in Special Education. See the Schedule of Classes for specific sections to be offered each semester. The SEGE section of the course is specifically designed to meet the VDOE requirement 8VAC20-543-500: special education general curriculum K-12; the ECSE section is specifically designed to meet the VDOE requirement 8VAC20-543-490: special education early childhood (birth through age 5); the ADCR section is specifically designed to meet the VDOE requirements for 8VAC20-543-460: special education adapted curriculum K-12.

SEDP 602. Methods II: Teaching Students in Special Education - General Education. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Delivered as online, face-to-face or hybrid course. Prerequisites: SEDP 601 and acceptance for teacher preparation if in the M.Ed. program. Provides a study of instructional strategies and organization of activities with focus on elementary and secondary students with high incidence disabilities (in grades K-12) including curriculum, media, materials and physical environment. Candidates will use the foundation from Methods I as a context for developing skills necessary to provide the most effective classroom instruction for secondary students. A continued focus will be on assessing and monitoring student performance, adapting instructional interventions based upon students' response to intervention, and selecting evidence-based practices that have the greatest likelihood of success.

SEDP 603. Theories, Assessment and Practices in Literacy Development for Individuals with Exceptionalities: _____. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course is designed to prepare teacher candidates to instruct and support individuals with exceptionalities in developing necessary skills for lifelong literacy. Teacher candidates will understand literacy development, including emergent literacy skills, and the impact of disabilities and delays on learning and progress in this domain. This course will emphasize assessment as the basis for designing instruction and interventions. A variety of strategies, methods and supports will be discussed, analyzed and applied to address a variety of reading, language and/or communication needs. This course is offered in multiple sections to accommodate specific program requirements across the concentrations offered in the M.Ed. in Special Education. See the Schedule of Classes for specific sections to be offered each semester. The SEGE section of the course is specifically designed to meet the VDOE requirement 8VAC20-543-500: special education general curriculum K-12; the ECSE section is specifically designed to meet the VDOE requirement 8VAC20-543-490: special education early childhood (birth through age 5); the ADCR section is specifically designed to meet the VDOE requirements for 8VAC20-543-460: special education adapted curriculum K-12.

SEDP 604. Characteristics of Students With Severe Disabilities. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students who have been admitted to the Virginia Consortium for Teacher Preparation in Special Education Adapted Curriculum. Examines nature and causes of disabling or special health conditions. Covers screening and evaluation techniques, characteristics and educational implications.

SEDP 607. Math Methods and Online Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Students will be introduced to current theory and best practices of mathematical instruction from K-12. They will be able to relate their learned knowledge of number and number sense; computation and estimation; measurement and geometry; probability and statistics; and patterns, functions and algebra to their instruction. Students will identify the risk factors associated with mathematics disabilities and learn intervention strategies to address the needs of students with disabilities.

SEDP 610. Teaching Strategies for Students with Severe Disabilities. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is designed to provide instruction in teaching methods for individuals with severe behavior, learning or emotional disabilities. Emphasis will be placed on instructional program development, task analysis and methods of precision teaching.

SEDP 611. Secondary Education and Transition Planning. 2 Hours.

Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Explores the literature, research, issues and trends that are relevant to high school-aged students with high incidence disabilities as they prepare for their transition to life after high school. Focus is on providing candidates with the ability to prepare their students and work with their families to promote successful student transitions throughout the educational experience including postsecondary training, employment and independent living that addresses an understanding of long-term planning, career development, life skills, community experiences and resources, self-advocacy and self-determination, guardianship, and legal considerations. The full range of functioning is addressed in the areas of education, employment, social/emotional functioning, personal and daily living issues.

SEDP 612. Assessment and Curriculum for Students with Severe Disabilities. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Addresses functional assessment strategies, IEP development, and curriculum organization and implementation for students with severe disabilities. Emphasizes educating learners in the least restrictive environment using a transdisciplinary team approach.

SEDP 616. Introduction to Disability Studies, Community Services and Business Networks. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines disability history, theory and current thinking in the field of disability studies. Changes in philosophy, legislation and policy over the past four decades will be examined to trace the paradigm shift that led to our current conceptualization of disability. Students will investigate the community services and resources available to support adults with disabilities, as well as new trends in business partnerships and employment service models that promote the economic self-sufficiency of adults with disabilities.

SEDP 619. Multicultural Perspectives in Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Designed to enhance cultural competence in diverse classrooms and schools. Major considerations include race, ethnicity, linguistic, gender, abilities and sexual orientation differences. Key concepts include structural, curricular and instructional facets of working successfully in diverse educational settings. Personal and theoretical constructs of race, ethnicity, culture, disability and other related concepts are explored. This course is delivered online.

SEDP 621. Applied Behavior Analysis: Principals, Procedures and Philosophy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Designed to provide an overview of the basic principles and procedures of applied behavior analysis. Factors and principles that contribute to improved performance as well as development of interfering behaviors are identified. Further procedures that can be used to minimize interfering behavior, improve performance, teach new behaviors and increase the probability of behaviors occurring under appropriate circumstances are described.

SEDP 622. Ethics and Professional Conduct for Behavior Analysts. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisite: SEDP 621. Provides an overview of the professional conduct standards consistent with the practices of applied behavior analysis and outlines how to provide ethical and responsible behavioral programming. The Virginia Behavior Analyst Licensure law, the Behavior Analyst Certification Board's Guidelines for Responsible Conduct and Disciplinary Standards, as well as the Association for Positive Behavior Supports Standards of Practice are reviewed and used to guide course content. A focus is placed on developing and implementing ethical behavioral programming that promotes the improvement as well as the dignity of the person receiving intervention. Ethical conduct as it relates to colleagues, the field of ABA and society also is discussed.

SEDP 623. Applied Behavior Analysis: Empirical Bases. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisite: SEDP 621. Provides information on the basic content of applied behavior analysis and how to implement the core principles in real-life situations. Participants will be instructed on how to implement behavioral procedures and develop behavioral programs for individuals who may need to increase positive skills or reduce interfering behavior. Participants also will be instructed on single-subject design, the research methodology used in the field of ABA and its applications in real-life situations.

SEDP 624. Applied Behavior Analysis: Applications. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisite: SEDP 621. Discusses the various applications of the field of applied behavior analysis and expands the capability to deal with more complex behavioral situations, enabling the ability to relate to more sophisticated professional issues and environments. Specifically, the course demonstrates how ABA is applied in real-world situations to make socially significant changes by minimizing interfering behavior, improving performance, teaching new behaviors and increasing the probability of behaviors occurring under appropriate circumstances. This course also provides a foundation for giving appropriate support to those implementing the behavior plan.

SEDP 625. Applied Behavior Analysis: Assessments and Interventions. 3 Hours.

Semester course. 3 lecture hours. 3 credits. Pre- or corequisite: SEDP 621. Expands on basic content of applied behavior analysis and teaches how to implement behavioral procedures and develop behavioral programs for individuals with fundamental socially relevant behavioral needs. In this course, participants will learn how to implement behavioral assessments, select and develop intervention procedures, and compose instructions for implementation.

SEDP 626. Applied Behavior Analysis: Verbal Behavior. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisite: SEDP 621. Further expands the participant's capability to use applied behavior analysis in complex behavioral situations and enables students to apply principles to sophisticated issues through analysis of language development. The course will provide information on verbal behavior and basic verbal operants and how to develop intervention procedures to teach diverse learners.

SEDP 630. Trends in Special Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Includes an overview of legislation and case law pertaining to special education, characteristics of individuals with and without exceptionalities including growth and development from birth through adolescence, mainstreaming, integration/inclusion, transition, and classroom adaptations for educating students with disabilities in least restrictive environments. Candidates will become familiar with the general characteristics of children with and without exceptionalities relative to age, varying levels of severity and developmental differences manifested in cognitive, linguistic, physical, psychomotor, social or emotional functioning.

SEDP 631. Behavior Support of Individuals with Disabilities: _____. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course will provide an in-depth analysis of theoretical models, research and strategies for supporting positive behaviors of young children and students with exceptionalities. Emphasis is on developing, implementing and/or structuring environments and interventions to encourage adaptive behaviors and the social/emotional development of individuals with exceptionalities, and directly teach them to adapt to the expectations of differing environments. Course content focuses on conducting formal and informal assessments of behavior and environments to individualize and implement strategies to support the growth and development of individuals with exceptionalities. This course will help develop a candidate's ability to examine the behaviors of students with special needs in a variety of settings, including an understanding and application of behavior management techniques and individualized behavioral interventions. Techniques and approaches taught will promote skills that are consistent with developmental milestones and/or standards and rules of a variety of educational environments, and will be diverse based upon developmental, cognitive, behavioral, social and ecological theory and best practice. Candidates will learn to integrate results of assessments to develop long- and shorter-term goals and objectives and integrate these into individualized service and behavior change plans. Focus will also be on how to consult and collaborate with colleagues and families to implement individualized plans across a variety of environments. Candidates will learn to evaluate young children's and/or students' behavior and environments, as well as reflect on their own role in contributing to and mitigating challenging behaviors. Candidates will also learn strategies to prevent and/or intervene safely with children who exhibit challenging behavior, as well as to facilitate positive behavior. As part of the course requirements, candidates will also complete approved modules in child abuse and neglect recognition and intervention if not already completed. This course is offered in multiple sections to accommodate specific program requirements across the concentrations offered in the M.Ed. in Special Education. See the Schedule of Classes for specific sections to be offered each semester. The SEGE section of the course is specifically designed to meet the VDOE requirement 8VAC20-543-500: special education general curriculum K-12; the ECSE section is specifically designed to meet the VDOE requirement 8VAC20-543-490: special education early childhood (birth through age 5); the ADCR section is specifically designed to meet the VDOE requirements for 8VAC20-543-460: special education adapted curriculum K-12.

SEDP 632. Transition Strategies for Students with Disabilities. 3 Hours. Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Designed to provide knowledge of the special educator's role in preparing students with disabilities for post-secondary educational and vocational environments. Emphasis is placed on designing and modifying high school curricula involving students and their families in transition planning and helping students acquire the services needed to be successful in adult life.

SEDP 634. Assessment, Curriculum and Teaching Methods for Autism Spectrum Disorder. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SEDP 532. Students will review assessment techniques and curriculum design, as well as the major methodologies to teach individuals with autism spectrum disorder from early intervention through transition to adult services in inclusive and specialized educational settings. This course will focus on scientifically based interventions that address the communication development and academic needs of the individual with autism spectrum disorder. Participants will be required to demonstrate knowledge of course goals by integrating content with students with autism spectrum disorder.

SEDP 635. Supporting Behavior and Social Skills for Autism Spectrum Disorder. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SEDP 532. Students will review major methodologies needed to create a positive social and emotional learning environment for individuals with autism spectrum disorder from early intervention through transition to adult services in inclusive and specialized educational settings. This course will address the individual's social, behavioral and sensory needs by focusing on the emerging best-practice interventions needed to teach social understanding and shape appropriate social behavior, build play and leisure skills, teach anger and stress management, procure sensory motor modulation, conduct functional behavior assessments, and provide positive behavior support. Participants will be required to demonstrate knowledge of course goals through integration with students with autism spectrum disorder.

SEDP 638. Instructional Design and Field Experience for Autism Spectrum Disorder. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SEDP 532, 634 and 635. Students will focus on the integration of theoretical and practical concepts related to supporting individuals with autism spectrum disorder from early intervention through transition to adult services in educational settings. It provides the opportunity to apply knowledge of assessment, curriculum design, teaching methodologies and environmental and technological supports while working collaboratively with caregivers and educational teams to develop individualized programming. This course has a 20-hour field-based experience that is to take place in an educational setting. The field-based experience will be coordinated with the course instructor.

SEDP 641. Independent Study. 1-3 Hours.

Semester course; variable hours. 1-3 credits. Prerequisite: permission of instructor. An individual study of a specialized issue or problem in education.

SEDP 651. Topics in Education. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for 9 credits. Check with department for specific prerequisites. A course for the examination of specialized issues, topics, readings or problems in education.

SEDP 655. Practicum A: Special Education in an Elementary Education Environment. 1 Hour.

Semester course; 1 practicum hour. 1 credit. Special education candidates will participate in 30 hours of supervised practicum activities within the public schools at the elementary level. The goal of this course is to provide special education candidates with real-world experience developing, implementing and monitoring progress of special education students within the general education environment. As part of the course, candidates will develop and implement an inclusive Universal Design for Learning unit plan within the academic (reading or mathematics) curriculum. The unit will include ties to the Virginia Standards of Learning, plan for collaboration with general education teachers, five traditional lesson plans, an online lesson, a unit assessment and Individual Education Program using collaboration with parents, general education teachers and the student. Additionally, the special education candidates will reflect on the effectiveness of the unit plan for students with special needs or other at-risk students. This course includes site-based requirements.

SEDP 656. Practicum B: Special Education in a Secondary Education Environment. 1 Hour.

Semester course; 1 practicum hour. 1 credit. Special education candidates will participate in 30 hours of supervised practicum activities within the public schools at the secondary level. The goal of this course is to provide special education candidates with real-world experience developing, implementing and monitoring progress of special education students within the general education environment. As part of the course, special education candidates will develop and implement an inclusive Universal Design for Learning unit plan within the academic (reading or mathematics) curriculum. The unit will include ties to the Virginia Standards of Learning, plan for collaboration with general education teachers, five traditional lesson plans, an online lesson, a unit assessment and an Individual Education Program using collaboration with parents, general education teachers and the student. Additionally, the special education candidate will reflect on the effectiveness of the unit plan for students with special needs or other at-risk students. This course includes site-based requirements.

SEDP 658. Individualized Supports and Specialized Care of Students With Significant Disabilities. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides an understanding of the unique physical, sensory, communication, and health and medical needs of students with significant disabilities; how these needs impact the educational program; how special education and related services are delivered; and how to design academic, functional and behavioral instruction and adaptations to meet those needs.

SEDP 700. Externship: ____. 1-6 Hours.

Semester course; 1-6 field experience hours. 1-6 credits. The externship experience for M.Ed. candidates requires the study and integration of theory with practice in a clinical setting supervised by an approved professional and university faculty member. This externship includes planned site visits by the university faculty member (at least four of the visits will be observations of the student in a teaching situation). During the semester-long externship, students are in classrooms with a set amount of hours spent supervised by a fully licensed, experienced teacher in direct teaching activities. M.Ed. candidates already teaching on a provisional license can do those field experience hours in their own classrooms, supported by a mentor special educator and the university faculty member. The supervision provided emphasizes effective techniques to use when working with special education and general education teachers, instructional assistants, parents and students with disabilities. This course is offered in multiple sections to accommodate specific program requirements across the concentrations offered in the M.Ed. in Special Education. See the Schedule of Classes for specific sections to be offered each semester. The SEGE section of the course is specifically designed to meet the VDOE requirement 8VAC20-543-500: special education general curriculum K-12; the ADCR section is specifically designed to meet the VDOE requirements for 8VAC20-543-460: special education adapted curriculum K-12. This course includes site-based requirements.

SEDP 705. Seminar on Disability Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Discussion and examination of key federal and state issues that affect disability policy and program management. Includes an in-depth examination of IDEA, ADA and the Rehabilitation Act of 1973.

SEDP 706. Personnel Development in Special Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prepares individuals to effectively design, provide and evaluate personnel development programs that prepare professionals to maximize the developmental, educational, emotional and employment outcomes of individuals with disabilities.

SEDP 707. Critical Issues in Special Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Discussion and examination of controversial and/or critical issues in special education, as well as current IDEA definitions, referral and assessment methods and instructional models.

SEDP 708. Grant Writing in Special Education and Other Social Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines conceptual, empirical and practical issues in the preparation of grant proposals and in the conduct of interdisciplinary research in the social sciences that focuses on education and related issues in youth development, with a specific emphasis on youth with disabilities. Students will develop practical skills in establishing interdisciplinary research teams; interdisciplinary research design and grant proposal development; matching research questions to funding agencies and their priorities; working with community agencies and relevant stakeholders to secure their involvement in the research process; writing research or training grant proposals.

SEDP 709. Literature Reviews in Special Education and Other Social Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides in-depth, advanced instruction in the conducting of systematic literature reviews; instruction in how to create and refine a research question; instruction in defining and refining search terms; instruction in critically analyzing identified literature; and instruction in the writing and structure of a literature review.

SEDP 711. Doctoral Seminar in Single Subject Design. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is intended to provide an overview of strategies for designing and conducting single subject studies that are relevant to education, special education, psychology and other related fields of inquiry. Its purpose is to provide doctoral students or advanced graduate students who are interested in applied research designs with an opportunity to acquire competencies related to planning, implementing and analyzing such research. The content of the course will focus on applications and interpretations of single-case research designs and the analysis of human behavior in educational and community settings. This course is designed as an initial course in single research design.

SEDP 771. Research Internship. 1-3 Hours.

Semester course; 1-3 research hours. 1-3 credits. May be repeated for a total of 3 credits. Enrollment requires prior approval of adviser. The research internship is designed to provide doctoral students with an opportunity to demonstrate competence at designing and conducting a pilot research study and disseminating research findings. Graded as S/U/F.

SEDP 772. Teaching Internship. 1-3 Hours.

Semester course; 1-3 internship hours. 1-3 credits. Enrollment requires prior approval of adviser. The teaching internship is designed to provide doctoral students with an opportunity to demonstrate competence in the activities related to the preparation of teachers of students with disabilities at the university level. Graded as S/U/F.

SEDP 773. Service/Policy Internship. 1-2 Hours.

Semester course; 1-2 hours of internship. 1-2 credits. Enrollment requires prior approval of adviser. The service competency is met through an internship that is designed to give doctoral candidates an intensive experience in which they can become actively involved in professional service to the field of special education and, in particular, in the development and implementation of local, state or national policy. Graded as S/U/F.

SEDP 798. Thesis. 1-9 Hours.

Semester course; 1-9 research hours (delivered online, face-to-face or hybrid). 1-9 credits. May be repeated for a maximum of 12 credits. Enrollment is restricted to students enrolled in the M.Ed. in Special Education program who have completed all other M.Ed. in Special Education course work. A research study of a topic or problem approved by the student's supervisory committee and completed in accordance with acceptable standards for thesis writing. Graded as Pass/Fail.

SEDP 890. Dissertation Prospectus Preparation. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: SEDP 709. Students will receive guidance in the preparation of their dissertation prospectus, describing their plan for conducting an original research study as the final requirement for their Ph.D. in Special Education and Disability Policy. Graded S/U/F.

SEDP 899. Dissertation. 1-9 Hours.

Semester course; variable hours. Variable credit. May be repeated. A minimum of 9 semester hours required. Prerequisite: Successful completion of comprehensive examinations and approval of student's doctoral prospectus. Dissertation work under direction of dissertation committee. Graded as S/U/F.

Teacher Education (TEDU)

TEDU 500. Workshop in Education. 1-3 Hours.

Semester course; 1-3 credits. Repeatable to 6 credits. Designed to focus on a single topic within a curriculum area, the workshop offers graduate students exposure to new information strategies and materials in the context of a flexible instructional framework. Activities emphasize a hands-on approach with direct application to the educational setting.

TEDU 501. Supervising Student Teachers. 1-3 Hours.

3 credits. Prerequisite: permission of instructor. Focuses on the role of clinical faculty as site-based supervisors of student teachers. Provides knowledge, skills and training necessary to supervise and evaluate student teachers.

TEDU 503. Guidance for Exceptional Children. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An introduction to guidance strategies for assisting exceptional children. Special attention is given to the interrelationships of home, school and community resources.

TEDU 510. Instructional Technology in PK-12 Environments. 2 Hours.

Semester course; 2 lecture hours (delivered online). 2 credits. Prerequisite: EDUS 301, PSYC 301 or PSYC 304 with a minimum grade of C. An introduction to effectively integrating technology into pK-12 instruction to improve student learning outcomes. Students will have hands-on experiences with a variety of current instructional technologies and learn how to integrate these technologies into their practice using research-driven theoretical frameworks. This online course models effective virtual teaching methods that can be utilized in hybrid and fully online environments. Students will design technology-rich instructional modules that can be utilized to improve student learning in their content areas, as well as develop personal learning networks that will continue to provide them with informal and independent learning opportunities well after the conclusion of the course.

TEDU 511. Curriculum and Instruction in Elementary Classrooms. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students enrolled in the RTR program or provisionally licensed teachers. This course is designed to support students to understand and use developmentally appropriate instructional methods to teach today's diverse students. The course will explore multiple curriculum models as well as Virginia's Standards of Learning and the Early Learning and Development Standards as the foundation for making strong and informed instructional decisions.

TEDU 512. Teaching Elementary Health and Physical Education. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Restricted to students in general health and physical education who have been admitted to teacher preparation program. Designed to enhance knowledge and advanced pedagogical skills in teaching elementary health and physical education. Through an analysis of the NASPE and AHEE standards, state SOL, goals, objectives and programs, students construct year-round curricula and daily lesson plans for use in public school settings. Emphasis also placed upon classroom management skills and administrative and organizational strategies dealing with facilities, equipment, teaching aids, measurement and safety.

TEDU 513. Teaching Health Education. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Restricted to students in general health and physical education who have been admitted to teacher preparation program. Prepares students to become independent problem-solvers and decision-makers by applying previously acquired knowledge to advanced instructional techniques in the public school health classroom. Students acquire advanced pedagogical skills and gain insight into the development of health education programs for middle and secondary schools. Course includes the development of curricula, unit plans and lesson plans.

TEDU 514. Teaching Physical Education. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Restricted to students in general health and physical education who have been admitted to teacher preparation program. Designed to enhance knowledge and advanced pedagogical skills in teaching secondary physical education. Through an analysis of the national standards, state SOL, goals, objectives and programs, students construct year-round curricula, units and daily lesson plans to be used in public schools. Emphasis also placed upon the acquisition of administrative and organizational knowledge dealing with facilities, equipment, teaching aids, measurement and safety.

TEDU 516. Elementary Social Studies Methods. 2 Hours.

Semester course; 2 lecture hours (delivered online, face-to-face or hybrid). 2 credits. Enrollment is restricted to students in the RTR program. This course is centered on helping participants in the RTR program to examine the purpose of social studies education, the connections between the social studies discipline and other curricular areas and the persisting issues in social studies education, including local government and civics instruction. It will introduce students to an integrative reflective planning process and a variety of instructional strategies and materials.

TEDU 517. Science Education in the Elementary School. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: TEDU 511 or permission of the instructor. A course designed to renew and/or expand teachers' knowledge and skills in the teaching of science in the classroom and the community. New materials and methodologies will be examined in the light of current trends, research findings and professional recommendations.

TEDU 521. Teaching Mathematics for Middle Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Emphasis on current instructional strategies, learning theories and manipulative materials appropriate for teaching mathematics to children. The content focuses on middle grades, but the developmental approach includes some topics from the primary grades.

TEDU 522. Teaching Mathematics for Elementary Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: TEDU 511 or permission of the instructor. Emphasis on current instructional strategies, learning theories and manipulative materials appropriate for teaching mathematics to children. The content focus is on the primary and elementary grades.

TEDU 523. Implementing and Administering Programs for Young Children. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides the student with fundamental knowledge and skills in the implementation, supervision and administration of educational programs in schools, centers and homes for infants and young children. A problems approach will be utilized with emphasis on creative management and evaluative processes.

TEDU 524. Cross-cultural Perspectives in Child Rearing and Early Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Analysis of the impact of linguistic patterns, child-rearing techniques and socialization processes on the education of young children in various cultural settings.

TEDU 525. Teaching Language Arts. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Teaching techniques and materials for the developmental teaching of communication skills. Students will explore significant research and current literature related to content, organization and instruction in language arts for the elementary and middle schools.

TEDU 526. Word Study. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Integrates the linguistic, historical, theoretical and research bases of developmental spelling and word knowledge (phonics, phonemic awareness and vocabulary). A primary focus is on the stages of spelling development, including assessment and instruction of orthographic knowledge at each stage.

TEDU 528. Children's Literature II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A study of classic and current children's books from a variety of literary genres. Magazines and media-related reference resources and journals are reviewed. The creative use of literature, its sociocultural functions and its contribution to the development of the oral and written expression of children from nursery to grade eight are explored. A focus on children with special problems is included. May not be taken for credit toward undergraduate English major if student has taken ENGL 351/TEDU 351. May not be used to fulfill literature requirement for M.A. in English or M.F.A. in Creative Writing, but may be taken as elective credit. Crosslisted as: ENGL 528.

TEDU 531. Media Literacy in the K-12 Classroom. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Offered in online and traditional formats. Explores the role of media in society and methods for incorporating media literacy instruction in the K-12 school classroom. Participants will study the foundations of media literacy, critical thinking and the ways media shapes our views of culture, society and education. Through hands-on activities and projects, participants will become familiar with a variety of media tools and instructional methods for utilizing media to support student learning. Participants will research methods for assessing student learning when using paper-based and digital media.

TEDU 535. Problems of Social Studies Instruction. 3-6 Hours.

Semester course; 3-6 credits. Prerequisite: Permission of instructor and appropriate teaching experience. An in-depth investigation into the nature of and alternatives to problems encountered by students while teaching. Developing and evaluating instructional alternatives will be stressed.

TEDU 537. Inclusive Curriculum in Secondary Schools. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Studies the background and objectives of the contemporary secondary school; basic issues, current trends and practices in curriculum construction and instructional planning are examined with an emphasis on the inclusion of students with different abilities and disabilities.

TEDU 540. Teaching Middle and High School Sciences. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: EDUS 301 and admission to teacher preparation or permission of instructor. Examines the teaching strategies, materials and objectives of the sciences in middle and high schools. Emphasizes the nature of science in science instruction, teaching of experimental design and translating science education research into teaching practices.

TEDU 544. Introduction to the Middle School. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An examination of the nature and capabilities of the middle school student, the school environment, teacher characteristics, instructional modes, the curriculum and the future of the middle school movement.

TEDU 545. Teaching Secondary School Mathematics. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: upper-division mathematical sciences major or EDUS 301 and admission to teacher preparation or permission of instructor. Examines materials, resources, innovations, procedures, methods, equipment and learning principles appropriate for decision-making related to the teaching of secondary mathematics.

TEDU 546. Teaching Foreign Language. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The goal of the course is to provide pre-service and in-service teachers with the theoretical and practical strategies necessary for successful foreign language teaching in K-12 school settings. This course offers a comprehensive approach to designing curriculum, instruction and assessment for foreign language programs in the schools.

TEDU 547. Teaching Secondary School Social Studies. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Examines demands involved in secondary social studies instruction; preparatory approaches to using academic and professional insights in confronting the demands; formulating and implementing appropriate methodological approaches.

TEDU 548. Teaching Secondary School English. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: EDUS 301 and admission to teacher preparation or permission of instructor. Studies teaching strategies, materials and objectives for literature, language and composition; developing and organizing English instruction; applying learning theory; examining evaluation strategies; questioning techniques; and classroom management.

TEDU 549. Diagnostic Reading in the Secondary School. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: TEDU 561 or 562 or permission of instructor. For prospective and practicing secondary school teachers. Studies diagnostic teaching of reading and techniques to help struggling readers in grades 6 through 12, as well as the role of the secondary reading specialist in reading instruction. Reading levels and selection of appropriate materials are considered. Various techniques and strategies for improving reading are investigated. Emphasis on evaluation of reading progress, differentiation of instruction, reading difficulties, and diagnostic and prescriptive procedures. Course techniques are practiced with students in grades 6 through 12.

TEDU 550. Teaching Interdisciplinary Language Arts and Social Studies in the Middle School. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Describes and applies basic principles of middle school education and early adolescence with attention to the persistence of the academic disciplines and traditional curricular approaches to English and social studies. Offers a rationale for interdisciplinary instruction and proposes solutions to the practical dilemmas that confront interdisciplinary teaching in the middle school. Identifies interdisciplinary themes drawn from history, the social sciences and literature; plans units of instruction around such themes; devises instructional strategies for the teaching of interdisciplinary skills and content.

TEDU 551. Foundations of Bilingual Education. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course will focus on the historical foundations of bilingual education in the U.S., current models of bilingual programs in PK-12 school settings and contemporary understandings of bilingualism/biliteracy development using sociolinguistic and sociocultural perspectives.

TEDU 552. Methods for Teaching Multilingual Learners. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides students who plan to teach people whose native language is not English with a variety of instructional/learning strategies. Presents and explores current approaches and methodology, as these relate to linguistic features and pedagogy. Crosslisted as: ENGL 552/LING 552.

TEDU 554. Applications of Computers in the Teaching of Mathematics. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: College calculus course or permission of instructor. Introduction to computers and programming using the language, BASIC. Applications of the computer in algebra, geometry, trigonometry, statistics and calculus.

TEDU 555. Geography in Social Studies Curriculum. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A survey of geographic concepts and processes as a basis for examining curricular projects for and developing instructional approaches to geography as part of the social studies curriculum.

TEDU 556. Advanced Computer Applications in Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: TEDU 507 or its equivalent, a portfolio demonstrating content and skills covered in TEDU 507, or permission of instructor. Develops the technology instructional framework, including teaching strategies, models of instruction and best practices in technology integration; creation of instructional lessons integrating technology by using typical office suite production tools; and connecting theory to practice. Will satisfy most of the ISTE and state technology standards.

TEDU 560. Instructional Strategies Using the Internet. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Emphasizes understanding of informational technology instructional strategies; theoretical underpinnings of constructivism; preparation and assessment of instructional models that include project-based learning, inquiry-based learning, problem-based learning and collaborative learning using resources on the Internet.

TEDU 561. Literacy Foundations: Sociological/Psychological Perspectives. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The purpose of this course is to provide a basic understanding of the theories, processes and methodologies of reading instruction. Multidisciplinary, multicultural aspects of reading instruction are stressed. Topics of particular importance to the classroom teacher are emphasized, including reading, writing, listening and speaking, and digital literacies.

TEDU 562. Reading Instruction in the Content Areas. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prepares teachers to apply skills and methods of reading instruction to content areas in elementary, middle and secondary school curricula. Includes theoretical bases and methodology for incorporating reading skills and strategies within content areas of instruction.

TEDU 564. Teaching the Gifted. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Curriculum development and organization of activities for the gifted at different maturational levels with specific attention given to program content, materials, resources and guidance.

TEDU 566. Diagnosis and Remediation in Reading. 4 Hours.

Semester course; 3 lecture hours and 1 practicum hour (delivered online, face-to-face or hybrid). 4 credits. Prerequisite: TEDU 426 or TEDU 561. Studies reading problems by focusing on reading diagnosis and correction related to classroom and clinic. Involves evaluating and tutoring individuals with reading difficulties. A supervised practicum is a course component that includes site-based requirements.

TEDU 569. Diagnosis and Remediation in Mathematics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. For classroom and resource teachers working with children whose arithmetic achievement is significantly lower than grade-level placement or expectancy level; designed to remediate learning problems in arithmetic at the child's level and to aid teachers in the sequential development of skills and concepts.

TEDU 575. Intercultural Communication. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). An experientially oriented seminar for persons preparing for or in careers necessitating intercultural communication among persons of differing cultural and/or national backgrounds. Special attention is given to teachers and other professionals who work with a clientele from Latin America, the Middle East, Asia, Africa and Eastern Europe. American cultural patterns broaden understanding of specific groups and engagement in intercultural communication. Crosslisted as: FRLG 575.

TEDU 588. Classroom Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Designed to assist teachers in becoming effective classroom managers. Emphasis on application of classroom management, motivational and instructional theories. Models of classroom management explored; personal management plans developed.

TEDU 591. Social Studies Education in the Elementary School. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: TEDU 511 or permission of the instructor. A course designed to renew and/or expand the knowledge and skills of the classroom teacher in the teaching of social studies. Curriculum emphasis on the development of knowledge, skills, values and attitudes will be examined in the light of professional recommendations, current trends and research findings.

TEDU 594. Topical Seminar. 1-3 Hours.

Semester course; variable hours. 1-3 credits. May be repeated for a maximum of 6 credits. A seminar intended for group study by students interested in examining topics, issues or problems related to teaching and learning.

TEDU 602. National Board Certification I and Externship Proposal Development. 3 Hours.

Semester course; 3 credits. Prerequisites: participation in a two-day pre-candidacy workshop and approval of department. Analyze and reflect on teaching practices, study national teaching standards, and develop initial portfolio entries. Development of externship proposal.

TEDU 610. Developing and Critiquing Visual Literacy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Develop skills and evaluate the effectiveness and appropriateness of the use of media. Understand imagery, develop visual communication skills to appropriately represent data, video or text by applying design principles in creating print, as well as non-print, as an instructional resource.

TEDU 611. Critical Investigations in Mathematics Education. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: TEDU 521, 522 or 545, or permission of instructor. A critical investigation of current and appropriate learning theories, instructional activities, programs and manipulative materials applicable to mathematics education in the elementary school. This course assumes an overall knowledge of the more prominent techniques and materials used to teach mathematics in elementary and middle schools. Students will undertake in-depth critical studies of alternative curricula, materials and strategies based on experience, learning theory and research findings.

TEDU 615. Curriculum Development. 3 Hours.
Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. A basic graduate course in curriculum development. Curriculum decision making is examined in relation to foundation areas, content areas and current educational trends. Various conceptions of curriculum are explored.

TEDU 617. Tensions in Educational Theory. 3 Hours.
Semester course; 3 lecture hours. 3 credits. This course introduces students to major educational theories they will encounter throughout their studies, such as behaviorism, critical theory, cognitive constructivism and social constructivism. Students will learn to use their experience and the phenomena they study in the field to enter into a dialogue with theories: refining them, challenging them and sometimes even replacing them.

TEDU 618. Curriculum Construction. 3 Hours.
Semester course; 3-6 lecture hours. 3-6 credits. A study of curriculum problems with special attention given to the organization and preparation of teaching units. The course is individualized to meet student needs and nature of study.

TEDU 621. Curriculum Seminar. 3 Hours.
Semester course; 3 lecture hours. 3 credits. A study of curriculum theory, research, and practice for advanced students. The seminar is an opportunity for students to integrate previous course work and professional experiences in curriculum.

TEDU 622. Creative and Cognitive Development. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: EDUS 603. Application of theories of creative and cognitive development in teaching.

TEDU 623. Child Study and Assessment in Early Childhood Education. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Investigation and application of methods of observing, recording, and interpreting the behavior of young children. Review of criterion and norm-referenced measures for assessing capacities and needs in early childhood education as a baseline for prescribing/providing appropriate activities.

TEDU 624. Early Childhood Education Programs and Policies. 3 Hours.
Semester course; 3 lecture hours. 3 credits. A study of Early Childhood Education paradigms including historical, federally funded and current center and home-based programs. A review of legislation, state and federal, that has affected ECE program development.

TEDU 625. Young Child and the Curriculum. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Translation of curriculum development principles into appropriate curricular programs for young children. Impact of recent research on these curricula. Consideration of child development as related to planned activities and expected outcomes.

TEDU 626. Family-School Partnerships. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: TEDU 414 or permission of instructor. Studies the rationale, methods, programs and current research of family-school partnerships, preschool through secondary education.

TEDU 627. Exploring Historical Consciousness. 3 Hours.
Semester course; 3 lecture hours. 3 credits. This course is designed to introduce students interested in the fields of public history and history teaching to the contemporary scholarship on how people become conscious of history in schools and in the culture at large. Two inquiry questions will guide our work: What does it mean to be conscious of history? and How do people learn to understand history?.

TEDU 639. Race, Ethnicity and Education. 3 Hours.
Semester course; 3 lecture hours. 3 credits. A cross-disciplinary examination of issues related to race, ethnicity and cultural diversity in education. This course works under the premise that race is an essential social category of analysis for the policies and everyday practices experienced in U.S. society. Students will review a variety of historical and contemporary theories of race from early foundations of race theory to relevant contemporary theories and methodological approaches to research and problem resolution strategies. Crosslisted as: EDUS 639.

TEDU 640. Designing and Managing eLearning. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: TEDU 556 or 560, or permission of instructor. Emphasizes identification of appropriate methods of instructional delivery to meet online learner needs, develop online modules and lessons for different virtual learning environments, including team and collaborative projects, and best practices associated with the development of online instruction.

TEDU 641. Independent Study. 1-6 Hours.
Semester course; 1-6 credits. May be repeated for a maximum of 9 credits. Determination of the amount of credit and permission of the instructor and department chair must be procured prior to registration. Cannot be used in place of existing courses. An individual study of a specialized issue or problem in education.

TEDU 642. Instructional Mentoring and Coaching. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Designed to develop skills in mentoring, coaching and observing teachers to improve instruction. Students learn how to build an effective mentoring relationship, select appropriate coaching strategies, collect and analyze data during instruction; provide strategic feedback to teachers using supportive language and behavior; assist teachers in analyzing K-12 student work; employ differentiated instruction; and help teachers set professional goals. Emphasis on developing the knowledge, skills and dispositions necessary to respond to teachers' individual and contextual needs through ongoing examination of classroom practice for the purpose of promoting high achievement for all students.

TEDU 643. Teacher as Change Agent. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Designed to help teachers become more effective leaders by assessing and developing their leadership skills, deepening knowledge about policy, sharpening skills at influencing change and developing action plans and issue portfolios to address educational issues.

TEDU 644. Leadership Theory and Practice. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Designed for teacher leadership as opposed to administrative leadership. Explores practical and theoretical models of leadership across several fields, with an emphasis on teacher leadership. Research examined on meaningful collegiality, the art and science of teaching, and the principles of leadership.

TEDU 648. Preparation of Instructional Materials. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: TEDU 507 or permission of instructor. Development of materials for the classroom with an emphasis on determining medium, designing the message, producing the material and evaluating the effect. The design of these materials will be predicated on the learning modes and instructional styles.

TEDU 649. Educational Media: Theory and Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: TEDU 507 or permission of instructor. An analysis of educational media with emphasis on the use of media in instructional design and development of teaching strategies.

TEDU 650. Second Language Acquisition. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. This course is designed for those who plan to work with English language learners in diverse instructional settings. A major focus of the course is analyzing second language acquisition theories and how they apply in classroom settings. In-depth analysis of readings will enhance the students' understanding of SLA and the research related to this field. Students will observe classroom teaching, analyzing the application of SLA theories utilized in the instructional setting. Crosslisted as: LING 650.

TEDU 651. Special Topics in Education. 1-3 Hours.

Semester course; variable hours. 1-3 credits. May be repeated for 9 credits. Check with department for specific prerequisites. A course for the examination of specialized issues, topics, readings or problems in education.

TEDU 657. Mathematics Education Leadership I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Analyze and reflect on mathematics instruction in the grades K-8 classroom with respect to design, teaching and evaluation of mathematical tasks, inquiry based instruction and discourse. Appropriate learning theories, instructional programs and technology are investigated. This course is an introduction to the role of the mathematics specialist and is a core course for preparation as a K-8 mathematics specialist.

TEDU 658. Mathematics Education Leadership II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: TEDU 657 or permission of instructor. Designed for teachers to build skills, understandings and dispositions necessary for mathematics education leadership roles. Emphasis is on developing and refining coaching and professional development skills, becoming familiar with a body of research within mathematics education, and building one's ability to work within and to lead a school-level mathematics learning community. This is a core course for preparation as a K-8 mathematics specialist.

TEDU 659. Mathematics Education Leadership III. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: TEDU 658 or permission of instructor. Designed to acquaint prospective mathematics specialists with those skills, understandings and dispositions needed to facilitate the lesson study process, create and use formative and summative assessments for diagnosing student mathematical understandings and misunderstandings, and increase communication and formal professional presentation skills to work within and lead a district-level mathematics learning community. This is a core course for preparation as a K-8 mathematics specialist.

TEDU 661. Current Topics in Virtual Teaching. 1 Hour.

Semester course; 1 lecture hour (delivered online, face-to-face or hybrid). 1 credit. Students will investigate and critically consider emerging technological tools and their impact on various forms of virtual teaching and learning. Affordances and constraints of emerging technologies will be identified and participants will consider the implications of these technologies on various content areas and pedagogical strategies.

TEDU 662. Foundations of Online Teaching. 3 Hours.

Semester course; 3 lecture hours; 3 credits. This introductory course in online teaching provides participants the opportunity to explore current research in online teaching, standards for course design and facilitation, methods and models, and the latest tools available. Participants will explore multiple learning management systems, as well as discover how to work outside of these systems to design effective learning environments. This course will benefit teachers working in solely online environments as well as those who wish to use elements of online teaching in their face-to-face and hybrid courses.

TEDU 663. Facilitating Digital Communication. 3 Hours.

Semester course; 3 lecture hours; 3 credits. The heart of online courses exists in communication: between instructors and students and among the students themselves. This communication requires strong writing and facilitation skills. This course will provide an overview of research related to online course communication as well as practical application for facilitating communications in online courses. Participants in the course will learn how to develop online discussions, employ a variety of techniques to encourage discussions, utilize a variety of tools to support discussion and moderate online conflict to create a healthy online learning environment. Activities will include analysis of online discussions to identify various discussion techniques, work in small groups to guide discussions and learning, respond to scenarios related to solving online conflict and experiment with Web-based discussion tools.

TEDU 664. Instructional Design of Online Environments. 2 Hours.

Semester course; 2 lecture hours; 2 credits. This course emphasizes a systematic instructional planning for online teaching and was created based on the idea of the technological pedagogical content knowledge model. Students will learn how effectively they can prepare their online teaching through a systematic instructional planning process and the use of effective technology integration for pedagogy around their specific subject matter. Students will explore both basic concepts and applied examples in accordance with each step of the online instructional planning processes.

TEDU 665. Assessment and Evaluation in Online Environments. 1 Hour.

Semester course; 1 lecture hour; 1 credit. Providing in-depth assessment and evaluation in online courses can be one of the most challenging parts of teaching and learning online. How does the instructor provide creative and useful assignments that incorporate Web-based tools and require students to demonstrate their learning in authentic ways? This course will provide an overview of formative and summative assessment techniques as they relate to online teaching and learning and provide participants with opportunities to practice those skills.

TEDU 666. Content Focus Workshop. 1 Hour.

Semester course; 1 workshop hour; 1 credit. Effective technology integration requires an understanding of all aspects of teaching including content, pedagogy and technology. Participants in this course will be introduced to the TPACK model that focuses on the knowledge needed to make effective choices for the use of technology to support content-based instruction. In addition, they will learn about activity types as tools for planning pedagogically sound instruction. Students will practice using the model and the activity types to develop technology enhanced curriculum using the framework.

TEDU 667. Course Development Practicum. 3 Hours.

Semester course; 3 practicum hours; 3 credits. This course provides participants with collaborative support and guidance to effectively utilize the knowledge and skills gained from prerequisite courses in foundations of online teaching, facilitating digital communications, instructional design, and assessment and evaluation. Practicum participants will work with a group of peers and the course instructor to finalize the development of their online course.

TEDU 668. Time and Course Management for Online Learning. 1 Hour.

Semester course; 1 lecture hour; 1 credit. Teaching and learning online makes different demands on both instructors and participants than the traditional face-to-face experience. In particular, working asynchronously means that instructors and participants must learn new ways of communicating – with both the instructor and other students. One important role of the instructor is to help participants navigate this online learning environment, including developing appropriate time-management skills for discussion participation and assignment completion and managing student expectations related to instructor support and feedback. Participants in this course will develop policies and procedures to use as part of their online courses.

TEDU 669. Online Course Facilitation Practicum. 3 Hours.

Semester course; 3 practicum hours; 3 credits. In this practicum experience, participants will facilitate an online learning course with the guidance of an experienced mentor. The exact details of the experience will be dependent on each participant's situation. Participants will collaboratively work together to reflect on various aspects of the experience to identify best practices, hurdles and other aspects of the experience.

TEDU 672. Internship. 4 Hours.

Semester course; 4 hours. 4 credits. May be repeated for a maximum of 12 credits. Prerequisites: passing scores on Praxis II examination and Virginia Communication and Literacy Assessment and permission of adviser. Study and integration of theory with practice in clinical or off-campus settings supervised by an approved professional and university faculty. May include seminars, selected readings, projects and other activities designed and evaluated by supervising faculty.

TEDU 673. Technology Leadership and Staff Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: Admission to IT certificate or master's in curriculum and instruction program, or permission of instructor. Emphasis on professional preparation in educational technology leadership; studies of and experiences with leadership, staff development, and supervisory concepts and skills as they relate to the use of technology in K-12 education. Participation in field experience to observe the use of technology to support instruction required.

TEDU 674. Internship II. 1-6 Hours.

Semester course; full time, eight weeks. 1-6 credits. Prerequisites: passing scores on Praxis II examination and Virginia Communication and Literacy Assessment and permission of adviser. Study and integration of theory with practice in clinical or off-campus settings supervised by an approved professional and university faculty member. May include seminars, selected readings, projects and other activities designed and evaluated by supervising faculty.

TEDU 675. Internship in ESL. 3 Hours.

Semester course; 3 field experience hours (150 contact hours). 3 credits. Enrollment requires permission of instructor. The ESL internship serves as an integrative application experience. Candidates are expected to implement a planned internship project with English language learners, apply knowledge in their area of focus within the field of ESL/TESOL education and demonstrate their ability to be a critically reflective practitioner. This course includes site-based requirements. Graded as Pass/Fail.

TEDU 680. Externship Proposal Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: enrolled in M.I.S. degree, mathematics specialist track; approval of externship goals by faculty specialist. Develops and refines the skills applicable to the preparation of an acceptable draft of an externship proposal.

TEDU 681. Investigations and Trends in Teaching. 1-3 Hours.

Semester course; 1-3 lecture hours (delivered online, face-to-face or hybrid). 1-3 credits. May be repeated for a maximum of nine credits. A course designed to familiarize educational professionals with recent trends and developments in course content, strategies for organizing learning experiences and presenting material. Laboratory experience may be incorporated where appropriate. Students must contact their adviser for information regarding which section to register for based on their program.

TEDU 682. Curriculum Development in Science Education. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A course for science teacher-developed curriculum innovations that emphasize the initiation of formal and informal classroom work on current scientific trends, as well as special class work and laboratory programs.

TEDU 683. ESL Assessment and Trends. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Provides future ESOL teachers with the ESL trends and assessment practices in K-12 settings including specific skills regarding instruction, evaluation, assessment and test construction for English learners. Examines policies that influence assessment and the role of standards in assessment.

TEDU 700. Externship. 1-6 Hours.

Semester course; 1-6 credits. May be repeated for a maximum of 9 credits. Prerequisite: Permission of department. Plan of work designed by extern with prior approval of the offering department. State certification or equivalent may be required for some externships. Off-campus planned experiences for advanced graduate students designed to extend professional competencies, carried out in a setting, under supervision of an approved professional. Externship activities monitored and evaluated by university faculty. Graded P/F.

TEDU 702. National Board Certification II and Externship. 3 Hours.

Semester course; 3 credits. Prerequisite: TEDU 602 with a minimum grade of B. Apply advanced analysis and reflection on teaching practice, culminating in the completion of a portfolio that provides evidence of meeting national teaching standards. Conduct externship.

TEDU 730. Teacher Education and Professional Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. In this course, students will critically analyze theory and research on teacher education for pre-service teachers and professional development for practicing teachers. Students will explore various conceptions of the teaching profession, the history of teacher education in the United States, debates on how best to educate teachers, and how teacher education and professional development can contribute to more equitable, just and inclusive education. This course cannot be used to meet a requirement for endorsement as a supervisor of instruction in Virginia.

TEDU 731. Exploring Research in Classrooms. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: TEDU 617. Enrollment is restricted to graduate students. The purpose of the course is to provide students with an overview of classroom-based research, particularly from the socio-cultural tradition. This course explores research on the classroom through recent and classic works of theory and empirical studies of teaching and learning. Throughout the course students will engage the tension between educational ends (educational theory, institutional goals and teachers' goals) and students' needs and desires.

TEDU 732. Advanced Seminar in Curriculum Studies. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Completion of TEDU 617 is recommended prior to enrollment. Designed to engage doctoral students in a range of readings, writings, discussions and other experiences that address the questions: What should be taught in schools? and Why? The course builds on earlier course work that examines curricular movements and frameworks, and considers contemporary approaches to curriculum study and the implications and effects of their epistemic and philosophical stances – regarding the nature of knowledge, learners, schools and society – on instruction.

TEDU 780. Researching Lived Experience: Post Phenomenology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EDUS 711, NURS 770, SWKD 704, SBHD 638 or equivalent basic qualitative research course or with permission of the instructor. This advanced qualitative research course focuses on "sensitive" approaches to the study of lived experience (phenomenology) before it is reduced by reflection to words and even before lived experience is felt or emerges as "an experience" (posthumanism). In this course, cherished qualitative notions – validity, experience, subjectivity, coding, thematic analysis, identity, voice, language, etc. – are interrogated, and rigor is invested in an open style of wondering, engaging, writing and creating that transcends the authority of an author acting on its own. The course is conceptually grounded in continental philosophy. Lively philosophical passages and research studies – drawn from feminism, affect theory, critical theory and other fields – are augmented with activities that keep concepts vibrant, immediately useful and dynamically in play throughout the semester. Crosslisted as: EDUS 780.

TEDU 798. Thesis. 1-6 Hours.

Semester course; 1-6 credits. May be repeated for a maximum of 6 credits. A research study of a topic or problem approved by the student's supervisory committee and completed in accordance with acceptable standards for thesis writing.

L. Douglas Wilder School of Government and Public Affairs

Criminal Justice (CRJS)

CRJS 501. Principles of Criminal Justice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Survey of the American criminal justice system, and the relationships among crime, law, police, courts and corrections. Review of contemporary criminal justice literature.

CRJS 550. Professional Ethics and Liability. 3 Hours.

3 credits. The ethical basis for decision-making in criminal justice. How ethical considerations affect every important decision in criminal justice, especially as they involve the liberty interests of others. These decisions include: police stop and arrest decisions, prosecutor charging decision, defendant plea decisions, defense strategy decisions, judicial evidentiary rulings, sentencing decisions, among others. The consequences of unethical decisions on management ability, civil and criminal liability faced by criminal justice professionals.

CRJS 591. Topic Seminar. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for a maximum of 6 credits. Periodic seminar in contemporary criminal justice topics. Topics to be determined.

CRJS 612. Criminal Justice Politics and Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Assesses political and public policy issues as they relate to the administration of justice planning and policy strategies. Emphasizes planning implications of interagency relationships, the impact of social change in the criminal justice process, and community involvement in the control and prevention of crime.

CRJS 616. Justice Policy and Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Analyzes the legal, philosophical, political and management influences that shape the criminal justice policy and its administration. Organization and management principles as they apply to the justice system with emphasis on leadership and human resource development.

CRJS 617. Law and Criminal Justice Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to graduate students. Analysis of intergovernmental relations and civil society in the forming and implementing of criminal justice policies, laws and procedures. The bases for the creation of laws, how they are enforced, applied by the courts and sanctioned will each be examined to evaluate the proficiency of law and the justice process as instruments of social control. The issues of race, class, gender and power will be explored in the passage and implementation of laws with a view toward developing more effective strategies in the planning and development of law and crime policy.

CRJS 620. Seminar in Criminology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examination and analysis of social, psychological, and economic theories and correlates of criminal behavior. Typologies of offenders. Crosslisted as: SOCY 620.

CRJS 622. Comparative Criminal Justice Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Study of crime, law and criminal justice from an international perspective, emphasizing their comparative aspects.

CRJS 623. Research Methods for Government and Public Affairs. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Introduction to the scope and methods of applied research for the public sector. Focuses on problem structuring through logical methods, exploring problems through observation and other methods of data collection, analyzing and summarizing findings using both qualitative and quantitative methods. Crosslisted as: GVPA 623/PADM 623/URSP 623.

CRJS 624. Problems in Policing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires graduate status. Intended to provide an overview of the causes, nature and potential solutions to many of the most significant problems in modern American law enforcement. Problems include issues related to excessive force, corruption, police pursuit and other areas of police discretion.

CRJS 631. Criminal Justice Management and Leadership. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Application of organizational theory and administrative behavior to criminal justice policy, management and operation. Administrative concepts, program planning and development, and innovative management practices.

CRJS 641. Jurisprudence. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the theoretical underpinnings of law and justice. Studies the evolution of theories of jurisprudence within the context of evolving concepts of responsibility and law. Systems of law will be contrasted and emphasis will be placed on contemporary developments in substantive laws.

CRJS 650. Race, Public Policy and Social Stratification. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in programs in the Wilder School. Students will develop an understanding of the theoretical foundations of social stratification, inequality, and theory and substantive empirical research on the subject, especially as it relates to race. Students will also develop the ability to critically analyze work in the field, media and rhetoric surrounding the concepts of social stratification, inequality, and their connections to race. The course will also be used to advance knowledge, research and practitioner work within the realm of public policy.

CRJS 660. Seminar in Legal Process. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Studies the formal and informal procedures of various criminal justice systems. Advanced study of criminal procedure and the major legal constraints and authorizations placed upon arrest, prosecution, trial, sentencing and appeal.

CRJS 680. Forensic Psychology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Guilty mind requirements in criminal law. Competency to stand trial, insanity defense, mental disorder and crime. Behavioral profiling of serial murders and sex offenders. Issues in the use of clinical and statistical prediction methods in criminal justice. Crosslisted as: FRSC 680.

CRJS 690. Criminal Justice Policy Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CRJS 501, CRJS 617, CRJS/SOCY 620 and CRJS/GVPA/PADM/URSP 623, each with a minimum grade of B. Enrollment is restricted to graduate students. Integration of knowledge of criminological theory and justice policy with the research skills acquired while working toward completion of the graduate degree. Successful completion of this course requires the formulation of a research question that addresses a problem of criminal justice policy, the conceptualization of the scope of the answer to the research question and the submission of an in-depth analysis of the question with reference to theory, methodology and policy.

CRJS 691. Special Topics in Criminal Justice and Public Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated with different topics. Enrollment requires graduate status. Periodic seminar in contemporary criminal justice or policy topics. Topics to be determined.

CRJS 692. Directed Independent Study. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for a maximum of 6 credits. The instructor's review and approval of the study proposal must precede independent work by student. Provides an opportunity for an advanced student to pursue an independent research project or extensive literature review under the supervision of an instructor.

CRJS 693. Internship. 3 Hours.

Semester course; 3 credits. Students must apply for this internship a semester in advance. Provides student an opportunity to relate theory to practice through observation and experience in an approved agency. The internship should be taken near the end of the degree program. Graded as pass/fail.

CRJS 763. Seminar in Social Justice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the philosophical and historical underpinnings of the principles of justice and their relationship to equality, liberty, government and law.

CRJS 798. Thesis Research. 1,3 Hour.

Semester course; 3 thesis hours. 3 credits (with possible 1-credit extension). Prerequisite: CRJS 623 with a minimum grade of B; a graduate statistics course is strongly recommended. Enrollment is restricted to students with permission of the graduate instructor. Registration for this course is permitted only upon approval of the candidate's detailed research proposal and statement of qualifications reviewed a semester in advance by a faculty committee. A two-semester project resulting in an advanced research paper that involves a comprehensive literature review, approved research design, and an original analysis or replication study. This course involves preparation and oral defense of the thesis prospectus. Graded as S/U/F.

CRJS 799. Thesis. 1-3 Hours.

Semester course; 1-3 thesis hours. 1-3 credits. May be repeated for a maximum total of three credits. Prerequisite: CRJS 798 with a minimum grade of B. Execution of the research prospectus approved in the prerequisite course. The master's thesis will be written according to university guidelines, approved by the student's faculty committee and defended orally before the faculty committee. Graded as S/U/F.

Government and Public Affairs (GVPA)**GVPA 591. Special Topics in Government and Public Affairs. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. An intensive focus on a specialized subject area relevant to graduate programs in the L. Douglas Wilder School of Government and Public Affairs. See the Schedule of Classes for specific topics to be offered each semester. Also open to graduate students in programs outside of the Wilder School with permission of the instructor.

GVPA 601. Principles of Public Administration. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Dynamics of governmental administration including administrative principles, decision-making, communication, leadership, organizational models, and the social, economic, legal and political milieu of administration. Crosslisted as: PADM 601.

GVPA 623. Research Methods for Government and Public Affairs. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Introduction to the scope and methods of applied research for the public sector. Focuses on problem structuring through logical methods, exploring problems through observation and other methods of data collection, analyzing and summarizing findings using both qualitative and quantitative methods. Crosslisted as: URSP 623/PADM 623/CRJS 623.

GVPA 625. Public Policy Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The examination of various methods for identifying and structuring public policy problems and issues, formulating and analyzing alternative responses, recommending policy actions for decision-making, and designing and evaluating implementation plans and the means to monitor and evaluate the resulting policy outcomes. Crosslisted as: PADM 625.

GVPA 632. Planning Theory and Processes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines major traditions in the theory of planning in the context of actual planning processes and outcomes. Explores in depth the political, economic, and institutional constraints to effective planning and plan implementation. Discusses the planners' ethical dilemmas. Crosslisted as: URSP 632.

GVPA 635. Theorizing Gender Violence. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Teaches students to think structurally about gender and violence. Familiarizes students with social science and feminist scholarship and explanatory theories related to preventing and responding to gender violence. Students will learn about the experiences of and responses to sexual and domestic violence in specific social contexts, with a focus on less visible and underserved populations. Guest lectures provided by community experts in these areas. Also examines social policy and research implications of various approaches.

GVPA 640. River Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines public policy related to rivers and watersheds. Uses the James River for exploring and illustrating generic river policy issues. Crosslisted as: ENVS 640.

GVPA 672. Social Equity and Public Policy Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Designed to provide an overview of the concept of social equity and its relationship to public policy, this course will introduce students to an array of public policy areas along the core dimensions of race, ethnicity, gender and class. More specifically, this interdisciplinary survey course is designed to introduce graduate students to the concept of social equity and its relationship to public policy from theoretical and applied perspectives. The primary social equity focus of the course is racial inequities in the United States. Crosslisted as: PADM 672.

GVPA 683. Administrative Ethics. 2,3 Hours.

Semester course; 2 or 3 lecture hours. 2 or 3 credits. A philosophical investigation into the problems of making ethical decisions, focusing on issues likely to confront the public administrator. Examples of such issues are equity in social services delivery, affirmative action, loyalty to the bureaucracy vs. "whistle blowing," and conflicts of interest between personal and public interest. Crosslisted as: PADM 683/PHIL 683.

GVPA 691. Special Topics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An intensive focus on a specialized subject area relevant to graduate programs in the L. Douglas Wilder School of Government and Public Affairs. Also open to graduate students in programs outside of the Wilder School, with permission of the instructor. See the Schedule of Classes for specific topics to be offered each semester.

GVPA 693. Internship. 1-9 Hours.

Semester course; 1-9 hours. 1-9 credits. Permission of instructor required. A graduate-level internship that allows students to explore professional opportunities that relate to one or more of the graduate programs in the Wilder School. See graduate coordinator for specific hour requirements.

Homeland Security and Emergency Preparedness (HSEP)**HSEP 501. Introduction to Homeland Security and Emergency Preparedness. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. A detailed examination of the post-9/11 institutional transformation within the U.S. Both the theoretical and practical aspects of the new environment of homeland security and emergency preparedness are examined in the context of local, state and federal government, as well as the private and nonprofit sectors. The dilemmas of coordination, collaboration, competition and decision-making across and within governmental levels and between government and other sectors are explored.

HSEP 502. Survey of Terrorism. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An introduction to the theoretical and practical aspects of terrorism and counter-terrorism. Provides a broad overview of the general use of terrorism as a political tool and the idiosyncratic strategies and tactics used by specific terrorist groups. Focuses upon the relationships between terrorism and religion, technology, globalization and organizational design (network organizations). The counter-terrorism policies of various nations are examined in terms of strategic purpose, implementation and success.

HSEP 601. Emergency Management: Response Planning and Incident Command. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An advanced analytical examination of emergency management, including mitigation (designing programs to reduce the risk to vulnerable targets/infrastructure), preparedness (response planning and training, particularly interagency and intergovernmental agreements on joint operations and burden sharing), response (actual operations during and after a terrorist attack or natural disaster) and recovery (maintaining services in the immediate aftermath of a disaster and the long term). Through discussions of theory and numerous case studies, students will be able to identify and investigate the strengths and weaknesses of the current practice of emergency management in the U.S.

HSEP 602. Government, Industry and Community Strategic Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An examination of the guiding principles of strategic planning and the manner in which strategic plans can be used to better identify resource requirements and a prioritized acquisition process. Analyzes the strategic planning goal of designing a coordinated and unified effort that is all inclusive of the multiple agencies (governmental and nonprofit), distinct communities and private industries that have a role in and are impacted by natural disasters or terrorist incidents.

HSEP 603. Risk Assessment. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An introduction to the assessment and management of risk. Focuses on analytical techniques that assess risk; the primary application will be threats to critical infrastructure. Students will learn to conduct a risk and vulnerability analysis of a specific target, city or region using various assessment techniques and to manage that risk by assessing the efficacy of both prevention and response measures. The techniques covered will be both quantitative and qualitative.

HSEP 610. Law Enforcement Policy and Judicial Precedent. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An examination of local, state and federal law enforcement agencies' evolving policies on crisis and consequence management, as well as court decisions guiding these policies and interpreting their implementation. Students will engage in case-study analysis while learning the fundamentals of policy development. Course content will include analysis and discussion of relevant statutes and court cases, and the issues, processes and procedures associated with the development and implementation of judicial policies that attempt to balance civil rights and homeland security, as well as legal aspects of natural disasters and public health crises.

HSEP 620. Private Sector Issues in Security and Preparedness. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A survey of the private sector's dilemmas and responsibilities in homeland security and emergency preparedness. Class will focus on issues such as the critical emergency management functions for private industry (resumption, recovery, restoration, continuity); the question of "how much security is enough"; and the central dilemma of private sector-public sector security and preparedness: the overwhelming majority of critical infrastructure is privately owned, yet it is the government's responsibility to prepare, protect and reconstitute it. Information sharing, communications and regulatory issues are examined.

HSEP 623. Research Methods Homeland Security and Emergency Preparedness. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The purpose of this course is to introduce students to research concepts. Topics to be covered include philosophy of science, the relationship between theory and methods, the fundamentals of the research process, how to choose an appropriate statistical technique, and organizing or presenting information. Generally, this course is designed to help students develop the basic skills to evaluate and conduct research at a graduate level. The fundamentals of research methodology will be covered and the student will be expected to demonstrate mastery of those concepts through a variety of assessment measures.

HSEP 628. Survey of Cyber Security. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course offers a survey of emerging strategic, legal and policy issues associated with computer network attack, exploitation and defense. Students will be introduced to research and developments across a range of issues and will engage with topics related to national security, homeland security and economic policy, and local governance. This course is designed to provide students with perspective on different technical, theoretical and policy issues and to enhance knowledge of cyber conflict conducted by both state and non-state actors.

HSEP 640. Intelligence and Counterintelligence. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The course will look at the origins of intelligence, tracing the history and role the intelligence community has played in the evolution of the United States. It will examine the "intelligence process" from requirements to collection, processing and exploitation, analysis, and the dissemination of finished products. Students will also look at how intelligence is used in national level policy and decision-making.

HSEP 646. Cybersecurity Risk Assessment. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course considers risk as an integral element of cybersecurity. The key issues that pose threats to cyber systems will serve as the predicate for the course. Key issues to be addressed include confidentiality, integrity and availability. The role and access of third-party and contract vendors; the legal components of service contracts; the role of controls, regulations and frameworks; and the importance and applicability of attestation documentation will all be considered.

HSEP 650. Public Health Preparedness. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An examination of the role of the public health sector in preparing for and responding to natural disasters, emerging infectious diseases, catastrophic terrorism and bioterrorism. The class focuses on coordination and cooperation of federal, state and local government and the public-, private- and nonprofit-sector components of the public health infrastructure. Topics include epidemiological and mental health issues related to disasters, command/communication concerns, national stockpile management, surge planning, all-hazard planning and exercise design.

HSEP 690. Capstone Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: 27 credits in HSEP courses or permission of instructor. A capstone and assessment course. Readings, writing assignments and the large research project are designed to allow students to use the sum of their knowledge and analytical skills to examine homeland security and emergency preparedness in a broad and comprehensive way. Students will engage in research linked to a role-playing simulation/exercise that will be held when the class meets in the last week of the semester.

HSEP 691. Special Topics in Homeland Security and Emergency Preparedness. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated with different topics. Enrollment requires graduate status. Periodic seminar in contemporary homeland security and emergency preparedness topics. Topics to be determined.

HSEP 692. Independent Study. 1-3 Hours.

Semester course; variable hours. 1-3 credits. May be repeated for a maximum of 6 credits. The instructor's review and approval of the study proposal must precede independent work by student. Provides an opportunity for an advanced student to pursue an independent research project or extensive literature review under the supervision of an instructor.

HSEP 695. Capstone in Cybersecurity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will provide students a forum to apply learned concepts in experiential, practical settings. Students will be connected with existing agencies, public and private, and will assist these agencies as they develop effective cybersecurity modalities. These real-world experiences will represent the foundation for learning in the class setting.

Policy and Leadership (DPAL)

DPAL 701. Cross Sector Leadership. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to doctoral students. Concepts of leadership have largely emerged from the study of people in positions of authority in business and politics whose characteristics, behaviors and values tend to dominate leadership theory. Less well-developed are concepts of public leadership, though its failures have dire consequences. More recently, scholars have turned to the study of civic leadership, which recognizes the benefits and challenges of civic action in shaping action based on shared goals. The course will explore the benefits and challenges of citizens and institutions (government, nonprofit and business) working together to advance sustainable communities.

DPAL 702. Web Technologies and Digital Governance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to doctoral students. This course emphasizes the importance of Web 2.0 technologies and digital governance. Students will learn about the nature of Web 2.0 technologies and their impacts on public policy and administration as well as how Web 2.0 applications can support the goals of government organizations.

DPAL 711. Theory and the Public Process. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to doctoral students. Applying a broad theoretical lens, students will critically examine issues surrounding an actual policy or leadership problem within a chosen concentration. Emphasis is placed upon critical analysis, developing a substantive level of knowledge within an existing literature, and developing and supporting an argument grounded in theory.

DPAL 712. Institutions and Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to doctoral students. Organizational and institutional theories look to the political, organizational and cultural contexts that shape social life. Some theories conceptualize environments in terms of networks and resources, within which social actors are "embedded." Others stress historically built-up structures (e.g., laws and governmental agencies) that shape and channel subsequent dynamics. More radical theories argue that the core features of modern social actors, themselves, are largely products of social constructs, rather than existing a priori as often assumed. This course explores theories of institutions and organizations to inform our thinking about the roles and behavior of public and nonprofit organizations in shaping democratic organizational life in societies.

DPAL 721. Systematic Inquiry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to doctoral students. This course is designed to teach students how to design and assess research in the policy setting. The course focuses on problem structuring through logical methods, exploring problems through multiple methods of data collection, analysis and summarization of findings using qualitative, quantitative and mixed-method designs. Through interpretation and critique of various research reports students gain an understanding of the different purposes that research can serve in applied policy settings.

DPAL 722. Methods of Decision-making. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to doctoral students. This course examines qualitative, quantitative and mixed-methods approaches to decision-making with an emphasis on situation factors impacting the decision-maker. Students will be able to describe, understand, evaluate, apply and create synergistic methods for making decisions.

DPAL 780. Synthesizing Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to doctoral students. Policy is frequently a bridge between political aspiration and practice. Focuses on studies, reports, research and public initiatives demonstrating the cycle of "idea" to "implementation." The Massengill Report (Virginia Tech tragedy), Richmond mayor's anti-poverty task force and meals tax referenda are examples of case studies that could be reviewed.

DPAL 890. Capstone. 6 Hours.

Semester course; 6 lecture hours. 6 credits. Restricted to doctoral students. Advanced doctoral students will design a capstone project with the advice and under the supervision of selected faculty. The doctoral student is expected to develop a formal proposal designed to respond to a current problem situation relevant to policy and leadership in governance. Once the proposal is approved, the student is to carry out a regimen of research and project development based in professional practice and seeking an innovative solution or model to advance the practice of their chosen concentration.

Public Administration (PADM)

PADM 583. Effective Managerial Communications. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Describes and explains the communications process as it applies in public organizations. Acquaints students with the theoretical basis of interpersonal communications and with applied methodologies from a managerial perspective.

PADM 584. Planned Organizational Change. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Describes and explains strategies and tactics of planned organizational change. Emphasis is placed on the change process in organized situations and on various strategies and tactics the manager may employ to achieve desired change in his or her organization.

PADM 585. Power, Influence and Organizational Competence. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course will explore the strategies and tactics of power and influence use in large-scale public organizations. A framework for use of influence strategies will be presented and tactical methodologies will be examined through case study and simulation.

PADM 591. Topic Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Seminar in contemporary public administration issues.

PADM 601. Principles of Public Administration. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Dynamics of governmental administration including administrative principles, decision-making, communication, leadership, organizational models, and the social, economic, legal and political milieu of administration. Crosslisted as: GVPA 601.

PADM 602. Public Administration Theory. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Examines historical and contemporary public administration theories and paradigms. Emphasizes the practical significance of such theories for both macro and micro issues in public administration.

PADM 603. Politics and Economics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines political and economic institutions and concepts as they affect and are affected by the practice of public administration. Topics include microeconomics and the public sector; the interrelationship between the private and public sectors; macroeconomics concepts and related institutions.

PADM 604. Comparative Public Institutions. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Applies a comparative methodology to explore theories and models of public institutions in the United States and in selected developed and developing countries. Focuses on administrative structures and practices, with emphasis on the relationship between administrative practice and cultural and political context. Institutions examined will be changed periodically to focus on interjurisdictional comparisons within the United States - at the local, state and federal levels - as well as among other countries and the United States.

PADM 605. Survey Research Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SOCY 601, SOCY 602 and SOCY/STAT 608, or permission of instructor. Examines all major areas of survey research methodology including sampling, design, data collection methods, questionnaire design, data analysis and data processing. Addresses problems specific to survey research, such as telephone interviewing, constructing large representative samples and nonresponse rates. Crosslisted as: SOCY 605.

PADM 606. Government Management Models. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An examination of current thought and research on management theory and organizational design in government. Theory and research from diverse sources, i.e., political science, sociology, industrial psychology and administrative science will be explored to provide each student with the macro conceptual framework necessary for development or refinement of effective public management skills.

PADM 607. Public Human Resource Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The general concepts, principles and techniques of personnel administration and employee relations as applied in governmental units and agencies.

PADM 609. Financial Management in Government. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The general concepts, principles and techniques of financial management as they are applied in governmental units and agencies.

PADM 621. Organizational Behavior and Management in Government. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The general concepts, principles and theories of management and organizational behavior as they relate to the administration of governmental units and agencies are dealt with in lecture, discussion and workshop formats.

PADM 622. Public Sector Budgeting. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PADM 609. Advanced theory and practice of public agency budgeting in the decision-making process and its impact on policy-making. Topics include alternative budgeting systems, capital planning and budgeting, budget execution, budgeting analysis techniques, and revenue and expenditure forecasting.

PADM 623. Research Methods for Government and Public Affairs. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Introduction to the scope and methods of applied research for the public sector. Focuses on problem structuring through logical methods, exploring problems through observation and other methods of data collection, analyzing and summarizing findings using both qualitative and quantitative methods. Crosslisted as: GVPA 623/CRJS 623/URSP 623.

PADM 624. Quantitative Methods for Public Administration. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: PADM 623 or permission of the instructor. Introduction to statistical methods for use in managerial decision-making, policy analysis and social science research. Descriptive and inferential statistics are explored through computations and using SPSS/PC computer software.

PADM 625. Public Policy Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. The examination of various methods for identifying and structuring public policy problems and issues, formulating and analyzing alternative responses, recommending policy actions for decision-making, and designing and evaluating implementation plans and the means to monitor and evaluate the resulting policy outcomes. Crosslisted as: GVPA 625.

PADM 626. Intergovernmental Relations. 3 Hours.

3 lecture hours. 3 credits. Focuses on various models of federalism and examines the pragmatic evolution of federal, state and local intergovernmental relations in the United States. Topics include policy implementation and implications, fiscal transfers, and local government cooperation and conflict in the metropolis.

PADM 627. Workshop in Policy Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is project-oriented, emphasizing practical experience in the design and conduct of policy analysis. Emphasizes political environment and client relationships.

PADM 628. Environmental Policy and Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course explores the relationship between environmental policy and its implementation within a democratic political system. It includes an investigation of basic concepts that underlie environmental policy and the difficulties encountered when attempting to apply them in a real-world setting. It also surveys a variety of tools and methodologies that may be useful in attempting to develop and implement environmental policy. Crosslisted as: ENV5 628.

PADM 630. Strategic Planning and Management in the Public Sector. 3 Hours.

3 lecture hours. 3 credits. Explores the benefits and limitations of strategic planning and management in the public sector, examines approaches to strategic management, especially in terms of the role and behavior of top management, and provides an introduction to the analytic and process methods used in strategic planning and management. Crosslisted as: URSP 630.

PADM 637. Organic Human Resources Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PADM 607 or equivalent. An examination of current thought, research, and personnel management theory and practice in government that is person-oriented is presented in this course. Topics include rank-in-the-personnel systems; career development, executive personnel systems; forecasting human resource needs; individual-based performance evaluation; employee assistance programs; and special emphasis program.

PADM 642. Grants Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Principles and practices of managing federal and state funds and implementing a grant-funded program. Topics include federal grant-making process, applying for a grant, developing grant accounting systems, joint funding, disputes, appeals and remedies, and close-out procedures.

PADM 650. Principles of Nonprofit Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Explores the history, theories and dynamics of not-for-profit organizations in the United States, with focus on organizations with local or regional services areas. Emphasizes political, legal, cultural and constituent environments; revenue generation; decision-making; communications leadership; and organizational models. Compares the mission and operations of nonprofit organizations, government organizations and for-profit enterprises in the delivery of services.

PADM 652. Administrative Law. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The course considers the administrative process from the perspective of rule-making and decision-making within the framework of public agencies. It will examine the development of the law, the use and control over administrative discretion, legislative and judicial controls over the administrative process, and remedies for improper administrative acts.

PADM 654. Program Design and Evaluation. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: PADM 623/CRJS 623/GVPA 623/URSP 623 or equivalent or permission of instructor. Designed to train students of public and nonprofit administration in the principles of program design and evaluation. Students will be introduced to the theoretical, organizational, political and ethical foundations of the program as well as practical research design and methodologies, both qualitative and quantitative.

PADM 656. Fund Development for the Nonprofit Sector. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students will study the multiple methods and sources for funding nonprofit organizations, the various methods for identifying and securing funding resources and for differentiating among them. Sources of funding that will be explored include corporate, annual, planned giving/endowment, individual, major gift, the use of special events and direct mail. Grant writing will be explored in detail. Students will examine ethical issues related to fund raising as well as the stewardship of funds received.

PADM 657. Nonprofit Advocacy and Government Relations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Addresses the growth and expansion of the nonprofit sector's relationship to the government sector both in the United States and internationally. Students will study historical and current partnerships with and regulation by government entities. Students also will study the nonprofit organization's advocacy role on behalf of its missions and beneficiaries, the scope of permitted lobbying and political activities, the state's role in regulating speech by nonprofits and government funding of service delivery through religious-based organizations.

PADM 659. Financial Management for Nonprofit Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Designed to introduce students to the financial practices of nonprofit organizations including budgeting, forecasting, accounting, auditing, and debt and cash management. The general concepts, principles and techniques of financial management will be studied in the context of the political, behavioral and social environments in which the nonprofit organization operates in order to determine the best manner for achieving the objectives of the nonprofit financial administrator/manager. This course may be substituted for the core course, PADM 609 Financial Management in Government, for students pursuing a nonprofit specialization.

PADM 660. Community Power Dynamics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examination of the location of power in the American community, operational concepts and general methodological approaches defined, empirical findings based on various methodological approaches, conclusions on community political systems and power.

PADM 661. Nonprofit Law, Governance and Ethics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines fundamental governance issues in nonprofit corporations with a focus on boards of trustees and their fiduciary responsibilities as established by law as well as moral imperatives stemming from their actions on behalf of the public interest. The ethical dimensions of work in nonprofit organizations are explored with specific emphasis on risk management, tax liability and human resource management.

PADM 662. Advanced Topics in Revenue and Taxation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ECON 616 or permission of instructor. An advanced examination of governmental revenue and taxation policies, tax incidence, and alternative funding techniques.

PADM 664. Local Government Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An intensive examination of the major functional responsibilities with a special emphasis on the organization, standards, operational imperatives, interrelationship with other functions, and special management problems at the local level, including small and rural jurisdictions.

PADM 670. Advanced Public Financial Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PADM 609 and ECON 616, or permission of department. Brings together specialty aspects of public financial management such as economic and political implications, practical skill-building, operational financial administration issues and tactics, and accounting principles and approaches, and integrates these disparate segments of public finance. The emphasis is on policy-level implications and strategies of public financial management strategies of executive planning, analysis, and management of the financial sector of public organizations.

PADM 672. Social Equity and Public Policy Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Designed to provide an overview of the concept of social equity and its relationship to public policy, this course will introduce students to an array of public policy areas along the core dimensions of race, ethnicity, gender and class. More specifically, this interdisciplinary survey course is designed to introduce graduate students to the concept of social equity and its relationship to public policy from theoretical and applied perspectives. The primary social equity focus of the course is racial inequities in the United States. Crosslisted as: GVPA 672.

PADM 675. Comparative Public Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores methodology, theories and models used in comparative approach to public administration, functional processes of administration in selected developing and developed countries, and role of bureaucracy in development and nation building.

PADM 680. Leadership in the Public Sector. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores aspects of current interest in leadership style, skills and roles. This course allows participants to explore areas of personal interest in contemporary public management leadership theory and practice and to share findings in seminar format.

PADM 681. Governmental Administrative Decision-making Processes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Identification of alternative decision-making processes in public sector management environments. Choosing the proper method of the appropriate management-level theory and method of controlling administrative decisions within governmental organizations. Dealing with political, budgetary and personal constraints in achieving organizational goals.

PADM 682. Advanced Public Human Resources Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PADM 607 or equivalent or permission of instructor. Public personnel management is analyzed in process and systems perspectives, with specific emphasis on the interrelatedness of discrete system components with other systems. Attention is given to the integration of personnel elements through the development of feedback systems, positive and negative impacts' analyses, and personnel policy development and implementation.

PADM 683. Administrative Ethics. 2,3 Hours.

Semester course; 2 or 3 lecture hours. 2 or 3 credits. A philosophical investigation into the problems of making ethical decisions, focusing on issues likely to confront the public administrator. Examples of such issues are equity in social services delivery, affirmative action, loyalty to the bureaucracy vs. "whistle blowing," and conflicts of interest between personal and public interest. Crosslisted as: PHIL 683/GVPA 683.

PADM 689. Seminar in Public Administration: Integration of Theory and Practice. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: PADM/GVPA 601, PADM 602, PADM 607, PADM 609, PADM/GVPA/CRJS/URSP 623, PADM 624 and PADM/GVPA 625. Integration of public management and administration theory and practice; goal setting for professional growth and approaches to lifelong continuing self-development; integration of theory, models, knowledge, skills, behaviors, values, ethics and philosophy of public management and administration. This is the capstone course required for M.P.A. students.

PADM 691. Topics in Public Administration. 1-3 Hours.

Semester course; 1, 2 or 3 lecture hours. Variable credit. Course may be repeated with different topics as approved. Prerequisite: permission of instructor. An in-depth study of a selected topic in public administration. See the Schedule of Classes for specific topics to be offered each semester.

PADM 693. Public Administration Practicum. 3 Hours.

3 credits. A professional internship in public service for those students without significant professional-level experience in a public agency.

PADM 697. Directed Research in Public Administration. 1-6 Hours.

Semester course; 1-6 credits. Prerequisite: permission of instructor. Independent research into public administration problems, issues, applications and theories related to student's field of concentration.

Public Policy and Administration (PPAD)**PPAD 711. Seminar in Public Policy I. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Restricted to doctoral students only. Provides a critical and comparative review of public policy and administration focusing on the empirical and theoretical literature in the field. Emphasizes the development of the policy studies field and its epistemological foundations. Includes alternative approaches to policy analysis, the place of analysis in the decision-making environment and the role of policy in shaping administrative institutions.

PPAD 712. Seminar in Public Policy II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PPAD 711. Enrollment is restricted to doctoral students. This seminar aims to facilitate examination of public policy in its macro context. It will assist participants in gaining an overview of fundamental and contextual features of public policy as it has evolved. It will explore underlying and outlying perspectives that shape thinking and theorizing and action about public policy, and that suggest fresh ideas about public policy. This will include selected aspects of philosophy of public policy, philosophy of methodology relating to public policy and epistemic pluralism as it relates to public policy. Continuation of PPAD 711.

PPAD 715. U.S. Political Processes and Institutions. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course examines the operation of the major national political institutions in the United States, the processes that help to define and shape those institutions, and the contexts in which these entities operate. The course familiarizes students with a broad range of scholarship and with the principal theoretical debates about U.S. politics.

PPAD 716. Public Policy Economics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is designed to introduce students to a set of applied microeconomic models that can be used to understand and evaluate important policy issues. Students will be shown how these models can be used as tools to design, to predict the effects of and to evaluate public policies. Specific models used in this course will include consumer theory, production theory, cost theory and the theory of economic organization. Discussions of policy analysis and evaluation will rely upon theoretical approaches to welfare economics.

PPAD 717. Law and Public Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An introduction to basic legal and constitutional issues that shape and limit the creation of public policy. An examination of court cases leads the student to examine the interaction between legislative policymakers, courts and administrative implementers, and how the law may be used both to support the role of policymakers as well as to constrain them. Issues to be examined include health care, regulation of commerce, First Amendment issues, the environment and educational policy.

PPAD 720. Public Organization Design and Behavior. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to doctoral students only. Provides an intensive examination of the public (and nonprofit) organization design and behavior literature. Students will review theories, models and latest research findings as vehicles for understanding behavior in and the design of effective public organizations.

PPAD 721. Survey of Applied Research Methods in Public Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to doctoral students. The study of the methods of policy and organization analysis including the assumptions, applications and limits of various research methodologies. Includes quantitative and qualitative methods; focus groups; probability and non-probability sampling; mail, telephone and in-person interviewing; design of instruments; evaluation research, experiments and quasi-experiments; content analysis; observational and unobtrusive methods; cost-benefit and forecasting models; sources for secondary data analysis; and ethics of research.

PPAD 722. Survey of Data Analysis Techniques in Public Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PADM 624 or equivalent; and PPAD 721. Enrollment is restricted to doctoral students. This is a second-level course in statistical data analysis for public policy and administration. It is a study of the levels of measurement and selection of appropriate analytical tools and the analysis of data. Focus will be kept on integrating data and analysis into decisions regarding research design and on understanding the application of a wide range of modern techniques to specific decision-making situations, rather than on mastering the theoretical underpinnings of the techniques. Upon successful completion of the course, students should possess valuable practical analytical skills that will equip them with a competitive edge in their research. The course covers methods that are aimed at description, inference, prediction, classification, clustering, visualization and data-reduction techniques.

PPAD 723. Survey Research Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Overview of survey research methods with an emphasis on hands-on training in how to evaluate, conduct and analyze survey research.

PPAD 724. Seminar in Advanced Analytical Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PPAD 721 and PPAD 722, both with a minimum grade of B. Enrollment restricted to students in the Ph.D. in Public Policy and Administration program or with permission of instructor. This seminar is the final in a three-course sequence that introduces students to methods of research and its many different applications in public policy analysis and management. Building upon the knowledge and skills learned in the prerequisite courses, students will be trained to tackle some of the advanced statistical techniques in various applied public policy and management settings. The final sequence is especially intended for doctoral students who are serious about publishing in top peer-reviewed public policy and public management journals using quantitative techniques.

PPAD 726. Advanced Research Design. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers skills needed to develop independent research projects including all aspects of research design, measurement design, data analysis planning and interpretation, and report writing.

PPAD 728. Seminar in Qualitative Research Methods. 3 Hours.

Semester course; 3 seminar hours. 3 credits. Enrollment is restricted to doctoral students. This seminar approaches qualitative research methodology in policy, administration and organizations from a research design perspective. Students learn to select a qualitative paradigm that is appropriate for their topic and interests; to develop research questions, research objectives and specific aims that are well-suited for qualitative methods; to develop data collection necessary to address specific aims using direct elicitation such as interviews, focus group discussions and open field survey items; using indirect elicitation such as participant observation and go-alongs and existing data sources such as documents, media and social media; and to prepare an initial data analysis plan. Students also learn how to conduct methodological literature searches and how to prepare for ethical and quality considerations unique to qualitative methods.

PPAD 730. Seminar in Health Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines key issues and alternative policy responses in health. Presents a framework for understanding health policy in terms of the regulatory environment, developing initiatives and emerging trends. Designed to assist students to build a program of research in health policy.

PPAD 740. Seminar in Public Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Doctoral students only. Examines key theoretical and empirical literature in public sector administration with an emphasis on state and local government. Covers the management of human resource, financial and information systems. Includes the impact of leadership, organizational design and policy on the conduct of public activities. Designed to assist students to build a program of research in public management.

PPAD 741. Advanced Theory in Public Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This seminar aims to contribute to understanding public policy by examining the public administration context. It will assist participants, first, in gaining an overview of fundamental features of varieties of traditional public administration. The categories of public administration theory are described by Harmon and Mayer as classical, neoclassical, systems, human relations, market, interpretive and critical theories. Elsewhere, they are described in terms of science, technology, enterprise and hermeneutics. Second, this overview will also include exploring underlying and outlying perspectives that shape thinking and theorizing about public administration. Perspectives include traditional, business, economic, political, critical theory, post-structural, psychoanalytic, neuroscience, feminist, ethical and data. Third, this overview will provide post-traditional examples that can assist students in developing their own view of how public policy and administration theory and practice should be shaped.

PPAD 742. Institutions and Organizations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Organizational and institutional theories, in the broadest sense, look to the political, organizational and cultural contexts that shape social life. Some theories conceptualize environments in terms of networks and resources, within which social actors are "embedded." Others stress historically built-up structures (e.g., laws and governmental agencies) that shape and channel subsequent dynamics. More radical theories argue that the core features of modern social actors, themselves, are largely products of social context, rather than existing a priori as many theories assume. This course explores theories of institutions and organizations to inform our thinking about the roles and responsibilities of the public, business and nonprofit organizations in shaping public life in a democratic society.

PPAD 750. Seminar in Urban Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Doctoral students only. Examines key issues in urban policy. Explores public policy as it relates to the natural, built, social, economic and political environments of urban life. Designed to assist students to build a program of research in urban policy.

PPAD 760. Criminal Justice Policy and Program Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The purpose of this course is to familiarize students with the main concepts of program evaluation, including but not limited to goals and objectives, needs assessment, process evaluation, and outcome evaluation in criminal justice settings.

PPAD 761. Risk Assessment in Criminal Justice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A large portion of criminal justice policy, research and practice has been devoted to risk assessment at the individual, group, and community or environmental levels. This course will assess what is known about applying existing risk, classification and prediction methods in the criminal justice system, and how data can be used to test the efficacy of these methods in different settings.

PPAD 780. Synthesizing Seminar in Public Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PPAD 711, PPAD 712, PPAD 721 and PPAD 722. Enrollment is restricted to doctoral students. This is a required course for the Ph.D. in Public Policy and Administration. It is designed to expose students to various areas within public policy, particularly those of the concentration areas within the program: public policy (e.g. health and education), public administration, criminal justice policy and urban and regional policy. The course is designed to acquaint advanced doctoral students with the academic profession with primary focus on research, teaching and service.

PPAD 791. Topical Seminar. 1-3 Hours.

Semester course; 1-3 credits. May be repeated for a maximum of 6 credits. Prerequisites: doctoral standing and permission of program director and instructor. An in-depth study of a selected topic in public affairs, policy or administration.

PPAD 792. Independent Study. 1-3 Hours.

Semester course; 1, 2 or 3 credits. May be repeated for a maximum of 6 credits. Prerequisites: doctoral standing and permission of program director and instructor. Independent study and research in selected areas of public affairs, policy and administration under the guidance of a graduate faculty member.

PPAD 898. Dissertation Research. 1-12 Hours.

Semester course; 1-12 hours. May be repeated for credit. Prerequisite: admittance to doctoral candidacy. Research on an approved dissertation subject.

Urban Studies (URSP)**URSP 502. Global Economic Change and Development. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. Explores the factors, both historical and contemporary, that have influenced the socioeconomic and environmental characteristics of national and subnational regions, mainly in the developing world. Analyzes development problems and strategies from various theoretical perspectives and examines the impacts of policy and planning interventions on regional conditions.

URSP 515. Watershed Planning and Governance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course presents an interdisciplinary approach to planning and governance for watersheds. Students will learn concepts from environmental science, hydrology, landscape ecology, environmental engineering, urban planning and geography, gaining baseline knowledge about the science, policy and practices of how humans interact with water and the biosphere within which it moves. Students will build on and apply this knowledge as they discuss and analyze case studies from around the world: interjurisdictional water allocation in the Colorado River, disaster management for colonias in the Rio Grande, privatization of water supply in Lagos, sanitation solutions in Nairobi and intersections of potable, storm and waste water infrastructures in Delhi. Throughout the semester, students will also examine watershed management for one of the nine major watersheds of the Chesapeake Bay. This semester-long group project provides an opportunity to not only gain in-depth knowledge about a nationally important watershed ecosystem, but also learn — through structured exercises/labs — how to collect and analyze data on water quality, quantity, movement and watershed land use, using various web tools and databases.

URSP 517. Historic Preservation in Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The course surveys the process of historic preservation that includes the evaluation of sites, identification of architectural styles, the adaptive use of sites and structures, and the various sources available for implementing preservation proposals in government or the private sector. Preservation is considered as a tool in the planning process; and its application to neighborhoods, downtowns, and other city districts is considered.

URSP 520. Park Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Explores the general approaches and strategies for planning recreation areas and facilities. Topics include specific principles of design relating to outdoor recreation facilities; standards relative to space requirements, locations and programs; and trends in site design and planning.

URSP 521. Introduction to Geographic Information Systems. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. An introduction to creating and using geographically referenced databases for urban and environmental analysis and planning. Includes geographic and remote sensing data structures, global positioning systems, spatial analysis, geographic data standards, public domain software and data resources, and principles of cartography design. Lab exercises in the use of geographic information systems software tools. Crosslisted as: ENVS 521.

URSP 523. GIS for Land Use and Transportation Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course focuses on the use of geographic information systems for land use and transportation planning at the local, regional and state level. It builds on concepts learned in introductory GIS classes. Advanced GIS tasks will be covered. Students will gain an in-depth understanding of GIS data layers used in land use and transportation planning. Students will also learn new GIS skills that will allow them to analyze development build-out, impervious surface, comprehensive planning, roadway functional classification, drive-time service areas and the relationship between land use and transportation.

URSP 525. Site Planning and Graphics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Addresses the environmental impacts and capacity of environmental systems in relation to the site requirements of various urban and rural situations. Introduces the use of graphics as an aid in presenting and analyzing planning and design ideas, maps and plans.

URSP 526. Design of Sustainable Places. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course introduces urban planning students to the practical application of sustainable urban design theory and practice through a series of design assignments. Student test how compactness, sustainable transport, density, a mix of land uses, diversity, passive solar design and greening can create economically, socially and ecologically sustainable urban environments.

URSP 541. Urban Public Policy-making Processes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Discusses the politics of urban life. Examines the physical, demographic and economic environments in which conflict resolution occurs, as well as the actors on the local, state and federal levels that participate in the political process.

URSP 545. Sustainable Energy Policy and Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Discusses current energy production and consumption trends and related economic, environmental and social issues. Reviews energy planning and policy approaches from the international to local levels. Analyzes and evaluates different types of energy systems and existing and proposed energy policies.

URSP 561. Real Estate Development Finance for Planners. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will prepare students to work on real estate development projects, but go beyond a typical real estate finance course by exploring how development plays out in its particular neighborhood, urban and regional contexts.

URSP 567. The American Suburb. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides students with an understanding of the suburban movement in America, the elements of suburban growth and an awareness of current and emerging approaches to suburban planning and design. Includes neotraditional design, transit oriented development, new urbanism and master planned communities. A working knowledge of the U.S. Census is needed for some assignments.

URSP 591. Special Topics in Urban and Regional Studies and Planning. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for credit. Students will have an opportunity to examine in detail some questions of significance in the field of urban and regional studies and/or planning. See the Schedule of Classes for the prerequisites and specific topics to be offered each semester.

URSP 605. Urban Planning History. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Discusses the historical context of planning solutions to contemporary urban problems by examining the rich planning tradition since the mid-nineteenth century in the U.S. Significant plans, people and movements in the history of planning are discussed in relation to the evolving traditions of the profession.

URSP 610. Introduction to Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces students to the planning profession. Provides an overview of the urban system and the history of planning, and covers the basics of comprehensive planning, including the context, process, agents, methods, components, and implementation. Prepares students for taking more specialized planning courses by introducing the sub-areas of planning, such as transportation planning, land use planning, environmental planning, housing, and urban design.

URSP 611. Principles of Urban Design. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Principles of urban design at the micro- and macro-scale. Expression of planning objectives in physical design, with emphasis on the relationship between urban design at various scales and the needs of individuals and groups.

URSP 621. Introduction to Geographic Information Systems. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours 3 credits. Introduces the components, capabilities, and functionalities of Geographic Information Systems. In addition to the concepts upon which GIS is based, how it works and what it does, this course introduces cartographic techniques necessary to design and construct effective maps with an emphasis on thematic mapping. It also examines the processing, compilation and symbolization of spatial data and the application of related analytical techniques. Laboratory work emphasizes practical applications and uses of ArcGIS and the spatial analyst extension.

URSP 622. Community Socioeconomic Analysis Using GIS. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Introduces students to data sources and database management for community analysis using geographic information systems. Includes an overview of database structures, public domain software and data resources, descriptive statistical analysis, population projection, graphic presentation of data, and principles of cartographic design. Laboratory exercises using GIS software and public domain data to describe communities and identify planning issues. Laboratory work emphasizes practical applications and uses of ArcGIS.

URSP 623. Research Methods for Government and Public Affairs. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Introduction to the scope and methods of applied research for the public sector. Focuses on problem structuring through logical methods, exploring problems through observation and other methods of data collection, analyzing and summarizing findings using both qualitative and quantitative methods. Crosslisted as: GVPA 623/PADM 623/CRJS 623.

URSP 625. Spatial Database Management and GIS Modeling. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: URSP 521, URSP 621 or URSP 622, or permission of the instructor. Introduces principles and applications of Geographic Information Science and GIS to transportation. Students discuss the fundamental scientific principles of capturing, representing, integrating, processing and analyzing digital geographic information about transportation infrastructure and systems. Concentrates on the applications of GIS-T software, tools and related technologies to transportation planning, intelligent transportation systems, environmental and hazards analysis and logistics.

URSP 626. Transportation Analytics and Modeling. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Introduces conventional travel demand forecasting techniques, i.e., the Urban Transportation Modeling System. UTMS typically consists of trip generation, trip distribution, mode choice and trip assignment. Land-use modeling and post-processing procedures will also be introduced. Additionally, other latest modeling developments, such as activity/tour-based modeling, 4D post-processing and land use/transportation integration models will also be explored. Case studies of the Virginia Transportation Modeling and its Cube Voyager applications are included.

URSP 627. GIS Applications in Urban Design. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: URSP 521, URSP 621 or URSP 622, or permission of the instructor. Covers GIS tools and techniques in relation to 3D visualization, decision analysis, program evaluation and Internet-GIS. Emphasizes the integration of exploratory/predictive spatial analyses and 3D visualization into the decision-making process. GIS tools and techniques are used to automate decision analysis and facilitate future visioning in analyzing and visualizing decision actions. Laboratory work emphasizes practical applications and uses of ArcGIS, ArcIMS and the Scenario 360 software suite.

URSP 628. Land Use Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces students to the context, substance, practical skills, and implementation of land use planning. Covers such topics as land capacity, land use system and design, land use controls, state and regional growth management, resource land preservation, rural growth management, urban containment, and facility planning.

URSP 629. Quantitative Geospatial Data Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: URSP 521, URSP 621 or URSP 622. This course is designed to provide a practical approach to quantitative methods and their applications in geospatial data analysis and visualization. It focuses on the description, analysis, interpretation and presentation of data in the context of conducting research that involves the use of geospatial data. This course begins with an overview of fundamental statistical concepts, builds upon them and introduces quantitative methods and their geospatial applications. Major topics include census data, geographic distributions, pattern analysis, correlation, regression, spatial relationship and statistical surface creation.

URSP 630. Strategic Planning and Management in the Public Sector. 3 Hours.

3 lecture hours. 3 credits. Explores the benefits and limitations of strategic planning and management in the public sector, examines approaches to strategic management, especially in terms of the role and behavior of top management, and provides an introduction to the analytic and process methods used in strategic planning and management. Crosslisted as: PADM 630.

URSP 632. Planning Theory and Processes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines major traditions in the theory of planning in the context of actual planning processes and outcomes. Explores in depth the political, economic, and institutional constraints to effective planning and plan implementation. Discusses the planners' ethical dilemmas. Crosslisted as: GVPA 632.

URSP 635. Legal and Legislative Foundations of Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Delineates the legal and legislative basis for planning at local, state, and federal levels. Judicial precedents in land use controls and environmental protection are investigated, including private controls, traditional zoning, administration of zoning ordinances, new flexible zoning concepts, development timing and growth controls, exclusionary land use practices, subdivision controls, and eminent domain regulations for environmentally sensitive areas, and environmental review.

URSP 637. Sustainable Community Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course includes both theoretical and practical aspects of sustainable development and its relationship to land-use planning. Through examination of the literature, class discussion, focused exercises and guest speakers, students will develop the skills needed to evaluate and propose activities to plan for sustainable development. The course begins with an overview of the origins and definitions of sustainability and developing operational principles of sustainable development. The three "Es" of sustainability (environment, equity and economics) are then explored and connected to the role of the planner in influencing the balance between these dimensions in practice. A variety of tools and initiatives for sustainable practices are introduced, followed by examination of standards for measuring progress toward sustainable goals. Finally, through the evaluation of case studies and construction of policy recommendations, students will propose guidance for adapting local government function and modifying regulations and policies for implementing and governing sustainable communities.

URSP 641. Public Participation and Negotiation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the theory and methods of public participation and negotiation in planning practice. Demonstrates processes, techniques and tools to foster equitable community engagement. Considers the roles, perspectives and power of both government actors and community members in the design and implementation of plans. Applies course learning to design a participatory planning process.

URSP 643. Housing Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines federal, state, and local housing policy. Discusses the issues of affordable housing, homelessness, and the private sector's contribution to housing.

URSP 645. Sustainable Energy Planning and Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Discusses current energy production and consumption trends and related economic, environmental and social issues. Reviews energy planning and policy approaches from the international to local levels. Analyzes and evaluates different types of energy systems and existing and proposed energy policies.

URSP 647. Adaptive Reuse of Buildings. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Describes from a public sector perspective identification for new uses, evaluation of benefits and preparation of implementation proposals for recycling older buildings. Discusses methods used to develop the necessary design guidelines as well as analyze these opportunities that can be a catalyst for urban revitalization.

URSP 650. Natural Resources and Environmental Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines key problems and challenges linked to the use and abuse of natural resources, both nationally and globally, through urbanization, agriculture, coastal zone development, waste generation and other human activity. Students explore these problems in terms of the biophysical processes to which they relate, as well as their underlying political-economic and sociocultural causes. Also studied are policy and planning strategies aimed at more efficient and sustainable use of natural resources and the environment.

URSP 651. Transportation Policy and Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides an introduction to the urban transportation system. Sets the scene by exploring core concepts, providing an overview of passenger and freight movements in the urban context, describing the history of transportation and urban form and assessing the likely impact of information technology on travel patterns and urban form. Introduces the urban transportation planning process and contemporary trends in this process, places the planning process within the political context and provides an overview of the use of GIS in transportation planning. Course will also address pressing policy issues such as public transportation, land use/transportation integration, clean vehicles, clean fuels, land use, energy, finance, equity and environmental impacts.

URSP 652. Environmental Analysis. 3 Hours.

Semester course; 1 lecture and 4 laboratory hours. 3 credits. Prerequisite: URSP 650. Familiarizes students with methods to carry out an environmental analysis. Provides a deeper understanding of environmental issues.

URSP 653. Transportation Projects. 3 Hours.

3 credits. Directed-research course in which students will complete a professional transportation project for a local or state government agency or nonprofit organization. For example, students might evaluate the effectiveness of a new high occupancy vehicle/toll lane in northern Virginia; develop an emergency evacuation plan for a small or midsized city; help a local government evaluate the likely transportation impacts of a new shopping mall; assist a local bus system in the development of more cost-effective transit routes; or finish a traffic-modeling and GIS application project.

URSP 654. Environmental Remote Sensing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 602, or permission of the instructor. This course provides a basic and applied understanding on the use of digital remote sensor data to detect, identify and characterize earth resources. Students are required to demonstrate an understanding of the spectral attributes of soils, vegetation and water resources through various labs involving both image- and non-image-based optical spectral data. Crosslisted as: ENVS 654/BIOL 654.

URSP 655. Environmental Policy and Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Investigates the environmental protection role of urban and regional planning, including the ways in which local planning implements and enforces state- and federal-level environmental policies. Explores the role of planners in environmental assessment, i.e. evaluating the environmental impacts of public and private sector development.

URSP 657. Regional Policy and Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The course will review recent regional settlement patterns, survey the history of regional policy and planning efforts to understand the barriers to, and limits of, regional planning and governance. Students will see how regional planning has advanced over the years, toward an increasing acceptance of "soft" regional planning and flexible initiatives such as inter-jurisdictional partnerships and councils of government. Further, the course will consider the important role of states and the federal government in promoting regional planning and governance.

URSP 658. Transportation Finance. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces urban transportation financing principles, procedures and funding mechanisms. Explores existing governmental institutions, intergovernmental relations and laws/regulations pertaining to transportation financing. Also details urban transportation financing procedures, such as fund estimates, Call for Projects, fund programming and contract management, and the auditing process. In particular, the Local Assistance Program and Transportation Improvement Program in the Virginia Department of Transportation will be emphasized. Innovative financing mechanisms and procedures will also be incorporated. More recent state-of-the-practice funding mechanisms used by VDOT will be introduced through guest lectures by VDOT administrators and other practitioners.

URSP 659. Transportation Project Development and Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces urban transportation project development and evaluation concepts, principles, methodologies and procedures. Related transportation laws, regulations and guidelines will be covered. Some case studies in the greater Richmond area will also be included to help students understand real-world transportation development and implementation processes.

URSP 662. Foundations for Development Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces public planners to the nature and development of the urban economy. Uses case study analysis of an economy's industrial structure, labor market, and other features. Considers the roles of public planners in maintaining a healthy economy.

URSP 664. Urban Economic Development Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines the economic development planning and implementation processes through theory and case studies in urban settings. Special topics include economic development institutions and practices, small business development programs, labor force development, community-based development, and sustainable development strategies.

URSP 666. Urban Commercial Revitalization. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines renewal of declining commercial areas in cities and towns as tools in the planning process. Discusses and applies through fieldwork, market studies and other analysis methods, strategies for revitalization, public and private project financing and development.

URSP 672. Food Systems, Rural Development and Landscape Conservation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An interdisciplinary analysis of the socioeconomic and environmental issues facing rural regions, mainly of the United States, and their relationship to the modern food system and other factors. Also examines policy and planning strategies that can help improve rural economic conditions, conserve rural resources and landscapes and achieve food system sustainability.

URSP 681. International Urban Policy and Planning. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Offers a comparative analysis of planning practices and policies in both developing and developed countries. Covers such topics as local implications of globalization, regional development strategies, urban governance and management, urban economic policies, sustainable development and urban infrastructure and shelter delivery.

URSP 691. Topics in Urban and Regional Planning. 1-3 Hours.

Semester course; 1, 2 or 3 credits. Students will have an opportunity to examine in detail some questions of significance in the field of urban and/or regional planning. See the Schedule of Classes for the specific topics to be offered each semester.

URSP 760. Capstone Proposal Development. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: URSP 610, URSP 622, URSP 623, URSP 632 and URSP 662. The purpose of this course is to guide students in developing their research proposal for the Master of Urban and Regional Planning capstone professional plan or thesis. The course focuses on defining a planning problem/topic, researching the current knowledge around this topic, generating and justifying the research question, conducting an inventory of existing conditions for the study area, developing a logical approach to answer the research question, detailing the research design and data collection needs, and developing a proposed research timeline. Graded as pass/fail.

URSP 761. Planning Studio. 3 Hours.

Semester course; 1 lecture and 4 laboratory hours. 3 credits.
Prerequisites: URSP 610 and URSP 622. Corequisite: URSP 662. This course is designed to provide Master of Urban and Regional Planning students opportunities to exercise and practice what they have learned in the core M.U.R.P. program courses. Elements of the planning process will be applied and will result in the development of a comprehensive plan for a specific community or neighborhood. The complication of engaging with clients, stakeholders, fragmentary research, constrained timelines and resources, and navigating unknowns makes the course a valuable experience in practicing planning. Students quickly find that immersion in a real-world project with such constraints aid in developing organizational, interpersonal, teamwork and oral/written communication skills. This course also helps students prepare for initiating and conducting an individual professional plan or thesis projects in the future.

URSP 762. Professional Plan. 3 Hours.

Semester course; 1 lecture and 4 laboratory hours. 3 credits.
Prerequisites: URSP 760 and URSP 761. Enrollment requires permission of instructor. Requires individual students to apply theory and methodology gained from the core courses to solve selected planning problems. Extended time may be granted with a grade of PR, with a final letter grade awarded upon completion.

URSP 764. Thesis or Projects. 2-6 Hours.

Semester course; 2-6 thesis hours. 2-6 credits. May be repeated for a total of six credits. Prerequisites: URSP 760 and URSP 761. Enrollment requires permission of the instructor. The thesis is intended to demonstrate the ability of Master of Urban and Regional Planning students to make independent use of their training, research skills and creative abilities. It is an individual project in which the student selects a topic that merits additional research, becomes well-versed in the literature and research pertaining to that topic, devises and executes an appropriate research design to advance knowledge regarding that topic or problem, applies analytical skills to develop valid responses to the selected thesis questions, and interprets the implications of research findings for the field of urban and regional planning. The student is responsible for defining, organizing, conducting and presenting the research. Graded as S/U.

URSP 794. Planning Practicum Seminar. 3 Hours.

Semester course; 3 credits. Provides an opportunity for a structured analysis of the student's internship experience. Professional skills are enhanced through lectures, assignments and discussions.

URSP 797. Directed Research. 1-3 Hours.

1-3 credits. May be repeated for a maximum of 6 credits. Prerequisites: Permission of instructor and graduate standing. Independent research into planning problems, issues, and theories.

School of Medicine

Anatomy and Neurobiology (ANAT)

ANAT 501. Dental Gross Anatomy. 6.5 Hours.

Semester course; 4 lecture and 3 laboratory hours. 6.5 credits. A systematic dissection and study of the human body with clinical correlation and emphasis on the head and neck.

ANAT 502. Microscopic Anatomy (Dentistry). 5 Hours.

Semester course; 44 lecture and 88 laboratory hours. 5 credits. A study of the normal tissues and organs of the human body at the microscopic level, with emphasis on the histological organization and development of the oral cavity.

ANAT 503. Dental Neuroanatomy. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Through this course, students will develop broad-level knowledge of neuroanatomical structures and principles and the role of the nervous system. Dental clinical correlations will be used to illustrate the future clinical necessity for and application of this scientific background.

ANAT 505. Principles of Human Anatomy (Pharmacy). 3 Hours.

Semester course; 2.5 lecture and 1.5 laboratory hours. 3 credits. The structure of the human body is surveyed by studying micro-, neuro-, and gross anatomy. Emphasis is placed on basic concepts and their application to various body components.

ANAT 525. Advanced Functional Anatomy (Occupational Therapy). 5 Hours.

Semester course; 3 lecture and 4 laboratory hours. 5 credits. A study of the anatomy and kinesiology of the human body using prosected specimens and the dissected cadaver. Emphasis is placed on the study of the extremities, particularly the hand. Enrollment requires admission to the M.S.O.T. program.

ANAT 608. Functional and Clinical Neuroanatomy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Survey of the basic morphological and functional aspects of the mammalian nervous system, with emphasis on functionally and clinically relevant neuroanatomical concepts.

ANAT 609. Human Gross Anatomy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the Certificate in Pre-Medical Graduate Health Sciences or the M.S. in Anatomy and Neurobiology. Macroscopic study of the human body, with clinical correlations, dissection and pro-section sessions. Some classes will include laboratory time.

ANAT 610. Systems Neuroscience. 4 Hours.

Semester course; 4 lecture hours. 4 credits. A study the neural circuits and function of systems in the central nervous system. Topics include sensory perception and integration, neural control of reflexes and voluntary movement, as well as a neural-systems approach to understanding certain diseases.

ANAT 611. Histology. 5 Hours.

Semester course; 4 lecture and 2 laboratory hours. 5 credits. A study of the basic light and electron microscopic structure of cells, tissues, and organs. Emphasis on correlating structure with function.

ANAT 612. Human Embryology. 2 Hours.

3-week course. 2 credits. Lectures present an overview of human embryology covering fertilization, implantation and the early stages of embryogenesis. Major organ systems including the gastrointestinal, cardiovascular and urogenital are covered, as well as the development of the limbs, pharynx, face and skull. In addition, students prepare a report on a selected topic in embryology affecting human health.

ANAT 613. Advanced Studies in Anatomy. 1-6 Hours.

1-6 credits. An in-depth study in specific areas of anatomy: histology, gross anatomy, and neuroanatomy.

ANAT 615. Techniques in Neuroscience and Cell Biology. 3 Hours.

Semester course; 4 lecture/lab hours. 3 credits. Recommended preparation: BIOC 503-504 or equivalent. Designed to provide in-depth coverage of techniques commonly used in neuroscience and cell biology. Topics include tissue processing for light and electron microscopy, immunocytochemistry, laser confocal microscopy, protein purification and analysis, molecular approaches to the study of the nervous system, genetic manipulation of protein expression, gene arrays, transgenic and knockout animal models, and electrophysiological techniques including single and multi-unit extracellular recording, sharp intracellular recording and patch clamp recording. Consists of one two-hour meeting per week. Graded as Pass/Fail.

ANAT 617. Developmental Neurobiology. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Prerequisite: permission of instructor. Designed to expose students to the fundamental mechanisms underlying the development of the central nervous system, including patterning, birth and death of neurons, axon guidance, formation, maintenance and plasticity of synaptic connections, and glial biology. Emphasis will be on the cellular and molecular aspects of these topics. The course consists of one meeting a week devoted to lectures (two one-hour lectures) and a second meeting devoted to a student-led discussion of scientific papers (two one-hour discussion meetings).

ANAT 619. Professional Skills in Biomedical Research. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to students with an advanced degree or enrolled in an advanced degree program. This hybrid online/in-person course will consist of online modules focused on basic writing skills, presentation skills and familiarization with resources for ongoing learning. In-person meetings will consist of student-led discussion, active revision of submitted work and faculty panel discussions. Fundamental skills will function as a learning opportunity for individuals training for careers in biomedical research. Graded as Pass/Fail.

ANAT 620. Scientific Writing and Grantsmanship. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Lectures present an overview of preparation for writing scientific manuscripts and grant proposals. Emphasis is placed on putting methods of writing into practice. Students will submit written samples to be discussed and critiqued each week. Special sessions on manuscript and grant review processes are included, as well as instruction on how to best utilize electronic and library resources. Graded as Pass/Fail.

ANAT 625. Anatomy of Risk and Resilience: The Biology of Stress. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Designed to expose students to the fundamental mechanisms underlying the influence of endocrinology on behavior with a particular emphasis on risk and resilience. Sex as a biological variable will be a key point of the curriculum. Emphasis will be placed on the cellular and molecular aspects of the biology of sex, stress, adaptation and survival. The course will also address implications of neuroendocrine dysfunction for mental diseases. The course consists of one online module a week related to fundamental information pertinent to understanding neuroendocrinology and a second in-person meeting devoted to a student-led discussion of scientific papers related to the module covered in that week (one-hour discussion).

ANAT 630. Research Presentations. 1 Hour.

Semester course. 1 credit. Weekly research presentations by master's and doctoral students that focus on the students' ongoing research. Course provides a weekly forum for students to develop presentation skills and foster scientific discussion among students and faculty. Graded as Pass/Fail.

ANAT 690. Anatomy and Neurobiology Seminar. 1 Hour.

1 lecture hour. 1 credit. A course consisting of faculty and student-led seminars presenting current research in neurobiology, immunobiology, and reproductive biology. Graded as S/U/F.

ANAT 691. Special Topics in Anatomy. 1-4 Hours.

1-4 credits. Lectures, seminars, tutorial sessions, and/or library research assignments in selected areas of advanced study not available in other graduate level anatomy courses, or as concentrated emphasis on a particular area of research.

ANAT 697. Directed Research. 1-15 Hours.

1-15 credits. Research leading to the M.S. or Ph.D. degree and elective research projects for other students.

Biochemistry (BIOC)**BIOC 502. Biochemistry (Medicine). 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students accepted in the School of Medicine. An introduction of structural biochemistry, intermediary metabolism, cell biology and methods of biochemical analysis as part of the fundamental background of modern medicine.

BIOC 503. Biochemistry, Cell and Molecular Biology. 1-5 Hours.

Continuous course; variable hours. 1-5 credits. Prerequisites: undergraduate organic chemistry, physical chemistry recommended. Permission of instructor is required for any student not enrolled in a graduate (certificate, M.S. or Ph.D.) program. A comprehensive introductory course that describes basic biochemistry and reviews current concepts of modern cell and molecular biology.

BIOC 504. Biochemistry, Cell and Molecular Biology. 1-5 Hours.

Continuous courses; variable hours. 1-5 credits. Prerequisites: undergraduate organic chemistry, physical chemistry recommended. Permission of instructor is required for any student not enrolled in a graduate (certificate, M.S. or Ph.D.) program. A comprehensive introductory course that describes basic biochemistry and reviews current concepts of modern cell and molecular biology.

BIOC 505. Experimental Biochemistry. 2 Hours.

Continuous courses; 4 laboratory hours. 2 credits. Prerequisite: BIOC 503 (or concurrent) or equivalent quantitative chemistry. Laboratory work, including theory and practice of advanced biochemical research methods.

BIOC 506. Experimental Biochemistry. 2 Hours.

Continuous courses; 4 laboratory hours. 2 credits. Prerequisite: BIOC 503 (or concurrent) or equivalent quantitative chemistry. Laboratory work, including theory and practice of advanced biochemical research methods.

BIOC 507. Bioorganic Chemistry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Permission of the instructor. Study of structure, chemistry, and mechanism of small, biologically important molecules.

BIOC 510. Radiation Safety. 1 Hour.

Semester course; 15 lecture hours. 1 credit. Provides basic principles for the safe use of radioactive materials in biological research and meets the minimum training requirements set forth for responsible investigators in the university's Nuclear Radiation License. Offered on a demand basis (2-4 times or approximately 20 students per year).

BIOC 524. Biochemistry (Pharmacy). 2 Hours.

Continuous courses; 2 lecture hours. 2 credits. Prerequisites: BIOC 501 or 523. Specialty topics in biochemistry are presented in the spring semester as part of the fundamental background of modern pharmacy.

BIOC 530. Biochemistry, Cell and Molecular Biology Module 1: Protein Structure and Function. 2 Hours.

Modular course; 2 lecture hours. 2 credits. Prerequisites: undergraduate organic chemistry, physical chemistry recommended. Permission of instructor is required for any student not enrolled in a graduate (certificate, M.S. or Ph.D.) program. The first module of a group of four (BIOC 530-533), which taken together provide a comprehensive introductory course that describes basic biochemistry and reviews current concepts of modern cell and molecular biology.

BIOC 531. Biochemistry, Cell and Molecular Biology Module 2: Basic Metabolism. 1 Hour.

Modular course; 1 lecture hour. 1 credit. Prerequisites: undergraduate organic chemistry, physical chemistry recommended. Permission of instructor is required for any student not enrolled in a graduate (certificate, M.S. or Ph.D.) program. The second module of a group of four (BIOC 530-533), which taken together provide a comprehensive introductory course that describes basic biochemistry and reviews current concepts of modern cell and molecular biology.

BIOC 532. Biochemistry, Cell and Molecular Biology Module 3: Central Dogma of Molecular Biology. 1 Hour.

Modular course; 1 lecture hour. 1 credit. Prerequisites: undergraduate organic chemistry, physical chemistry recommended. Permission of instructor is required for any student not enrolled in a graduate (certificate, M.S. or Ph.D.) program. The third module of a group of four (BIOC 530-533), which taken together provide a comprehensive introductory course that describes basic biochemistry and reviews current concepts of modern cell and molecular biology.

BIOC 533. Biochemistry, Cell and Molecular Biology Module 4: Lipids/Membranes and Bioenergetics. 1 Hour.

Modular course; 1 lecture hour. 1 credit. Prerequisites: undergraduate organic chemistry, physical chemistry recommended. Permission of instructor is required for any student not enrolled in a graduate (certificate, M.S. or Ph.D.) program. The fourth module of a group of four (BIOC 530-533), which taken together provide a comprehensive introductory course that describes basic biochemistry and reviews current concepts of modern cell and molecular biology.

BIOC 601. Membranes and Lipids. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOC 503. Comprehensive presentation of important areas in biological membrane research. Key topics include techniques in the study of membrane lipids and proteins, "order" and organization in membranes, transport, receptors and cell surface antigens, physical measurements in membranes, reconstituted systems, and signal transduction.

BIOC 602. Physical Properties of Macromolecules. 1-4 Hours.

Semester course; 4 lecture hours. 1-4 credits. Prerequisites: BIOC 503 and physical chemistry or permission of instructor. Structure of macromolecular components and macromolecules; biophysical approaches to the determination of structure.

BIOC 604. Enzymology. 1-3 Hours.

Semester course; 3 lecture hours. 1-3 credits. Students may register for module 1 only, modules 1 and 2, or modules 1, 2 and 3. Prerequisite: BIOC 503. Physical and chemical properties and mechanisms of action of enzymes. Treatment of chemical catalysis, enzyme kinetics and correlation of enzyme structure to mechanisms.

BIOC 605. Molecular Biology. 2 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: undergraduate chemistry or biochemistry. An advanced course on molecular biology. Eukaryotic replication, transcription, RNA processing, control of gene expression, translation, cell cycle, oncogenes and tumor suppressors, viral vectors, and gene therapy.

BIOC 610. Current Trends in Biochemistry. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisites: BIOC 503-504. A study and literature review of common and complex biochemical substances using recent research methodology.

BIOC 651. Biochemistry Journal Club. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Talks given by students describing and critiquing recent published research or review articles.

BIOC 652. Cancer Biology Journal Club. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Permission of instructor is required for any student not enrolled in a graduate program. Oral presentations/discussions on the advances in cancer biology research in order to further the field in cancer research and critically evaluate and understand scientific research articles. Graded S/U/F.

BIOC 661. Critical Thinking. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for credit. Paper presentations and discussions of important topics in biomedical science.

BIOC 662. Signal Metabolism Lipids. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Talks given by faculty members, students describing research progresses or discussion of recent published research or review articles.

BIOC 690. Biochemistry Seminar. 1 Hour.

Semester course. 1 credit. Reports on recent biochemical literature and research by students and staff. Graded as S/U/F.

BIOC 691. Special Topics in Biochemistry. 1-4 Hours.

Semester course; 1-4 credits. Lectures, tutorial studies and/or special assignments in selected areas of advanced study not available in other courses or as part of research training.

BIOC 692. Special Topics. 1-4 Hours.

Semester course; 1-4 variable hours. 1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of the research training. Graded as S/U/F.

BIOC 695. Biochemistry Student Seminar. 1 Hour.

Semester course; 1 seminar hour. 1 credit. Reports by students on their thesis research projects. Graded as Satisfactory/Unsatisfactory/Fail.

BIOC 697. Directed Research in Biochemistry. 1-15 Hours.

Semester course; 1-15 credits. Research leading to the M.S. or Ph.D. degree and elective research projects for other students.

Human and Molecular Genetics (HGEN)**HGEN 501. Introduction to Human Genetics. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment by undergraduates students requires permission of instructor. Basic knowledge of genetics is recommended. Provides a comprehensive examination of the fundamentals of human genetics. Explores topics including Mendelian and non-Mendelian inheritance, pedigree analysis, cytogenetics, aneuploid syndromes, cancer, gene structure and function, epigenetics, gene expression, biochemical genetics, and inborn errors of metabolism.

HGEN 502. Advanced Human Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HGEN 501 or equivalent. Enrollment restricted to graduate students. A comprehensive study of the principles of specific areas in human genetics. Explores topics including quantitative genetics, genetic epidemiology, gene mapping, animal models, the characterization of complex disease, diagnostic testing and genetic counseling.

HGEN 510. Classic Papers in Human Genetics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment restricted to graduate students in the School of Medicine. This course surveys the seminal discoveries in the discipline of human genetics and introduces students to reading, understanding, discussing, critiquing and presenting original journal articles.

HGEN 511. Human Cytogenetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HGEN 501. A discussion of recent advances in human cytogenetics. Topics covered will include chromosome banding techniques and ultrastructure, meiosis, numerical and structural abnormalities, fragile sites, cancer cytogenetics, methodology for linkage studies, and population cytogenetics. Clinical cases are used to illustrate the application of special diagnostic methodologies.

HGEN 516. Population Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT/BIOS 543. Theoretical and empirical analyses of how demographic and evolutionary processes influence neutral and adaptive genetic variation within populations.

HGEN 517. Introduction to R Programming for Statistical Genetics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Open only to graduate students or by permission of course director. This course is to provide and introduction to statistical programming in R. Lectures will provide the fundamentals for efficient handling and exploration of common data set structures in genetic and biomedical sciences.

HGEN 525. Practice of Genetic Counseling. 3 Hours.

Continuous courses; 3 lecture hours. 3-3 credits. Enrollment restricted to genetic counseling master's students. Provides context for practice of genetic counseling through literature review and practical techniques. Places specific emphasis on pregnancy and childhood evaluation, interviewing techniques, social and ethical issues, including fieldwork in prenatal, general genetics and specialty clinics.

HGEN 526. Practice of Genetic Counseling. 3 Hours.

Continuous courses; 3 lecture hours. 3-3 credits. Enrollment restricted to genetic counseling master's students. Provides context for practice of genetic counseling through literature review and practical techniques. Places specific emphasis on pregnancy and childhood evaluation, interviewing techniques, social and ethical issues, including fieldwork in prenatal, general genetics and specialty clinics.

HGEN 527. Medical Genetics. 3 Hours.

Continuous courses; 3 lecture hours. 3-3 credits. Prerequisite: HGEN 525-526 or permission of instructor. Enrollment restricted to genetic counseling master's students. Provides medical information and principles of human genetic disease with specific emphasis on the molecular basis of Mendelian disorders, disorders of sexual development, assessment of dysmorphic features, and the genetics of common diseases. Emphasizes the use of all available resource materials in genetics.

HGEN 528. Medical Genetics. 3 Hours.

Continuous courses; 3 lecture hours. 3-3 credits. Prerequisite: HGEN 525-526 or permission of instructor. Enrollment restricted to genetic counseling master's students. Provides medical information and principles of human genetic disease with specific emphasis on the molecular basis of Mendelian disorders, disorders of sexual development, assessment of dysmorphic features, and the genetics of common diseases. Emphasizes the use of all available resource materials in genetics.

HGEN 600. Clinical Genetics. 3 Hours.

Semester course; 1 lecture and 4 laboratory hours. 3 credits. May be repeated for credit. Enrollment is restricted to students in the genetic counseling master's program. Practical experience in the genetic counseling clinic and on ward rounds. Includes collection and analysis of family histories, genetic counseling and introduction to genetic nosology. Graded as S/U/F.

HGEN 601. Research in Genetic Counseling. 2 Hours.

Semester course; 1.5 lecture and .5 thesis hours. 2 credits. Enrollment restricted to genetic counseling graduate students only. Students must have chosen their research project adviser, with whom they will meet throughout the semester, prior to enrolling. Provides a comprehensive examination of the fundamentals of research relevant for the scientific advancement of the genetic counseling field. Explores topics including developing a research question; conducting literature reviews; designing a research project; working with the institutional review board; and collecting, analyzing and interpreting data. Students will develop and deliver a research proposal orally and in writing.

HGEN 602. Genetic Models of Disease. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Understanding the molecular basis of human disease states is a major focus for biomedical research. This course will train students to investigate molecular-genetic mechanisms of disease using four genetic model organisms: the nematode *C. elegans*, the fruit fly *Drosophila melanogaster*, the teleost zebrafish *Danio rerio* and the mouse *Mus musculus*, which serve as important laboratory models for human diseases and facilitate the elucidation of the underlying molecular mechanisms.

HGEN 603. Mathematical and Statistical Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: HGEN 611; and BIOS 543 and BIOS 544 or HGEN 651 and HGEN 652. Provides an introduction to the rudiments of theoretical and applied mathematical population genetics including the segregation of genes in families, genetic linkage and quantitative inheritance. Emphasizes the methods used in the analysis of genetic data.

HGEN 605. Experimental Methods in Human Genetics. 1-3 Hours.

Semester course; 2-6 laboratory hours. 1-3 credits. Restricted to students in the M.S. or Ph.D. programs in human genetics. Provides hands-on experience with the experimental methods that are used to carry out research in specific areas of human genetics prior to beginning thesis/dissertation research. Graded S/U/F.

HGEN 606. Introduction to Clinical Genetics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: open only to graduate students in human genetics programs or by permission of instructor. Provides an overview of medical genetics and counseling practice for non-genetic counseling students, including orientation to the translational side of research genetics and contemporary practice of clinical genetics. Graded S/U/F.

HGEN 607. Processes in Genetic Counseling I. 1 Hour.

Semester course; 1 practicum hour. 1 credit. Enrollment restricted to students in the genetic counseling program. Training in the ability to recognize the psychological and social processes affecting counselor-patient interactions. Graded as pass/fail.

HGEN 608. Processes in Genetic Counseling II. 1 Hour.

Semester course; 1 practicum hour. 1 credit. Prerequisite: HGEN 607. Enrollment restricted to second-year students in the genetic counseling program. Further training in the ability to recognize the psychological and social processes affecting counselor-patient interactions. Graded as pass/fail.

HGEN 609. Clinical Genomics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students and residents with undergraduate degrees in an area related to genetics, biology or psychology. Provides an overview of modern genetic and genomic diagnostic testing. Explores topics including genomic variation, epigenetics, modern methodologies, applications of testing, data interpretation including variant classification, and the benefits and limitations of testing. Crosslisted as: PATH 609.

HGEN 610. Current Literature in Human Genetics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to graduate students. Provides directed experience in critiquing, understanding and presenting current literature on a focused topic in human genetics. Graded as S/U/F.

HGEN 611. Data Science I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will introduce students to tools and techniques from the discipline of data science that support efficient and reproducible scientific computing. Students will gain hands-on experience developing complete data analysis projects based on real-world datasets. Lessons will cover the primary tasks that comprise most analyses: data management/acquisition, cleaning, reshaping, manipulation, analysis and visualization, as well as strategies for arranging these constituent parts into cohesive workflows that are verifiable, easily repeatable and consistent with best practices for reproducible computational research. This course will focus on the statistical programming language R but no programming background is necessary. Crosslisted as: OVPR 611.

HGEN 612. Data Science II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HGEN 611/OVPR 611. This course builds upon the material introduced in the prerequisite course by providing instruction on advanced techniques for working with data and producing highly reproducible data products. The learning path focuses on the fundamentals of both machine learning and the creation of production-ready web applications as two highly marketable skills for future data scientists. Project-based assignments culminate in students creating their own applications that take advantage of tidyverse principles to automate machine-learning workflows, visually communicate knowledge with interactive graphics and using Git and OSF for project management. The guiding principle of the course is that the products of research should be open and accessible to all members of a project team for maximum impact. This course will continue the use of the statistical programming language R with a focus on advanced tidyverse functions for data wrangling and statistical model development. Crosslisted as: OVPR 612.

HGEN 614. Pathogenesis of Human Genetic Disease. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students. Surveys the mechanisms and varieties of human gene mutations resulting in human genetic disease and emphasizes different investigational disorders using current scientific literature.

HGEN 615. Techniques in Genetic Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students in the M.S. in Genetic Counseling program or by permission of the instructor. Provides theory and context for interviewing as well as counseling skills required for genetic counseling practice. Literature and practical techniques utilized to acquire skills. There is significant reliance on live in-class role play scenarios to exercise and demonstrate emerging skills. Additional deconstruction of taped master genetic counselor role plays aids in the understanding and evaluation of theory and skill to be acquired. Emphasis is on understanding and developing the verbal and non-verbal skills required for effective genetic counseling practice.

HGEN 616. Cultural Diversity in Genetic Counseling. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in the M.S. in Genetic Counseling program. This class explores topics related to providing genetic counseling to individuals from diverse backgrounds. Students learn skills for working with in-person and phone interpreters and practice applying these skills. Students will receive instruction in how to provide care for individuals from diverse spiritual backgrounds and the role that hospital chaplains can serve in helping families dealing with grief and crisis. Students are led in discussion to begin to recognize the unique health issues that are encountered by marginalized populations, including transgender and LGBTQ+. Students will also learn about health disparities among different cultural backgrounds and learn to recognize personal biases and ways to avoid countertransference. This course will use readings from peer-reviewed literature to emphasize concepts presented in class. Graded as satisfactory/unsatisfactory.

HGEN 617. Genetic Analysis of Complex Traits. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: introductory biostatistics or permission of instructor. Introduces the theory and practice of analysis of complex human traits. Provides a solid grounding in the fundamental concepts, study designs and analytical strategies for this evolving and important area.

HGEN 619. Quantitative Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The effects of genes and environment on complex human traits with emphasis on: Genetic architecture and evolution; nongenetic inheritance; mate selection; developmental change; sex-effects; genotype-environment interaction; resolving cause from effect; design of genetic studies, statistical methods and computer algorithms for genetic data analysis.

HGEN 620. Principles of Human Behavioral Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The theory of genetic and nongenetic transmission considered in relation to the design, analysis, and interpretation of studies to identify the principal genetic and environmental causes of behavioral variation. Included will be analysis of intelligence, personality, social attitudes, and psychiatric disorders.

HGEN 622. Cancer Genetic Counseling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HGEN 501 or permission of instructor. Provides a background in as well as the most current information relevant to cancer genetics and cancer genetic counseling. Includes instruction in basic science and genetic and psychosocial aspects of cancer, with an emphasis on familial and hereditary cancers.

HGEN 651. Statistics for Genetic Studies I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Teaches students statistical methods for multidisciplinary research, specifically presenting the mathematical components that underlie statistical analysis and including probability theory, statistical distributions, inference and linear models.

HGEN 652. Statistics for Genetic Studies II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HGEN 651. Builds upon the quantitative statistical methods from prerequisite course. Students will learn the mathematical components that underlie statistical analysis with a focus on maximum-likelihood methods and structural equation modeling. These components provide the necessary foundation for the advanced statistical genetic methods for understanding how genetic and environmental factors impact the development of psychiatric and substance abuse disorders.

HGEN 690. Genetics Research Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Selected topics in genetics presented by students and staff.

HGEN 691. Special Topics in Genetics. 1-4 Hours.

1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of the research training.

HGEN 692. Special Topics. 1-4 Hours.

Semester course; 1-4 variable hours. 1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of the research training. Graded as S/U/F.

HGEN 697. Directed Research in Genetics. 1-15 Hours.

1-15 credits. Research leading to the M.S. or Ph.D. degree and elective research projects for other students.

Interdisciplinary Biomedical Sciences (IBMS)**IBMS 600. Laboratory Safety. 1 Hour.**

Semester course; 1 lecture hour. 1 credit. Describes health hazards commonly found in biomedical laboratories and their appropriate safety precautions, government regulations and emergency responses. Includes hazards of working with micro-organisms, experimental animals, and chemical, electrical and fire hazards. Graded as S/U/F.

IBMS 620. Laboratory/Clinical Rotations. 2 Hours.

Semester course; 2 credits. Students conduct laboratory and/or clinical rotations to gain direct exposure to individual SOM projects. Graded S/U/F.

IBMS 621. Laboratory Rotation I. 2 Hours.

Semester course; 2 laboratory hours. 2 credits. Students conduct laboratory rotations to develop basic laboratory techniques, develop literature review skills and gain insights into the basic principles of experimental design. Students will learn how to present their experimental processes and findings to peers and advisers. Graded S/U/F.

IBMS 622. Laboratory Rotation II. 2 Hours.

Semester course; 2 laboratory hours. 2 credits. Students conduct laboratory rotations to advance their laboratory techniques, develop comprehensive literature review skills and in-depth principles of experimental design. Students will develop enhanced communication skills to convey complex research findings to diverse audiences. Graded S/U/F.

IBMS 623. Laboratory Rotation III. 2 Hours.

Semester course; 2 laboratory hours. 2 credits. Students engage in laboratory rotations to develop innovative laboratory techniques, learn to formulate novel hypotheses and conceive complex experiments. Students will master the ability to convey their experimental findings to both expert audiences and the general public. Graded S/U/F.

IBMS 624. Research Reproducibility and Transparency. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to graduate students. This course is designed to provide students with background knowledge about issues related to and build resources for ensuring reproducibility and transparency in research. Taught in six two-hour blocks during the summer. Graded as satisfactory/unsatisfactory.

IBMS 635. Cellular Signalling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOC 503/504 with minimum grade of B, or permission of instructor. An interdisciplinary introduction to molecular mechanisms important in eukaryotic inter- and intracellular signaling. Topics covered: common signaling mechanisms (heterotrimeric G proteins and G-protein-coupled receptors, small G proteins, tyrosine kinases and MAP kinases, and ion channels), membranes, lipids and ions (calcium signaling, phosphoinositols and lipid signaling through GPCRs), immune and metabolic kinase cascades (AMP-activated kinase, NFκB and Jak/Stat pathways), and programmed cell death.

IBMS 651. M.D.-Ph.D. Journal Club. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for credit. Enrollment is restricted to students in the M.D.-Ph.D. program. This course is intended for first-year M.D.-Ph.D. students as a complement to the ongoing medical curriculum and is designed to expose them to research literature related to their ongoing course work. The objectives are to introduce students to original research papers from the current and classical literature and to provide practice and training in effectively identifying and discussing key hypotheses, methods, results and conclusions, as well as in evaluating the strengths and weaknesses of papers. Graded as Satisfactory/Unsatisfactory.

IBMS 652. M.D.-Ph.D. Science and Disease. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in the M.D.-Ph.D. program. This course is intended for second-year M.D.-Ph.D. students as a complement to the ongoing medical curriculum. Clinical faculty or physician-scientists present a patient and then either the physician-scientist or a basic science faculty member discusses the basic science underpinnings of the disease in question. The sessions are coordinated with the MS2B curriculum. Active student participation in the discussion of the case and scientific basis is expected and required. Faculty members are encouraged to present informal sessions designed to encourage student participation and engaged learning. Graded as Satisfactory/Unsatisfactory.

IBMS 653. M.D.-Ph.D. Research Seminar. 0.5 Hours.

Semester course; 1 lecture hour (alternate weeks). .5 credits. May be repeated for credit. Enrollment is restricted to students enrolled in School of Medicine M.D.-Ph.D. training while in the medical or graduate phases. Course exposes M.D.-Ph.D. students to state-of-the-art research in a range of fields. The objectives are to provide an opportunity for students to attend formal research presentations by faculty experts; participate in discussions of the underlying hypotheses, research methods, critical results and interpretation of data; give formal presentations based on their own research and receive feedback. Graded as Satisfactory/Unsatisfactory.

IBMS 690. Basic Health Sciences Research Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Faculty and/or visiting lecturers present current research in basic health sciences. Students attend 12 seminars per semester in any of the basic health science or clinical departments in the School of Medicine and submit a one-paragraph (approximately 100-word) summary description of the seminar. Graded S/U/F.

IBMS 691. Special Topics in Interdisciplinary Biomedical Sciences. 0.5-4 Hours.

Semester course; variable hours. 0.5-4 credits. Lectures, seminars, tutorial sessions, Web-based courses and/or library research assignments in selected areas not available in other graduate-level courses or as a concentrated emphasis on a particular topic. Graded as S/U/F.

IBMS 692. Special Topics in Interdisciplinary Biomedical Sciences. 0.5-4 Hours.

Semester course; 0.5-4 variable hours. 0.5-4 credits. Lectures, seminars, tutorial sessions, Web-based courses and/or library assignments in selected areas not available in other graduate-level courses or as a concentrated emphasis on a particular topic.

IBMS 697. M.D.-Ph.D. Directed Research. 1-3 Hours.

Semester course; 1-3 research hours. 1-3 credits. May be repeated for a maximum of six credits. Enrollment is restricted to students in an M.D.-Ph.D. dual degree program. Initial research experience leading to Ph.D. degree for students in M.D.-Ph.D. dual-degree programs. Research experience can be undertaken in one or more laboratories. Graded as satisfactory/unsatisfactory.

International Program in Addiction Studies (IPAS)**IPAS 600. The Biological Basis of Addiction. 4 Hours.**

11-week online course; 4 credits. Open only to students in the International Program in Addiction Studies (Master of Science in Addiction Studies), graduate certificate program in addiction studies or with permission of the IPAS program director. Designed to provide an overview of the neuropharmacology of drugs of abuse and dependence, including basic principles of drug action as well as comprehensive coverage of the major classes of drugs (opioids, stimulants, nicotine, alcohol, sedatives, cannabis, hallucinogens). Students will study mechanisms of action, effects, pharmacokinetics as well as tolerance and dependence for each of these drugs/drug classes. The reasons for addiction including biological, genetic, cultural and other determinants will be discussed. Laboratory-based methods used in addiction research will be covered.

IPAS 601. Treatment of Addiction: Psychosocial Interventions. 4 Hours.

11-week online course; 4 credits. Open only to students in the International Program in Addiction Studies (Master of Science in Addiction Studies), graduate certificate program in addiction studies or with permission of the IPAS program director. Designed to explore the scientific basis and treatment of substance misuse from a psychological perspective germane to the management of drug, alcohol and nicotine dependence. Students will have the opportunity to evaluate the principles of different theoretical approaches underlying psychological assessment and evidence-based practice. Students will develop a critical awareness of the current literature related to psychological theories of addiction. Students will examine the use and comparative efficacy of different psychological therapies in clinical practice including brief interventions, cognitive behavioral therapy and motivational interviewing/MET. Other interventions (case management, group work, self-help, integrated treatment for co-occurring disorders, etc.) will also be examined along with the evidence base for relapse prevention, contingency management and therapeutic communities. Students will also have the opportunity to explore psychological approaches used with specialist populations such as young people and adolescents.

IPAS 602. Public Health Issues and Approaches to Addictions. 4 Hours.

11-week online course; 4 credits. Open only to students in the International Program in Addiction Studies (Master of Science in Addiction Studies), graduate certificate program in addiction studies or with permission of the IPAS program director. Provides an introduction to basic concepts and research methods in public health and epidemiology as they relate to the study of addictions, as well as an in-depth consideration of the personal, social, economic and cultural burdens/costs associated with drug and alcohol abuse and dependence. Individual and community-based risk and protective factors related to addictions, as well as primary and secondary prevention efforts aimed at reducing the addictions-related public health burden, also are a focus. An online lecture format featuring presentations by leading researchers and policy-makers in the field of addictions will be used, along with readings, online discussions and writing assignments, to (1) gain a greater understanding of the enormous costs of addictions at every level of society and (2) introduce students to some of the current thinking and programs related to the primary and secondary prevention of addictions.

IPAS 603. Addiction Policy. 4 Hours.

11-week online course; 4 credits. Open only to students in the International Program in Addiction Studies (Master of Science in Addiction Studies), graduate certificate program in addiction studies or with permission of the IPAS program director. Designed to provide students of differing backgrounds an understanding of the process by which international addiction health policy is formed and reformed around the use and misuse of both licit and illicit drugs. The course will look at the epidemiology of addiction around the world and the relationship between the burden of addiction and the corresponding effects of national and international drug policies.

IPAS 604. Treatment of Addiction: Pharmacotherapies. 4 Hours.

11-week online course; 4 credits. Open only to students in the International Program in Addiction Studies (Master of Science in Addiction Studies), graduate certificate program in addiction studies or with permission of the IPAS program director. Designed to provide an overview of the pharmacological management of alcohol and drug addiction. Covers the management of withdrawal from alcohol, sedatives, opioids, cannabis and stimulants, as well as long-term management of dependence on opioids, tobacco and alcohol. Additional topics include international perspectives on management of dependence, management of dependence during pregnancy and the process of medication development.

IPAS 605. Treatment of Addiction: Critical Issues. 4 Hours.

11-week online course; 4 credits. Open only to students in the International Program in Addiction Studies (Master of Science in Addiction Studies), graduate certificate program in addiction studies or with permission of the IPAS program director. Designed to enable students to gain advanced understanding of the critical issues involved in the identification, recruitment, assessment, diagnosis and classification of individuals who misuse substances. Local, national and international barriers to treatment (stigma, culture, religion, politics, legal issues, civil commitment, cost, attitudes and beliefs) will be considered. Students will explore and critically examine treatment options in special settings (for instance, prisons, criminal justice and employment) and in special populations (for instance, addicted health care professionals, co-morbid patients, pregnancy).

IPAS 606. Research Methodology in Addictions. 6 Hours.

11-week online course; 6 credits. Open only to students in the International Program in Addiction Studies (Master of Science in Addiction Studies). Designed to enable students to develop knowledge and understanding of the different methodological processes underpinning research in the addictions. The research principles involved in hypothesis testing and estimation procedures will be covered as well as the generic skills necessary to analyze data and interpret statistical findings. Basic epidemiological study designs, policy analysis and inferential statistical methods pertinent to the addictions field will be explored.

IPAS 692. Research Project in Addictions. 6 Hours.

12-week intensive online course; 6 lecture hours. 6 credits. Open only to students in the International Program in Addiction Studies (Master of Science in Addiction Studies). Students will be required to complete a research project under the supervision of IPAS faculty. The submitted written text will be a minimum of 10,000 words in length and must demonstrate a critical knowledge of the chosen topic area. The ability to apply scientific scrutiny to a topic related to aspects of drug and alcohol etiology, treatment, prevention, public health or policy as identified by the program team will be required. The research project may involve original data collection, secondary analysis of previously collected data sets or other quantitative or qualitative research methods. The necessary defining feature is that the research project should demonstrate an appropriate level of academic rigor and understanding of the scientific implications of the findings of the project. Students will need to demonstrate competence in the integration and analysis of data to further the translation of this knowledge into more effective policies and practices, in keeping with the stated aims of the program. Graded S/ U/F.

Medical Physics (MEDP)**MEDP 520. Introduction to Radiation Therapy Physics Laboratory. 1 Hour.**

Semester course; 2 laboratory hours. 1 credit. Provides practical exercises in the radiation measurement devices and quality assurance procedures commonly employed in radiation therapy physics. Measurements of beam characteristics for treatment machines, including electron linear accelerators, and radioactive sources, including high dose rate brachytherapy are investigated.

MEDP 561. Topographical Anatomy and Physiology. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Restricted to medical physics graduate students. This course will cover fundamental gross anatomy, pathology and physiology as necessary for medical physicists. It will include basic medical terminology and have a focus on cross-sectional CT imaging and MRI, as well as 2-D X-ray imaging. Basic information on pathophysiology of cancer diseases and cancer treatment strategies will be provided.

MEDP 563. Radiological Physics and Radiation Dosimetry. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the fundamental conceptual, mathematical and physical aspects of radiation interactions with matter and energy deposition, including a thorough understanding of basic quantities and units. Application to the principles and methods of radiation detection and dosimetry will be emphasized.

MEDP 564. Radiological Physics and Radiation Dosimetry Lab. 1 Hour.

Semester course; 2 laboratory hours. 1 credit. Prerequisite: MEDP 563. Laboratory consisting of experiments and activities related with MEDP 563.

MEDP 567. Introduction to Radiation Therapy Physics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the fundamental conceptual and technical aspects of the use of ionizing radiation to evoke a therapeutic response/benefit to patients. Treatment planning and dose calculations for external beam radiation therapy and brachytherapy are emphasized.

MEDP 591. Special Topics in Medical Physics. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Open to graduate students and to undergraduate students with advanced standing. An in-depth study of a selected topic in medical physics. See the Schedule of Classes for specific topics to be offered each semester and prerequisites. Applicable toward physics major requirements.

MEDP 592. Special Topics. 1-4 Hours.

Semester course; 1-4 variable hours. 1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of the research training.

MEDP 601. Health Physics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Theoretical foundation and practical application of health physics as applied to diagnostic radiology, nuclear medicine and radiation therapy. Regulatory and scientific aspects of the subject are covered. Mathematical models and physical principles of radioactive decay and radiation interactions are used to assess the relative values of different radiation safety practices.

MEDP 630. Radiobiology for the Medical Physicist. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the fundamental aspects of radiobiology with specific emphasis on relative biological effectiveness and linear energy transfer, the oxygen effect, radiation carcinogenesis, DNA repair, hereditary effects of radiation, radiation-induced cell killing, cellular responses to radiation including cell cycle effects and activation of cell signal transduction pathways, early and late effects of radiation, and time, dose and fractionation in radiotherapy.

MEDP 633. Advanced Radiation Therapy Physics. 4 Hours.

Semester course; 3 lecture and 2 laboratory hours. 4 credits. Prerequisites: PHYS 563 and PHYS 567 or instructor's permission. The course presents a survey of modern developments and methodological tools used in the following areas of radiation oncology physics: experimental dosimetry, computational dosimetry, quality assurance and commissioning, and advanced treatment planning and delivery modalities. By means of hands-on projects and literature reviews, students will become acquainted with the medical physics literature and acquire practical skills in selected areas. The course consists of a coordinated set of didactic lectures and laboratory projects.

MEDP 635. Physics of Diagnostic Imaging. 3 Hours.

Semester course; 3 lecture and 1 laboratory hours. 3 credits. Covers the physics of X-ray production, radiography, fluoroscopy and computed tomography. Covers the basics of ultrasound physics, equipment, image quality, safety and quality assurance. Emphasis will be placed on the physical foundations of currently used diagnostic imaging techniques using X-rays and ultrasound and their relevance to the clinical setting.

MEDP 636. Physics of MRI. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the physics of magnetic resonance imaging. Emphasis will be placed on the physical foundations of currently used diagnostic techniques and their relevance to the clinical setting. The classroom lectures will be enhanced through a series of integrated laboratory exercises.

MEDP 637. Physics of Nuclear Medicine. 2 Hours.

Semester course; 2 lecture and 1 laboratory hours. 2 credits. Covers the physics of nuclear medicine imaging (including PET). Emphasis will be placed on the physical foundations of currently used diagnostic techniques and their relevance to the clinical setting.

MEDP 682. Clinical Rotations in Medical Physics. 1-3 Hours.

Semester course; variable hours. 1-3 credits. May be repeated for credit. Prerequisites: at least one graduate medical physics course and permission of instructor. Clinical rotations in various medical physics sub-specialties.

MEDP 689. Medical Physics Literature Review. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Review and discussion of relevant journal articles from the medical physics literature. May be repeated for credit with instructor's permission.

MEDP 697. Directed Research. 1-15 Hours.

Semester course; 1-15 credits. May be repeated for credit. Prerequisites: at least one graduate-level physics course and permission of instructor. Research leading to the M.S. or Ph.D. degree.

Microbiology and Immunology (MICR)**MICR 501. Infection and Immunity (Pharmacy). 4 Hours.**

Semester course; 4 lecture hours. 4 credits. Offered to pharmacy students in the first professional year. Others admitted with permission of instructor. A course on the fundamentals of microbiology and immunology with aspects on disease and treatment of interest to dentistry and pharmacy.

MICR 505. Immunobiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Background in cellular and molecular biology, and biochemistry is recommended. Nondegree-seeking students admitted with permission of instructor. A survey of immunobiology as a total host response to foreign agents, covering the nature of antigens and antibodies, antigen-antibody reactions, immunocompetent cells, allergic reactions, tumor immunology, transplantation immunology, immunological diseases and immunogenetics.

MICR 513. Infection and Immunity (Dentistry). 4 Hours.

Semester course; 4 lecture hours. 4 credits. Offered to dental students in the first professional year. Others admitted with permission of instructor. A course on the fundamentals of microbiology and immunology with aspects on disease and treatment of interest to dentistry and pharmacy.

MICR 515. Principles of Molecular Microbiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A comprehensive course designed to provide the student with a thorough understanding of microbial physiology, genetics and diversity. Also covered are some basic concepts in microbial pathogenesis and in applied microbiology. The course focuses on structural and functional characteristics of micro-organisms; ecological and physiological diversity of microbes; growth and control of micro-organisms; genetics of bacteria and viruses; bacteria as agents of disease; and applications of microbiology.

MICR 605. Prokaryotic Molecular Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOC 530, BIOC 531, BIOC 532 and BIOC 533; or BIOC 503 and BIOC 504; or permission of instructor; MICR 515 or equivalent recommended. A comprehensive introductory course examining the organization of the genetic material in bacteria and their viruses and the molecular mechanisms involved in its maintenance, replication, exchange and expression. Emphasis will be on experimental approaches integrating classical and modern methods of genetic analysis with biochemical studies of genetic regulatory mechanisms.

MICR 607. Techniques in Molecular Biology and Genetics. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisites: MICR 515 or equivalent; permission of instructor. Designed to give an overview of the techniques utilized in modern molecular biology. The principles underlying techniques such as plasmid cloning, RNA and DNA analysis, PCR, DNA sequencing, mutagenesis, genomic mapping, heterologous gene expression, CRISPR-mediated genome editing, production and analysis of recombinant proteins, application of mass spectrometry and microscopy techniques, and transgenic mouse technology will be discussed in detail by experts in the field.

MICR 608. Introduction to Microbiology and Immunology Research I. 4 Hours.

Semester course; 4 laboratory hours. 4 credits. Enrollment requires permission of the instructor. Required of all first-year graduate students. Introduction to all active research programs in microbiology and immunology. Rotation of students through faculty laboratories to gain direct exposure to individual research projects. Graded as Pass/Fail.

MICR 609. Introduction to Microbiology and Immunology Research II. 4 Hours.

Semester course; 4 laboratory hours. 4 credits. Enrollment requires permission of the instructor. Required of all first-year graduate students. Introduction to all active research programs in microbiology and immunology. Rotation of students through faculty laboratories to gain direct exposure to individual research projects. Graded as Pass/Fail.

MICR 616. Mechanisms of Viral and Parasite Pathogenesis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A comprehensive introduction to the basic principles of virology and human parasitology. Interactions of the infecting agents and hosts will be stressed at the molecular and cellular level.

MICR 618. Molecular Mechanisms of Microbial Pathogenesis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students who have completed undergraduate-level courses in microbiology or microbial physiology, immunology, and molecular genetics. The goals of this comprehensive course are to explore in detail the virulence mechanisms of microbes and the response of the infected host. The focus will be on important microbial pathogens.

MICR 684. Molecular Biology of Cancer. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: MICR 515 or equivalent; or permission of instructor. Advanced graduate-level course to provide theoretical background to graduate students interested in cancer research. Emphasis will be placed on experimental approach integrating classical and modern methods of genetic analysis with biochemical studies in genetic regulatory mechanisms. The course includes presentations by students and interactive discussion of the scientific literature in the area of oncogenesis.

MICR 686. Advanced Immunobiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open primarily to residents, medical students and graduate students with an immunology background such as MICR 505. Lectures, seminars, conferences on basic and clinical immunobiology and literature review on the topic, with more emphasis on methods in immunology research and exercising the ability to communicate the topic verbally. Topics have included tumor immunology, cell interactions in the immune response, genetics of the immune response, mechanisms of host-defense and membrane receptors in immunology and neoplasia.

MICR 690. Microbiology Research Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Presentation and discussion of research reports and topics of current interest to the departmental seminar or special group seminars.

MICR 691. Special Topics in Microbiology. 1-4 Hours.

Semester course; 1-4 credits. Lectures, tutorial studies, and/or library assignments in selected areas of advanced study not available in other courses or as part of the research training.

MICR 692. Current Topics in Molecular Pathogenesis. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Open to all graduate and certificate students. Presents a forum for the discussion of recent advances in the study of the molecular mechanisms of microbial pathogenesis. Consists of presentations by students, postdoctoral fellows and faculty followed by interactive discussions of the implications of presented work to the study of molecular pathogenesis.

MICR 694. Current Topics in Immunology. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Open to all graduate students. Presents a forum for discussion of the scientific literature in the area of cellular and molecular immunology, focusing on mechanisms involved in the operation and regulation of the vertebrate immune system. Consists of presentations by students and interactive discussions of the implications of presented work to the study of immunology.

MICR 695. Special Topics in Microbiology. 1-4 Hours.

Semester course; 1-4 variable hours. 1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of the research training. Graded as S/U/F.

MICR 697. Directed Research in Microbiology. 1-15 Hours.

Semester course; 1-15 credits. Research leading to the M.S. or Ph.D. degree and elective research projects for other students.

Neurosciences (NEUS)**NEUS 609. Cellular and Molecular Neuroscience. 4 Hours.**

Semester course; 4 lecture hours. 4 credits. Recommended preparation: BIOC 503-504 or equivalent. Designed as an interdisciplinary introduction to the cellular and molecular aspects of central nervous system function. The basic principles of neuroscience including neuronal structure, electrical properties of single neurons, cell biology of neurotransmitter release and postsynaptic function will be discussed, followed by intracellular signaling in neurons, gene regulation, transgenic model systems, glia, neuronal development, basic neurochemistry, and molecular and cellular aspects of motor, sensory and integrative function. The course will conclude with lectures on various aspects of neural injury and disease, including traumatic brain injury, Parkinson's and Alzheimer's diseases.

NEUS 619. Synaptic Organization of the Brain. 3 Hours.

Semester course; 4 lecture and laboratory hours. 3 credits. Prerequisite: ANAT 610 or equivalent and permission of instructor. Designed to provide an in-depth integrative examination of the neural circuitry underlying the functions of selected regions of the brain and spinal cord. During each class meeting, faculty present lectures followed by an oral presentation by a student. Lecturers will highlight principles that are common to all regions of the central nervous system as well as adaptations that are unique to each. Student also complete weekly take-home essay assignments.

NEUS 640. Neurobiology of CNS Diseases. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Background in cellular and systems neuroscience similar to NEUS 609 and ANAT 610 or consent of course director. The course explores the cellular and molecular basis of major diseases and conditions affecting the central nervous system as well as current and developing treatment strategies and translational approaches. Topics include stroke and cerebrovascular disease, neurotrauma and regeneration, epilepsy, neurodevelopmental disorders, neurodegenerative disease and dementia, demyelinating diseases, neuropsychiatric disorders and autism, neurooncology, and neuroAIDS.

NEUS 690. Neuroscience Research Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Consists of faculty and visiting lecturers presenting current research in neuroscience. Students attend one seminar per week and submit a one-page summary description of the seminar. Graded as S/U/F.

NEUS 697. Directed Research. 1-15 Hours.

Semester course; variable hours. 1-15 credits. Research leading to the Ph.D. degree and elective research for other students. Graded as S/U/F.

Pathology (PATH)**PATH 521. Laboratory Techniques in Diagnostic Pathology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This team taught course includes principles of automated and non-automated testing, diagnostic testing, and an active laboratory demonstration of each method.

PATH 540. Pathology for Allied Health Sciences. 2 Hours.

Semester course; 1.5 lecture and 1 laboratory hours. 2 credits. Explores morbid tissue changes involved in selected disease states, with emphasis on musculoskeletal and nervous systems. Provides the foundation to understanding clinical problems that physical therapists and other paramedical personnel will encounter and treat in their patients.

PATH 590. Experimental Pathology Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit.

PATH 601. General Pathology (Dentistry). 6 Hours.

Semester course; 6 lecture hours. 6 credits. Instruction in the basic principles regarding alteration of structure and function in disease and in the pathogenesis and effect of disease in the various organ systems.

PATH 609. Clinical Genomics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students and residents with undergraduate degrees in an area related to genetics, biology or psychology. Provides an overview of modern genetic and genomic diagnostic testing. Explores topics including genomic variation, epigenetics, modern methodologies, applications of testing, data interpretation including variant classification, and the benefits and limitations of testing. Crosslisted as: HGEN 609.

PATH 620. Special Topics in Modern Instrumental Methods. 2 Hours.

Semester course; 1 lecture and 2 laboratory hours. 2 credits. A study of some of the modern research methods of molecular biology. The student gains experience with the technique concomitant with discussions with faculty. The student writes a comprehensive review of the technique studies.

PATH 670. Experimental Approaches to Tumor Biology. 3 Hours.

Semester course; 3 lecture/discussion hours. 3 credits. Introduces central problems in tumor biology and the methods available for their study. Develops through lectures and presentations skills in critical review and interpretation of research reports.

PATH 690. Clinical Chemistry Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Graduate students, residents, and staff present topics of current interest in clinical chemistry.

PATH 691. Special Topics in Modern Instrumental Methods. 2 Hours.

Semester course; 1 lecture and 2 laboratory hours. 2 credits. By special arrangement with instructor. A study of some of the modern research methods of molecular biology. The student gains experience with the technique concomitant with discussions with faculty. The student writes a comprehensive review of the technique studied.

PATH 697. Research in Pathology. 1-15 Hours.

Semester course; 1-15 credits. Research leading to Ph.D. degree and elective research projects for other students.

Pharmacology and Toxicology (PHTX)**PHTX 535. Introduction to Toxicology. 4 Hours.**

Semester course; 4 lecture hours. 4 credits. The basic principles of toxicology and toxicological evaluations; correlations of toxicological responses with biochemical, functional and morphological changes; environmental (including occupational and public health), forensic and regulatory concerns; and risk assessment and management are presented for graduate students in the biomedical sciences.

PHTX 548. Drug Dependence. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students with graduate or post-baccalaureate standing or with permission of instructor. This pharmacology course will focus on the neurochemical and molecular adaptations in the brain that contribute to drug abuse. The course will provide an overview of neurobiology, pharmacology, and human and animal methods to study drug use and major drugs with dependence liability, as well as covering special topics in drug dependence. Students will become familiar with evidence supporting addiction theory and mechanisms of drug action and will have the opportunity to apply this knowledge to consider public policies as they relate to drugs of abuse.

PHTX 597. Introduction to Pharmacological Research. 1-12 Hours.

Semester course; 1-12 credits. Prerequisite: permission of instructor. Rotation research in pharmacology and toxicology laboratories for beginning graduate students.

PHTX 606. Introduction to Pharmacology of Therapeutic Agents. 1 Hour.

Module course; 1 lecture hour. 1 credit. The basic principles of pharmacology and an in-depth consideration of the biodisposition and mechanisms of action of these agents. Drugs acting on the autonomic system are covered.

PHTX 614. Foundation in Psychoneuroimmunology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: at least one graduate-level course in immunocompetence, pharmacology, physiology, immunology, biochemistry or psychology, or permission of instructor. This course will provide an in-depth overview of how brain and immune systems interact to maintain physiological and biochemical steady-states essential to wellness. Theory and research drawn from neuroscience, immunology and psychology will be examined as a foundation for understanding mind-body relationships. Beginning at the cellular level, fundamental information underlying mutually interact neuroendocrine-immune system functions will be synthesized to inform an understanding of wellness as well as a variety of pathophysiological states related to the stress process.

PHTX 620. Ion Channels in Membranes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Previous course work including basic concepts in electrophysiology, such as those covered in PHIS 501 or PHTX/PHIS/ANAT 509, is highly recommended. Detailed presentation of the fundamental biophysical properties of ionic channels in membranes including the elementary properties of pores, molecular mechanisms of ionic selectivity, mechanisms of drug block, structure-function relationships, and basis for channel gating. Discussion will encompass modern techniques for studying ion channel function. Crosslisted as: PHIS 620.

PHTX 625. Cell Signaling and Growth Control. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHTX 536 or consent of instructor. Covers biochemical and molecular biology approaches to pharmacological problems. Emphasizes signal transduction, oncogenes, protein kinases, stress responses and the control of cellular proliferation.

PHTX 630. Basic Concepts in Pharmacology for Graduate Students. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOC 503 or permission of instructor. This course provides basis for drug-receptor theory, quantitative understanding of drug-receptor interaction, drug-receptor-based signaling, in-vivo application of drug-receptor theory, pharmacokinetics and statistical treatment of drug-receptor interaction in pharmacology and toxicology.

PHTX 631. Virtual Pharmacology Lab. 1 Hour.

Semester course; 1 laboratory hour. 1 credit. Corequisite: PHTX 630. Enrollment is restricted to graduate students. The goal of the course is to offer experience in pharmacology skills related to the design, conduct and interpretation of pharmacology research. The course will also include special topic discussions on emerging techniques and opportunities to discuss rotation research results. Graded as pass/fail.

PHTX 632. Neurochemical Pharmacology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHTX 630, PHTX 636, BIOC 503, BIOC 504, NEUS 609 or MEDC 555, or permission of instructor. Course focuses on neurotransmitters, transporters, receptors and intracellular signaling pathways that mediate chemical neurotransmission in the nervous system, with a secondary focus on the role of these neurochemical systems as pharmacological targets. Students attend lectures, read assigned scientific research articles, and present and critique these articles in class (2-3 presentations per student per semester). Students will also compose a final original perspective-type review paper based on a topic related to the course content, and give a final presentation based on their paper. Grading is determined by student presentations, an original final scientific review paper and participation in class discussions.

PHTX 633. Behavioral Pharmacology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This is a survey course covering research on the effects of drugs on behavior -- ranging from classical to operant conditioning behaviors. Additional topics will include drug self-administration, drug discrimination, unconditioned and conditioned drug effects, and behavioral toxicology. The course focuses primarily on laboratory research in animals although human research will also be covered. The relevance of this research literature to drug treatment of mental health disorders such as substance use disorders and pain will be discussed.

PHTX 636. Principles of Pharmacology. 5 Hours.

Semester course; 5 lecture hours. 5 credits. Prerequisite: PHTX 630 or permission of instructor and graduate program director. Corequisite: PHTX 639. A comprehensive course in pharmacology for graduate students. The mechanisms of action of major classes of pharmacologically active agents and basic principles of pharmacology are discussed. Topics include autonomic and cardiovascular pharmacology; CNS pharmacology; pharmacology of antimicrobials and cancer; gastrointestinal and endocrine pharmacology.

PHTX 638. Cellular Mechanisms of Toxicology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHTX 536 or permission of instructor. A holistic approach is taken to describe and analyze toxicological information. Intact animal, organ, cellular, and biochemical responses to toxic agents are presented. Immunologic, genetic, endocrine, and central nervous system paradigms and their relationship to the mechanism of action of toxic agents as well as the predictive value of tests of these systems are presented. Kinetics and metabolism of toxic agents as well as statistical and analytical procedures are integrated into the discussions.

PHTX 639. Principles of Pharmacology Journal Club. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: PHTX 630 or permission of instructor. Corequisite: PHTX 636. This course will be in journal club format run in parallel with PHTX 636. Journal club articles pertaining to drug classes and their mechanism of action will be presented by students. Topics include autonomic, CNS, endocrine, cardiovascular and cancer pharmacology.

PHTX 640. Pharmacology of Analgesics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: PHTX 630 and PHTX 636 or permission of the instructor. The course will be divided into three sections. In the first, students will review methods for measurement of pain and analgesia in humans and animals and describe the implications of these measures for translational pain research. In the second section, students will review the neurobiology of pain, with a focus on neural systems that mediate sensory and affective dimensions of pain and their modulation by endogenous pain inhibitory systems. In the final section, students will review the pharmacology of existing classes of drugs and the research strategies for evaluation of new candidate analgesics. Throughout the class, readings and discussions will consider both seminal literature and recent research papers.

PHTX 641. Introduction to Clinical Pharmacology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students who have completed a post-baccalaureate degree or an undergraduate physiology degree or by permission of the instructor. This course is a general survey of clinical pharmacology designed for students pursuing professional degrees including dental, medical and pharmacy programs. The basic principles of pharmacokinetics, pharmacodynamics and pharmacogenetics are presented followed by discussions of neuropharmacology, including drugs for treating neurological disorders and drugs of abuse; immunopharmacology and drugs for pain management; systems pharmacology including autonomic, cardiovascular, respiratory, renal, GI and endocrine pharmacology; and drugs targeting infectious diseases and cancer chemotherapy.

PHTX 690. Pharmacology Research Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Members of the departmental staff, students, and visiting lecturers participate in discussions on topics of current and historical interest.

PHTX 691. Special Topics in Pharmacology. 1-4 Hours.

Semester course; 1-4 credits. Prerequisite: permission of instructor. Special topics in pharmacology or toxicology covered in less detail in other courses will be studied in depth in this course.

PHTX 692. Special Topics. 1-4 Hours.

Semester course; 1-4 variable hours. 1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of the research training. Graded as S/U/F.

PHTX 697. Directed Research in Pharmacology. 1-15 Hours.

Semester course; 1-15 credits. Research leading to the M.S. or Ph.D. degree and elective projects for other students.

Physiology and Biophysics (PHIS)**PHIS 501. Mammalian Physiology. 5 Hours.**

Semester course; 5 lecture hours. 5 credits. A comprehensive study of the function of mammalian organ systems at the organ, cell and molecular level, designed for graduate and professional students. Successful students typically have high achievement in intermediate-level undergraduate biology, chemistry and physics.

PHIS 502. Mammalian Physiology II. 5 Hours.

Semester course; 5 lecture hours. 5 credits. Students should have previous course work in biology, chemistry and physics. A comprehensive study of the function of mammalian organ systems, designed primarily for dental students.

PHIS 503. Predental Mammalian Physiology. 5 Hours.

Semester course; 5 lecture hours. 5 credits. Enrollment requires permission of the instructor. A comprehensive study of the function of mammalian organ systems at the organ, cell and molecular level designed for predental students planning to seek a D.D.S. or equivalent degree.

PHIS 512. Cardiac Function in Health and Disease. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501 or permission of instructor. A comprehensive study of cell and system cardiovascular physiology with pathophysiological implications, primarily designed for professional students.

PHIS 514. Cardiovascular Hemodynamics. 2 Hours.

Semester course; 30 lecture/lab hours. 2 credits. Prerequisite: PHIS 501. Emphasizes the pathophysiological implications of cardiovascular hemodynamics. The rationale and principles of a variety of clinical and paraclinical examination methods used in cardiology will be studied and demonstrated. The pathophysiology of some of the major cardiovascular diseases will be explained by specialists.

PHIS 604. Cell Physiology: Cardiovascular and Respiratory. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501. Enrollment restricted to Ph.D. and M.S. students. This research-oriented course covers topics such as the cellular, molecular and structural bases for cardiovascular and pulmonary function, including detailed analyses of the behavior and regulation of diverse types of transmembrane ion channels at the molecular and cellular level; detailed studies of oxygen delivery by microcirculation; mechanisms of ischemia-reperfusion injury, novel cardio-protection strategies and heart failures; cholesterol homeostasis by macrophages in coronary artery disease; and airway inflammation and mucus secretion as a model for drug development.

PHIS 606. Molecular Basis for Disease. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Topics covered include an introduction to structure of macromolecules and biophysical methods of protein determination. The second part of the course includes research topics such as gene regulation, protein folding and ribosome biogenesis. The third section includes ion channel structure and function. Each section includes problem sets that students are required to complete, three exams and a written mini-grant chosen from the topics discussed in class.

PHIS 607. Cell Physiology: GI and Endocrine. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501. This course focuses on physiology at the levels of individual molecules, cells, organs and entire organisms. Molecular mechanisms, regulatory processes and diseases processes are considered. The course is designed for research-oriented students and focuses on taste, gut, intestines, endocrine and reproductive systems and is structured around the ongoing research activity of the participating faculty.

PHIS 612. Cardiovascular Physiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501. An in-depth study of the original literature in selected areas of cardiovascular physiology.

PHIS 615. Signal Detection in Sensory Systems. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501 or permission of instructor. An in-depth study of cells and cell systems that serve as either internal or external environmental sensors. Topics will emphasize the physiology, anatomy and the biochemistry of mature sensing systems, the systems in normal development and their plasticity toward stresses during development or in maturity.

PHIS 619. Mitochondrial Pathophysiology and Human Diseases. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Mitochondria are essential for eukaryotic life energy production in an oxygen environment, extensively modulate intracellular calcium signaling, are the major source of damaging oxygen free radicals, control activation of cell death pathways and are now known to be impaired in many human diseases of aging. For all these reasons, understanding mitochondrial physiology is essential for graduates of biomedical research programs in medical schools.

PHIS 620. Ion Channels in Membranes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Previous course work including basic concepts in electrophysiology, such as those covered in PHIS 501 or PHTX/PHIS/ANAT 509, is highly recommended. Detailed presentation of the fundamental biophysical properties of ionic channels in membranes including the elementary properties of pores, molecular mechanisms of ionic selectivity, mechanisms of drug block, structure-function relationships, and basis for channel gating. Discussion will encompass modern techniques for studying ion channel function. Crosslisted as: PHTX 620.

PHIS 630. Methods in Molecular Biophysics: A Practical Approach. 2 Hours.

Semester course; 2 lecture hours. 2 credits. The course will cover the theoretical and practical aspects of several techniques that are used to study the structure and function of biological macromolecules. In each section the theoretical background and practical application will be covered. The design of the course is to provide a basic familiarity of biophysical techniques used in structural biology and biochemistry laboratories to understand biological phenomena. Graded S/U/F.

PHIS 631. Electrophysiology and Photonic Methods. 2 Hours.

Semester course; 2 lecture hours. 2 credits. This course elaborates on the fundamentals of bioelectrical activity (resting and action potentials, electrical propagation and synaptic transmission) guiding the student to the use of equivalent circuits to model the electrical properties of cells design and the use of basic operational amplifiers for electrophysiological studies. The course develops a similar approach to understand the basis for fluorescence and phosphorescence techniques and how they can be applied to biophysical research.

PHIS 650. Critical Thinking in Physiology. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Journal club format. Pre- or corequisite: PHIS 501. Enrollment restricted to students with graduate standing or by permission of instructor. This course introduces classical research papers and incorporates problem sets in areas that lend themselves to an analytical approach. Students read and present papers, contributing answers to questions about them.

PHIS 651. MD/PhD Journal Club. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for credit. Enrollment restricted to students in the MD/PhD program. This course is intended for first-year MD/PhD students as a complement to the ongoing medical curriculum and is designed to expose MD/PhD students to research literature related to their ongoing course work. The objectives are to introduce students to original research papers from the current and classical literature and to provide practice and training in effectively identifying and discussing key hypotheses, methods, results and conclusions, as well as in evaluating the strengths and weaknesses of papers. Graded as Satisfactory/Unsatisfactory.

PHIS 652. MD/PhD Science and Disease. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment restricted to students in the MD/PhD program. This course is intended for second-year MD/PhD students as a complement to the ongoing medical curriculum. Clinical faculty or physician-scientists present a patient and then either the physician-scientist or a basic science faculty member discusses the basic science underpinnings of the disease in question. The sessions are coordinated with the MS2B curriculum. Active student participation in the discussion of the case and scientific basis is expected and required. Faculty members are encouraged to present informal sessions designed to encourage student participation and engaged learning. Graded as Satisfactory/Unsatisfactory.

PHIS 653. MD-PHD Research Seminar. 0.5 Hours.

Semester course; 1 lecture hour (alternate weeks). .5 credits. May be repeated for credit. Enrollment is restricted to students enrolled in School of Medicine M.D.-Ph.D. training while in the medical or graduate phases. Course exposes M.D.-Ph.D. students to state-of-the-art research in a range of fields. The objectives are to (1) provide an opportunity for the students to attend formal research presentations by faculty experts, (2) participate in discussions of the underlying hypotheses, research methods, critical results and interpretation of data and (3) give formal presentations based on their own research and receive feedback. Graded as satisfactory/unsatisfactory.

PHIS 689. Physiology Preseminar Highlights. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for credit. Designed to review research to be presented in the department's upcoming weekly seminar. Students present and discuss papers by that week's seminar speaker. Graded as Satisfactory/Unsatisfactory/Fail.

PHIS 690. Physiology Research Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Presentation and discussion of research reports and topics of current interest to the departmental seminar or special group seminar.

PHIS 691. Special Topics in Physiology. 1-4 Hours.

Semester course; 1-4 credits. Prerequisite: PHIS 501 (or taken concurrently).
Special Topics in Physiology (Section 1)
 1-4 credits. Lectures, tutorial studies and/or library assignments in selected areas of advanced study not available in other courses or as part of the research training.
Special Topics: Student Seminar (Section 3)
 Semester course; 1 credit. Pre- or corequisite: PHIS 501. Designed to develop skills in preparing and delivering lectures and other oral presentations. Students present talks on topics in which they are particularly interested, and provide mutual constructive criticism.
Special Topics: Nutrition Research (Section 5)
 Semester course; 3 credits. Weekly discussion of selected topics in nutrition. Topics change yearly. Topics range from biochemical aspects of nutrition to International Nutrition, with selections from various levels of nutritional interest presented each year. Past topics have included nutrition and exercise, diet and cancer, total parenteral nutrition, alcohol nutrition, food safety, drug-nutrient interactions, nutrition and immunological response, cholesterol and nutrition, salty taste mechanisms, vitamin A, vitamin D, and intestinal calcium absorption.

PHIS 692. Special Topics. 1-4 Hours.

Semester course; 1-4 variable hours. 1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of the research training. Graded S/U/F.

PHIS 693. Methods in Molecular Biophysics: A Practical Approach. 2 Hours.

Semester course; 1 lecture and 2 laboratory hours. 2 credits. Covers the theoretical and practical aspects of several techniques that are used to study the structure and function of biological macromolecules. In each section, theoretical background and practical applications will be covered. The course will provide a basic familiarity of biophysical techniques used in structural biology and biochemistry laboratories to understand biological phenomena. Graded S/U/F.

PHIS 695. Research in Progress. 0.5 Hours.

Semester course; .5 lecture hour. .5 credit. Restricted to Ph.D. students or, with permission of instructor, master's students. Student presentations and discussion of research results and contemplated research projects base on research rotations, thesis proposals and ongoing thesis research. Graded S/U/F.

PHIS 697. Directed Research in Physiology. 1-15 Hours.

Semester course; 1-15 credits. Research Leading to the M.S. or Ph.D. degree and elective research projects for other students.

School of Nursing**Interprofessional Education and Collaborative Care (IPEC)****IPEC 510. Interprofessional Communication and the Care Coordinator I. 1 Hour.**

Semester course; 1 lecture hour (delivered online). 1 credit. Defines the various roles of the care coordinator. Identifies all health care providers on the interprofessional team and what their responsibilities are to patient and family care. Focuses on development of effective interprofessional communication and leadership strategies by introducing concepts of teamwork. Explores strategies for conflict negotiation and patient engagement. Facilitates the sharing of individual perspectives and patient care experiences.

IPEC 511. U.S. Health Care and Care Coordination. 2 Hours.

Semester course; 2 lecture hours (delivered online). 2 credits. Explores the overall infrastructure of the health care system and care delivery models. Introduces concepts of regulation. Examines how the effect of different settings and levels of care impact care transitions. Explores effective use of the electronic health record. Identifies the patient-centered care model as integral to improving outcomes. Describes the best ways to share information across health care settings during care transitions.

IPEC 512. Health Care Payment Models and Care Coordination. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Examines aspects of health care financing that affect the type of services the care coordinator can provide. Provides an overview of key points related to insurance coverage, including managed care, Medicare and Medicaid. Reinforces the utilization review process and compliance. Discusses an overview of current U.S. health policy with a special focus on vulnerable patients and the importance of population health management.

IPEC 513. Ethical and Legal Considerations in Care Coordination. 2 Hours.

Semester course; 2 lecture hours (delivered online). 2 credits. Focuses on applying ethical decision-making frameworks to analyze ethical dilemmas that occur with patient care and between members of the interprofessional team. Examines care coordinator role conflict between patient advocacy versus health system advocacy. Provides a framework for identifying potential liabilities while working in the care coordinator role. Examines issues surrounding access to care and social justice. Explores legal responsibilities of the care coordinator.

IPEC 514. Hospital-based Care Coordination. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Explores care coordination in the hospital setting with a focus on discharge planning, medication reconciliation and effective care transitions out of the hospital. Addresses how to identify those patients who have high risk for excess utilization of hospital resources due to limited financial means, lack of insurance, chronic illness, and/or catastrophic injury. Addresses national recommendations for effective care coordination strategies to improve patient outcomes.

IPEC 515. Interprofessional Communication and the Care Coordinator II. 1 Hour.

Semester course; 1 lecture hour (delivered online). 1 credit. Prerequisite: IPEC 510. Reinforces roles and responsibilities of health care providers on the interprofessional team during care coordination and prepares students to assume a professional role. Applies effective interprofessional communication and leadership strategies by reinforcing concepts of teamwork. Explores strategies for conflict negotiation and patient engagement. Facilitates the sharing of individual perspectives and patient care experiences.

IPEC 516. Community-based Care Coordination. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisites: IPEC 511, IPEC 512, IPC 513, IPEC 514 and IPEC 515. Enrollment is restricted to students in the care coordination certificate program. Emphasizes the value of maintaining a primary care provider and connecting the patient with appropriate community resources. Emphasis will be on the patient-centered medical home model of health care delivery, which provides an environment conducive to direct coordination of a patient's primary care with a special focus on effective care transitions. Discusses concepts of advanced care planning, medication management and patient engagement from the outpatient perspective. Identifies how to differentiate high-risk patient populations and provide effective transitions of care within community settings. Introduces concepts of population health and the role of the family in care of the patient.

Nursing (NURS)**NURS 501. Advanced Professionalization I. 1 Hour.**

Semester course delivered online; 1 lecture hour. 1 credit. Prerequisite: admission to the graduate program in nursing. Focuses on socialization to the roles and responsibilities related to advanced nursing preparation. Introduces the history, competencies and roles of advanced practice nursing with an emphasis on role acquisition. Addresses trends and issues which shape advanced practice nursing.

NURS 502. Advanced Pharmacology. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 credits lecture). Enrollment is restricted to students admitted to a graduate program in nursing. Students will develop the requisite knowledge of pharmacotherapeutics necessary for the safe pharmacological management of common patient problems across the lifespan experienced by the advanced practice nurse.

NURS 503. Ethics, Advanced Nursing Practice and the Health Care Environment. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: NURS 501. Grounded in the disciplinary perspective and heritage of nursing, emphasizes analysis of ethical concepts foundational to advanced nursing practice while considering diverse perspectives of the patient, family, health care team and organizational system. Focuses on applying ethical decision-making frameworks to analyze ethical dilemmas and negotiating individual and team-based values. Addresses development of effective communication and leadership strategies for promoting ethical health care delivery and managing ethical conflicts.

NURS 504. Advanced Pathophysiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 credits lecture). Enrollment is restricted to students admitted to a graduate program in nursing. This course focuses on the biological and pathophysiological foundations of health problems across the lifespan. Uses biologic changes underlying selected health risks and health problems as a framework for critically appraising health assessment data and for understanding advanced nursing therapeutic strategies.

NURS 507. Health Promotion and Disease Prevention Across the Lifespan. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Pre- or corequisite: NURS 504. Focuses on advanced nursing assessment and the design and delivery of evidence-based, culturally relevant health promotion and disease prevention strategies for individuals across the lifespan. Applies theories, concepts and research findings related to health promotion, health protection and disease prevention as a basis for clinical decision-making with child, adolescent and adult patients and their families within a variety of care settings.

NURS 508. Policy, Processes and Systems for Advanced Nursing Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: admission to the nursing program. Explores various influences on the structure and financing of health care, advanced nursing practice and health outcomes from a macro and micro perspective of the current health care system. Addresses the policy-making process at various levels of government and within institutions, policies affecting current and future nursing care delivery systems and nursing's role in policy advocacy to improve the quality of health care delivery. Using policy, processes and systems-level strategies, including quality improvement and high reliability organizational theory, students will be able to articulate the methods, performance measures, culture of safety principles and quality standards necessary for effective leadership as a change agent in the current health care system.

NURS 511. Advanced Health Assessment. 3 Hours.

Semester course; 2 lecture and 1 laboratory hours (40 laboratory contact hours). 3 credits (2 credits lecture and 1 credit laboratory). Enrollment is restricted to students admitted to a graduate program in nursing. Provides a framework for conducting a comprehensive and systematic assessment of individuals across the lifespan. Focuses on advancing students' knowledge and assessment techniques in collecting and interpreting data from the health history and physical examination. Emphasizes the identification of deviations from normal in assessment data, including laboratory and diagnostic studies, and application of diagnostic reasoning skills to develop a prioritized differential diagnosis list.

NURS 512. Foundations for Evidence-based Advanced Practice. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students admitted to a graduate program in nursing. This course assists with the identification and use of evidence to identify and address problems faced in the health care setting. Emphasizes appraisal and synthesis of scientific literature to design evidence-based practice strategies and outcome measures in the context of a selected clinical problem, population health risk or organizational issue.

NURS 515. Holistic Leadership in Health Care Delivery. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Leadership concepts are advanced from a self- to organizational and societal perspective. How leaders evolve and maintain critical perspectives based on organizational mission, purpose and goals are critically analyzed. Political, legal, ethical, diversity and cultural perspectives are explored as a basis for leadership expression. Emphasis will be placed on communication and decision-making skills.

NURS 516. Health Care Information Technology. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. The course gives students a broad overview of health information technology in the context of the health care organization; discusses principles of informatics and information flows in nursing and health care using systems analysis techniques; and emphasizes understanding of how health care leaders implement, manage and evaluate health care technology and informatics projects. Information and communication technology system integration and data security, as well as ethical and regulatory issues, will be reviewed. Current topics and issues related to the use, retrieval, evaluation and dissemination of health care information will be discussed, as well as the role of informatics and analytics in decision-making.

NURS 517. Organizational Science Implications for Human and Material Resource Management. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Classical, modern and postmodern theories of organizations are examined as the scientific foundation for leadership and administration in health care organizations. Human capital is presented as a foundation for examining individual and group thinking and decision-making. How groups and organizations form and evolve is explored through classic and current research. Foundations in human resource management and law, evaluating performance, job analysis and design, managing conflict, and influencing a culture of diversity and inclusion will be applied to current practice issues. Supply chain logistics and management, including product evaluation and decision-making related to sustainability, are studied.

NURS 518. Mindfulness Practices for Health Care Professionals: Clinical Applications. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course will provide health care professional students with an interprofessional curriculum in mindfulness practices, with a focus on clinical applications for health care providers. The didactic component of the course will focus on subjects such as research on the physiological and psychological effects of stress; methods to integrate mindful practices into daily life; the use of mindfulness when facing difficult clinical situations; balancing life with clinical workload; mindful leadership and interpersonal strategies; and compassionate self-care and care for others. Didactic content will be combined with experiential modules during which students will be guided through gentle mindfulness-based yoga and meditative practices. Students will participate in discussions related to the integration of mindfulness into clinical and personal life. The course will have relevance for the student who is interested in stress management and gaining a comfort with mindfulness-based practices for personal application and for integration into clinical practice. Graded as pass/fail.

NURS 520. Professional Transitions for the Advanced Practice Nurse. 2 Hours.

Semester course; 2 lecture hours. 2 credits (2 credits lecture). This course emphasizes the transition to the advanced practice nursing role. The course focuses on synthesizing the knowledge, skills and abilities that will allow students to transition successfully into the advanced practice nursing role.

NURS 521. Psychiatric Disorders Across the Lifespan. 4 Hours.

Semester course; 3.5 lecture and 20 laboratory hours. 4 credits (3.5 credits lecture and .5 credits laboratory). Prerequisites: NURS 504, NURS 512, NURS 623 or permission of instructor. This course explores the role and scope of the advanced practice psychiatric mental health nurse, the psychiatric diagnostic reasoning process, psychiatric case formulation and treatment planning. Laboratory experiences will accompany didactic content.

NURS 522. Psychopharmacology for Advanced Practice. 3 Hours.

Semester course; 2.5 lecture and .5 laboratory hours (20 laboratory contact hours). 3 credits (2.5 credits lecture and .5 credits laboratory). Prerequisites: NURS 521, NURS 502 or permission of instructor. This course examines the psychopharmacological treatment of psychiatric disorders. The course will cover pharmacodynamics and pharmacokinetics of psychotropic medications in detail and will explore major psychopharmacological drug classes and specific medications, indications, dosing and side effects. Students will be exposed to content related to the interaction between prescription medications and nonprescription substances. Laboratory experiences will accompany didactic content.

NURS 523. Fundamental Nursing Concepts. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 credits lecture). Enrollment is restricted to students admitted to the School of Nursing. This course provides an overview of the foundations of nursing practice and person-centered care across the lifespan. Students are introduced to the nursing process, clinical reasoning and decision-making in various settings. The course highlights the role of a nurse as a collaborative team member and underscores the importance of professional accountability in providing safe, quality care.

NURS 524. Applied Practice: Health Assessment Across the Lifespan and Fundamental Nursing Concepts. 3 Hours.

Semester course; 45 clinical and 60 laboratory hours. 3 credits (1 credit clinical and 2 credits laboratory). Enrollment is restricted to students admitted to the School of Nursing. This course provides opportunities to demonstrate foundational nursing knowledge, assessment techniques and introductory skills across the lifespan in clinical settings. Emphasis will be placed on fostering a culture of safety, effective communication and collaboration in the health care environment.

NURS 530. U.S. Health Care and Care Coordination. 2 Hours.

Semester course; 2 lecture hours (delivered online). 2 credits. Partial semester course which will be delivered in the first seven weeks of the semester. Explores the overall infrastructure of the health care system and care delivery models. Introduces concepts of regulation. Examines how the effect of different settings and levels of care impact care transitions. Explores effective use of the electronic health record. Identifies the patient-centered care model as integral to improving outcomes. Describes the best ways to share information across health care settings during care transitions.

NURS 531. Health Care Payment Models and Care Coordination. 2 Hours.

Semester course; 2 lecture hours (delivered online). 2 credits. Partial semester course which will be delivered in the second seven weeks of the semester. Examines aspects of health care financing that affect the type of services the care coordinator can provide. Provides an overview of key points related to insurance coverage, including managed care, Medicare, Medicaid, the utilization review process and compliance. Discusses an overview of current U.S. health policy with a special focus on vulnerable patients.

NURS 532. Ethical and Legal Considerations in Care Coordination. 2 Hours.

Semester course; 2 lecture hours (delivered online). 2 credits. Partial semester online course which will be delivered in the first six weeks of the semester. Focuses on applying ethical decision-making frameworks to analyze ethical dilemmas that occur with patient care and between members of the interprofessional team. Examines care coordinator role conflict between patient advocacy and health system advocacy. Provides a framework for identifying potential liabilities while working in the care coordinator role. Explores legal responsibilities of the care coordinator.

NURS 533. Transitional Care. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Partial semester course which will be delivered in the second nine weeks of the semester. Explores care coordination in the hospital setting with a focus on discharge planning, medication reconciliation and effective care transitions out of the hospital. Addresses how to identify those patients who have high risk for excess utilization of hospital resources due to limited financial means, lack of insurance, chronic illness and/or catastrophic injury. Addresses national recommendations for effective care coordination strategies to improve patient outcomes.

NURS 534. Community-based Care Coordination. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits.
Prerequisites: NURS 530, NURS 531, NURS 532 and NURS 533, or permission of instructor. Focuses on the development of knowledge and skills essential to provide care coordination in community-based settings. Emphasizes the value of maintaining a primary care provider and connecting the patient with appropriate community resources. Examines concepts of advanced care planning, medication management and patient engagement from the outpatient perspective. Identifies high-risk patient populations and how to best provide effective transitions of care within community settings. Designs an evidence-based capstone project which is used to identify care coordination challenges and propose solutions.

NURS 535. Population Health, Prevention, and Wellness Concepts Across the Lifespan. 4 Hours.

Semester course; 4 lecture hours. 4 credits (4 credits lecture).
Prerequisites: NURS 523, NURS 524, NURS 624, NURS 625 and NURS 633; or NURS 350, NURS 380, NURS 450, NURS 523 and NURS 524; or permission of the course faculty. This course provides an overview of the principles of health and wellness across populations and the lifespan. Students will be introduced to the role of the nurse in improving the health of populations through health promotion and disease prevention.

NURS 536. Applied Practice: Population Health, Prevention, and Wellness Across the Lifespan. 2 Hours.

Semester course; 45 clinical and 30 laboratory hours. 2 credits (1 credit clinical and 1 credit laboratory). Prerequisites: NURS 523, NURS 524, NURS 624, NURS 625 and NURS 633; or NURS 350, NURS 380, NURS 450, NURS 523 and NURS 524; or permission of the course faculty. This course provides opportunities to demonstrate nursing competencies related to health promotion and disease prevention to improve the health of populations. Emphasis will be placed on using a holistic approach to address health and wellness needs for patients across the lifespan.

NURS 547. Chronic Care Concepts Across the Lifespan. 4 Hours.

Semester course; 4 lecture hours. 4 credits (4 credits lecture).
Prerequisites: NURS 523, NURS 524, NURS 624, NURS 625, and NURS 633; or NURS 350, NURS 380, and NURS 450, NURS 523 and NURS 524; or permission of the course faculty. This course focuses on chronic disease management including self-management, care coordination and support during transitions in care for patients and caregivers across the lifespan. Content will emphasize effective communication and collaboration skills and strategies to promote patient empowerment.

NURS 548. Applied Practice: Chronic Care Concepts Across the Lifespan. 3 Hours.

Semester course; 90 clinical and 30 laboratory hours. 3 credits (2 credits clinical and 1 credit laboratory). Prerequisites: NURS 523, NURS 524, NURS 624, NURS 625, and NURS 633; or NURS 350, NURS 380, and NURS 450, NURS 523 and NURS 524; or permission of the course faculty. This course provides opportunities for students to provide care for patients with chronic disease in a variety of clinical settings and at various points along the disease trajectory across the lifespan. Emphasis will be placed on demonstrating techniques for ongoing patient assessment and engagement in chronic disease management across the lifespan.

NURS 550. Acute Care Concepts Across the Lifespan. 4 Hours.

Semester course; 4 lecture hours. 4 credits lecture. Prerequisites: NURS 535, NURS 536, NURS 547 and NURS 548; and NURS 451 or NURS 626; or permission of the course faculty. This course introduces students to the nursing management of disease states, critical conditions and health events commonly seen in acute care across the lifespan.

NURS 551. Applied Practice: Acute Care Concepts Across the Lifespan. 3 Hours.

Semester course; 135 clinical hours. 3 credits (3 credits clinical).
Prerequisites: NURS 535, NURS 536, NURS 547 and NURS 548; and NURS 451 or NURS 626; or permission of the course faculty. This course provides opportunities to demonstrate nursing care in a variety of acute care settings across the lifespan. Students will build upon previously learned skills to develop, implement and evaluate a plan of care as part of an interprofessional team.

NURS 580. Primary Care of the Adult-Gerontology Population. 4 Hours.

Semester course; 3.5 lecture and .5 laboratory hours (20 laboratory contact hours). 4 credits (3.5 credits lecture and .5 credits laboratory).
Prerequisites: NURS 504 and NURS 623. This course provides content on the primary care management of adolescents through geriatrics. It focuses on building a foundation of knowledge and clinical decision-making skills related to normal development, health promotion and disease prevention, and the diagnosis and management of common health conditions across the adult lifespan. Laboratory experiences will accompany didactic content.

NURS 581. Adult-Gerontology Acute Care Practicum I. 2 Hours.

Semester course; 2 clinical hours (120 clinical contact hours). 2 credits (2 credits clinical). Prerequisites: NURS 502 and NURS 580. This course focuses on management of adolescent through geriatric patients with complex health care conditions through precepted experiences. Students have opportunities to focus on the provision of a spectrum of care ranging from disease prevention to acute care management. Graded as Satisfactory/Unsatisfactory.

NURS 589. Maternal and Child Health in Primary Care. 3 Hours.

Semester course; 2.5 lecture and .5 laboratory hours (20 laboratory contact hours). 3 credits (2.5 credits lecture and .5 credits laboratory).
Prerequisite: NURS 580. The course provides content on the management of the primary care health needs of pregnant women, as well as children from birth to adolescence. This course explores how family theory and health promotion of families provides the basis for both patient- and family-centered approaches to providing evidence-based quality health care.

NURS 590. Complex Problems in Family Primary Care. 4 Hours.

Semester course; 3.5 lecture and .5 laboratory hours (20 laboratory contact hours). 4 credits (3.5 credits lecture and .5 credits laboratory).
Prerequisite: NURS 632. This course builds upon knowledge and skills from prior courses and clinical practicum experiences. The course provides content on the management of complex health issues across the lifespan. Students will increase knowledge and decision-making skills in the primary care treatment of vulnerable populations and patients with multiple comorbidities, as well as selecting appropriate pharmacotherapeutics.

NURS 591. Special Topics. 1-3 Hours.

Semester course; 1-3 credits. Prerequisite: admission to the graduate program in nursing. Explores specific topics in nursing theory and practice.

NURS 592. Directed Study in Nursing. 1-3 Hours.

Semester course; variable hours. 1-3 credits. Prerequisite: admission to the graduate program in nursing. Independent study in a specific area of nursing developed under the supervision of a member of the graduate faculty.

NURS 593. Project and Planned Change Management. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Models for leading change through project management are examined using linear and nonlinear change dynamics. Skills in problem analysis, change agent-client system capacity for change and standard setting are acquired in this course. The impact of nonlinear social change on organizations is introduced. Project management and tools to evaluate the impact of change are examined.

NURS 594. Directed Study: Nursing Clinical Practicum. 1-6 Hours.

Semester course; 1-6 clinical hours (60-360 clinical/lab hours). 1-6 credits (1-6 clinical/lab credits). Enrollment requires permission of the instructor. Independent study in specific practicum area of nursing developed under the supervision of a faculty member. Graded as pass/fail.

NURS 595. Family Primary Care Practicum I. 2 Hours.

Semester course; 2 clinical hours (120 clinical contact hours). 2 credits (2 credits clinical). Prerequisites: NURS 502 and NURS 580. This course provides opportunities for students to develop beginning competencies as a family nurse practitioner through precepted practicum experiences. Advanced health assessment skills and knowledge of management of common health problems are applied in the clinical setting to improve critical thinking and diagnostic reasoning. Graded as Satisfactory/Unsatisfactory.

NURS 596. Adult-Gerontology Primary Care Practicum I. 2 Hours.

Semester course; 2 clinical hours (120 clinical contact hours). 2 credits (2 credits clinical). Prerequisites: NURS 511 and NURS 580. This course focuses on providing primary care management of adolescent through geriatric patients across the wellness-illness continuum through precepted clinical experiences. Provides opportunities to focus on the differing and unique developmental life-stage needs that impact a patient's care across the adult age spectrum and application of evidence-based strategies in directing health promotion, health protection, disease prevention and primary care management of injuries and disease. Graded as pass/fail.

NURS 597. Psychiatric Mental Health Practicum I. 2 Hours.

Semester course; 2 clinical hours (120 clinical contact hours). 2 credits (2 credits clinical). Prerequisites: NURS 502 and NURS 521 or permission of instructor. This course focuses on the diagnosis and management of individuals with psychiatric disorders across the lifespan through faculty-supervised clinical experiences with a preceptor. The course provides opportunities to perform comprehensive psychiatric evaluations and ongoing psychiatric care. Graded as Satisfactory/Unsatisfactory.

NURS 598. Managing Psychiatric Disorders in Special and Vulnerable Populations. 2 Hours.

Semester course; 2 lecture hours. 2 credits (2 credits lecture). Prerequisite: NURS 597, NURS 622 or permission of instructor. This course deepens students' knowledge of the diagnosis and treatment of psychiatric disorders in special and vulnerable patient populations, such as children and adolescents; older adults; individuals with chronic illness, substance use disorders and/or personality disorders; individuals within the criminal justice system; refugees; LGBT+ populations; and military populations. Students will be challenged to confront their own biases and values as related to psychiatric practice.

NURS 601. Advanced Professionalization II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: NURS 501. Designed to prepare students to assume an advanced practice nursing role after graduation. Focuses on role development in advanced practice nursing, marketing oneself as an advanced practice nurse, and regulatory and economic policies that affect advanced practice nursing in today's health care system. Presents strategies to evaluate outcomes attributable to APN practice.

NURS 602. Psychotherapy: Theory and Practice. 2 Hours.

Semester course; 1.5 lecture and .5 laboratory hours (20 laboratory contact hours). 2 credits (1.5 credits lecture and .5 credits laboratory). Prerequisite: NURS 597, NURS 622 or permission of instructor. Corequisite: NURS 598, NURS 641 or permission of instructor. This course addresses the theoretical foundations and application of psychotherapy in advanced practice psychiatric mental health nursing. The course will explore major psychotherapy approaches. Students will apply principles of reflective practice relevant to their future practice as psychiatric mental health nurse practitioners. Laboratory experiences will accompany didactic content.

NURS 603. Improvement Science and Outcomes Management. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. With an emphasis on the foundations of quality and safety science, the techniques and tools for analyzing organizational and clinical processes for efficacy, root cause analysis when examining medical errors, and developing or using valid and reliable metrics to measure outcomes are presented. The importance of building a culture of quality and safety is reinforced, along with the role of regulators and regulations to monitor safety.

NURS 604. Applied Budgeting and Finance. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Fiscal analysis and application to unit, program and service-line management are presented using finance language to advance human resource, supplies and capital budgeting. Specific topics include price-setting, cost-benefit/break-even analysis, contract development and financial ratio analysis. Clinical operations, grant budgets and start-up fund acquisition skills are acquired. The cost analysis and clinical benefit of current staffing models will be justified from a fiscal/clinical perspective. Requires competency in Excel.

NURS 605. Statistical Methods for Quality Improvement. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits (3 credits lecture). Enrollment restricted to students admitted to a graduate program. This course focuses on common analytic approaches in practice change projects, including correlation, chi-square analysis, independent and paired t tests, analysis of variance, and logistic and multiple regression. Selection of the most relevant analytic strategy to determine clinical significance of a quality improvement initiative will be emphasized. The application of statistical process control methods to health care quality improvement projects will be emphasized. The student will apply principles of statistical analysis to a dataset using statistical software to identify characteristics of participants and outcomes.

NURS 606. Evaluating Evidence to Improve Health Outcomes. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Provides essential skills for using research evidence to support and promote practice change. Collaboration between nursing and other disciplines in problem identification will be explored. Ethical dimensions of quality improvement research and research evidence will be reviewed. Students will formulate a clinical question, search for supporting evidence, apply appraisal principles to evaluate the evidence and derive practice-specific recommendations for implementation.

NURS 607. Epidemiology and Population Health. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students admitted to a graduate program. Integrates principles of epidemiology, evidence-based clinical prevention, health screening, behavioral modification, disease modification, disease management of populations and quality metrics. Students will assess population health models and frameworks to address a multilevel perspective of the health status of vulnerable populations and sources of health inequalities. Cultural perspectives will be emphasized at a regional, national and global level.

NURS 608. Quality Improvement in Practice. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits (3 credits lecture). Enrollment restricted to students admitted to a graduate program. This course prepares the student for proficiency in the development of quality improvement initiatives for sustainable practice change. The student will assess evidence as it relates to cost, quality and health outcomes (individual and aggregate) within the context of current regional and national health care trends and emerging issues. Emphasis will be on the methods and tools utilized in performance improvement and patient safety. The student will develop a quality or safety initiative using a systems approach.

NURS 609. Health Care Delivery and Reimbursement Systems for Nurse Leaders. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course summarizes contemporary issues in health care delivery, evolving models of health care delivery systems and reimbursement. The focus is on current policies and systemic factors that affect the delivery of health care to the U.S. population and their potential impact on future health care delivery. The course presents factors affecting the evolution of the U.S. health care system and health care provider roles with a focus on the nurse and advanced practice. Issues are presented in context of patient-centered care and population-level aims for quality outcomes.

NURS 610. Health Information and Emerging Health Care Technologies. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students admitted to a graduate program. Health informatics will be explored as an integral component of health care delivery. Focuses on building understanding of effective use and evaluation of health information technologies. Particular emphasis will be on informatics' role in health care decision-making, access to care, patient safety and quality of care. Also emphasizes the use of health informatics as a component of patient care and for the improvement of quality and safety outcomes over time, leading to sustainable change. Additional focus on current and emerging technologies.

NURS 611. Primary Care Advanced Practice Clinical Procedures. 1 Hour.

Semester course; 7.5 lecture and 22.5 laboratory (contact) hours. 1 credit. Prerequisites: NURS 504 and 511. Provides the foundation for acquiring a beginning level of competency in a variety of common primary care advanced clinical practice skills and procedures. Emphasizes correct technique and includes supervised experiences.

NURS 612. Acute Care Advanced Practice Clinical Procedures. 1 Hour.

Semester course; 7.5 lecture and 22.5 laboratory (contact) hours. 1 credit. Prerequisites: NURS 504 and 511. Provides the foundation for acquiring a beginning level of competency in a variety of common acute care advanced clinical practice skills and procedures. Emphasizes correct technique and includes supervised experiences.

NURS 613. Organizational Behavior and Leadership for Nurse Leaders. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Corequisite: NURS 668. This course introduces students to organizational behavior as it relates to leadership theory based on classic and contemporary readings in organizational behavior. Students will engage in self-evaluative processes to assess and enhance their leadership capabilities in relation to elements of sound leadership principles. The course will examine topics in organizational behavior that relate to the nurse leader role in health care delivery. Management principles are outlined, discussed and put in context to give a realistic focus to issues in leadership and organizational behavior. The course uses case method, simulation, discussion, self-assessment instruments, written exercises and audiovisual aids to illuminate leadership and managerial practices in relation to organizational behavior.

NURS 614. Organizational Systems and Leadership for Nurse Leaders. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students admitted to the graduate program in nursing. This course introduces a systems approach to health care organizational operations leadership and management. Students will gain an understanding of how nurse leaders working with the health care team organize and use structures and analytical approaches to assess and report on the efficiency and effectiveness of work processes that affect patient care, satisfaction and health outcomes. Students will gain skills in operations management by analyzing work processes, patient flow, project management, and the supply chain and customer service.

NURS 615. Diagnosis and Management in Adult-Gerontology Primary Care I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisites: NURS 501, NURS 504, NURS 507, NURS 511. Provides content on the primary care management of health and illness changes throughout the adult lifespan. This course focuses on increasing the nurse practitioner student's knowledge and clinical decision-making skills in order to provide health screening, identify health promotion needs, and accurately diagnose and manage common health conditions across the adult lifespan. Emphasis is placed on developmental, prevention, pathophysiological, pharmacological and critical-thinking skills in the management of common complex and multisystem disorders.

NURS 616. Diagnosis and Management in Adult-Gerontology Primary Care II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: NURS 615. This course is a continuation of NURS 615. The course includes prevention, pathophysiological, pharmacological and critical-thinking skills in maximizing health with common and complex health problems. Emphasis is placed on increasing the nurse practitioner student's knowledge and clinical decision-making skills in order to provide health screening, identify health promotion needs, accurately diagnose and provide women's- and adult-specific care and psychobehavioral care across the adult lifespan, particularly in the context of common complex and multisystem disorders.

NURS 617. Advanced Gerontology Primary Care Across the Care Continuum. 4 Hours.

Semester course; 3.5 lecture and .5 laboratory hours (20 laboratory contact hours). 4 credits (3.5 credits lecture and .5 credits laboratory). Prerequisites: NURS 580 and NURS 619. In this course students will further examine and integrate physiological, psychological and sociocultural processes associated with normal aging. Students will refine knowledge of pharmacotherapeutics needed by the advanced practice nurse for the safe pharmacological management of common patient problems in older adults. Relevant theories, concepts and research findings from the behavioral, social and biological sciences are analyzed as a basis for advanced nursing practice with older adults and their families. Emphasis is placed on enhancing the individual's health within the context of their functional capabilities, social support networks and environment. Important geriatric care models for effective practice with older adults across the care continuum, coordinated care across the interprofessional team including families and caregivers, transitions of care, and complex care management are reviewed.

NURS 618. Diagnosis and Management in Adult-Gerontology Acute Care I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisites: NURS 501, NURS 504, NURS 507, NURS 511. Provides content on the management of adult and geriatric patients and populations who are physiologically unstable, technologically dependent and/or highly vulnerable to complications. The focus of this course is on increasing students' acute care knowledge and decision-making skills in order to accurately assess, diagnose and manage complex acute, critical, and chronically ill or injured adult and geriatric patients.

NURS 619. Acute and Complex Health Conditions of the Adult-Gerontology Population. 3 Hours.

Semester course; 2.5 lecture and .5 laboratory hours (20 laboratory contact hours). 3 credits (2.5 credits lecture and .5 credits laboratory). Prerequisite: NURS 580. This course builds upon knowledge and skills from prior courses and provides content on the management of acute and complex health issues in the adolescent, adult and geriatric population. Students will increase knowledge and decision-making skills in the management of physiologically unstable patients, multiple comorbidities and appropriate prescribing practices. Laboratory experiences will accompany didactic content.

NURS 620. Gero-pharmacology. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: NURS 502. This course refines knowledge of pharmacotherapeutics needed by the advanced practice nurse for the safe pharmacological management of common patient problems in older adults. Emphasis is placed on the interprofessional team, including families and caregivers, as an essential component of care for older adults.

NURS 621. Leadership and Organizational Systems. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Examines system leadership and change within the context of organizational culture. Models and strategies related to leadership, effective organizational processes, organizational change, strategic planning and intraprofessional teamwork will be evaluated. Emphasizes development of skills in system assessment and system intervention design.

NURS 622. Psychopharmacology for Advanced Practice. 3 Hours.

Semester course; 2.5 lecture and .5 laboratory hours (20 laboratory contact hours). 3 credits (2.5 credits lecture and .5 credits laboratory). Prerequisite: NURS 521, NURS 502 or permission of instructor. This course examines the psychopharmacological treatment of psychiatric disorders. The course will cover pharmacodynamics and pharmacokinetics of psychotropic medications in detail and will explore major psychopharmacological drug classes and specific medications, indications, dosing and side effects. Students will be exposed to content related to the interaction between prescription medications and nonprescription substances. Laboratory experiences will accompany didactic content.

NURS 623. Advanced Health Assessment. 3 Hours.

Semester course; 2 lecture and 1 laboratory hours (40 laboratory contact hours). 3 credits (2 credits lecture and 1 credit laboratory). Enrollment is restricted to students admitted to a graduate program in nursing. This course assists with the identification and use of evidence to identify and address problems faced in the health care setting. Emphasizes appraisal and synthesis of scientific literature to design evidence-based practice strategies and outcome measures in the context of a selected clinical problem, population health risk or organizational issue.

NURS 624. Roles and Responsibilities of the Professional Nurse. 2 Hours.

Semester course; 2 lecture hours. 2 credits lecture. Enrollment is restricted to students admitted to the master's program in the School of Nursing. This course provides an overview of the history and current state of the nursing profession including regulatory, licensing and professional standards. Emphasis is on the professional nurse's role in the health care environment as well as the impact of self-care for career longevity.

NURS 625. Integration of Pathophysiology and Pharmacology for Nursing Practice I. 4 Hours.

Semester course; 4 lecture hours. 4 credits (4 credits lecture). Enrollment is restricted to students admitted to the master's program in the School of Nursing. This course introduces pathophysiological foundations of disorders and pharmacological concepts. Emphasizes the connection among underlying pathophysiology, clinical manifestations, pharmacological treatments and nursing care for selected concepts.

NURS 626. Integration of Pathophysiology and Pharmacology for Nursing Practice II. 4 Hours.

Semester course; 4 lecture hours. 4 credits (4 credits lecture). Prerequisite: NURS 625 or permission of the course faculty. This course builds on pathophysiological foundations of disorders and pharmacological concepts. It emphasizes the connections among underlying pathophysiology, clinical manifestations, pharmacological treatments and nursing care for selected concepts.

NURS 627. Foundational Perspectives of Family-centered Care. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: admission to the graduate program in nursing. This course is foundational to the family nurse practitioner curriculum and provides the theoretical foundation and context for the FNP's role in the care of families. The course will emphasize analysis of theories and research concerning families. The effects of psychosocial, cultural, socioeconomic and spiritual variables on families at risk will be discussed. The effects of transitions and crises on the health/illness status of patients in the context of family will be explored. Culturally appropriate communication skills to facilitate family decision-making and foster positive behavioral change in the patient and caregiver will be analyzed. Students will examine their personal beliefs and family life experiences to inform their developing advanced practice role.

NURS 628. Practicum in Nursing Leadership and Organizational Science. 5 Hours.

Semester course; 5 clinical hours (300 clinical contact hours). 5 credits (5 credits clinical). Prerequisites: NURS 515, NURS 517, NURS 603 and NURS 604. A field-based course project is the centerpiece of the practicum, where the learner advances leadership skills through decision-making, human and capital resource management, communication and change management. Knowledge is synthesized and applied in this practicum experience. Graded as Satisfactory/Unsatisfactory.

NURS 629. Diagnosis and Management in Family Primary Care I. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Enrollment restricted to students admitted to a graduate program in nursing. This course is designed to introduce the student to the role of the nurse practitioner as a provider of primary care across the lifespan. Concepts of advanced health assessment, pharmacology and pathophysiology are synthesized with a focus on diagnostic decision-making and interdisciplinary management of common acute and chronic health problems. Emphasis is placed on facilitating optimal health and function of patients from newborn through senescence. Strategies to enhance, maintain and restore health are emphasized, while promoting health-seeking behaviors and the impact on family-centered care.

NURS 630. Diagnosis And Management In Family Primary Care II. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Prerequisite: NURS 629. This course is a continuation of NURS 629. Concepts of health promotion and disease prevention, advanced health assessment, pharmacology, and pathophysiology are incorporated into the diagnosis and interdisciplinary management of common acute and chronic health problems. Emphasis is placed on the formation and evaluation of comprehensive evidence-based care with regard to the care of common complex and multisystem disorders. Strategies to enhance, maintain and restore health are emphasized. Health-seeking behaviors and the impact on family are stressed.

NURS 631. Primary Care of Select Populations. 2 Hours.

Semester course; 1 lecture and 45 clinical/lab hours. 2 credits (1 credit lecture and 1 credit clinical/lab). Prerequisites: NURS 629 and NURS 630. This course addresses the diagnosis and management of select primary care topics in women's health, pediatrics, gerontology and psychiatric-mental health. Laboratory experiences including simulation, standardized patients and objective structured clinical examinations will accompany didactic content delivery. Graded P/F.

NURS 632. Maternal and Child Health in Primary Care. 3 Hours.

Semester course; 2.5 lecture and .5 laboratory hours (20 laboratory contact hours). 3 credits (2.5 credits lecture and .5 credits laboratory). Prerequisite: NURS 580. Corequisite: NURS 595. The course provides content on the management of the primary care health needs of pregnant women, as well as children from birth to adolescence. This course explores how family theory and health promotion of families provides the basis for both patient- and family-centered approaches to providing evidence-based quality health care.

NURS 633. Integration of Applied Health Assessment Across the Lifespan. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 credits lecture). Enrollment is restricted to students admitted to the master's program in the School of Nursing. This course focuses on development of nursing knowledge, skills and techniques necessary for history-taking, physical examination and interpretation of data across the lifespan. Emphasizes the integration of these skills and techniques into the role of the professional nurse.

NURS 634. Application of Evidence-based Practice in Health Care. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 credits lecture). Enrollment is restricted to students admitted to the master's program in the School of Nursing. This course introduces the basic principles of the research process, evidence-based practice and quality improvement in health care.

NURS 635. Advanced Practice Psychiatric Mental Health Nursing Practicum I. 6 Hours.

Semester course; 270 clinical/lab hours. 6 credits (6 credits clinical/lab). Prerequisites: NURS 502, NURS 503, NURS 511 and NURS 657; corequisite: NURS 636. Focuses on the diagnosis and management of mental health problems and psychiatric disorders for individuals, families and groups across the lifespan through faculty supervised clinical experiences with a preceptor. Demonstrates ability to perform a comprehensive psychiatric evaluation while incorporating therapeutic communication skills. Provides opportunities to apply knowledge of standardized taxonomy systems and evidence-based screening guidelines to formulate a differential diagnosis. Requires students to develop plans of care incorporating evidence-based practice guidelines. Performance of clinical skills at a basic level is expected. Graded Pass/Fail.

NURS 636. Advanced Practice Psychiatric Mental Health Nursing Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 lecture credits). Corequisite: NURS 635. Prepares for and builds on practicum experience. Focuses on the management of both acute and chronic psychiatric disorders for individuals, families and groups across the lifespan. Examines the unique characteristics of selected populations diagnosed with mental health problems or psychiatric disorders and ways to address complex management needs through a case study approach. Provides opportunities for students to plan and discuss treatment plans while integrating health promotion and education strategies. Students are expected to apply knowledge of both psychotherapeutic and psychopharmacologic interventions. Focuses on synthesis of evidence to analyze clinical decision-making and formulate a patient-centered plan of care across the treatment trajectory.

NURS 637. Advanced Practice Psychiatric Mental Health Nursing Practicum II. 6 Hours.

Semester course; 270 clinical/lab hours. 6 credits (6 credits clinical/lab). Prerequisite: NURS 635. Builds on previous practicum experience. Focuses on the advanced management of mental health problems and psychiatric disorders for individuals, families and groups across the lifespan through faculty-supervised clinical experiences with a preceptor. Students will implement and evaluate the management of both common and complex mental health problems and psychiatric disorders. Provides opportunities for the synthesis, application and evaluation of knowledge needed to provide evidence-based psychiatric care. Focuses on strategies to lead the interprofessional health care team in quality improvement methods. Promotes the provision of high-quality, collaborative and ethical care. Performance of clinical skills at the advanced level is required. Graded as Pass/Fail.

NURS 638. Health Policy Leadership and Advocacy. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students admitted to a graduate program. Emphasizes critical analysis of the political, organizational, economic, ethical, quality and safety dimensions of health policy issues. Contextual factors such as social justice, health disparities, vulnerable populations, access to care, health care financing and the globalization of health care will be explored. Leadership skills in health policy advocacy will be refined throughout the course.

NURS 639. Health Informatics for Nurse Leaders. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The course gives students a broad overview of health informatics in the context of the health care organization; discusses principles of informatics and information flows in nursing and health care using systems analysis techniques; and emphasizes understanding of how nurse leaders implement, manage and evaluate health care information and informatics projects. Information and communication technology system integration, data security, as well as ethical and regulatory issues, will be reviewed. Current topics and issues related to the use, retrieval, evaluation and dissemination of health care information will be discussed, as well as the role of informatics in decision-making.

NURS 640. Teamwork In Complex Clinical Situations. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Students collaborate with their peers to analyze complex clinical situations from individual- and system-level perspectives. Through teamwork, students apply critical decision-making skills to improve quality, safety and care coordination.

NURS 641. Psychiatric Mental Health Practicum II. 4 Hours.

Semester course; 4 clinical hours (240 clinical contact hours). 4 credits (4 credits clinical). Prerequisites: NURS 597 and NURS 622, or permission of instructor. This course provides opportunities for students to expand on their competencies as a psychiatric mental health nurse practitioner student through faculty supervised practicum experiences with a preceptor. Students will provide high quality, safe, collaborative and ethical care. Graded as Satisfactory/Unsatisfactory.

NURS 642. Family Primary Care Practicum II. 4 Hours.

Semester course; 4 clinical hours (240 clinical contact hours). 4 credits (4 credits clinical). Prerequisites: NURS 595 and NURS 632. The course provides opportunities for students to expand on their competencies as a family nurse practitioner through precepted practicum experiences. Critical thinking and diagnostic reasoning are applied in the management of common and complex health conditions across the lifespan. Students will develop, implement and evaluate treatment plans. Students will provide high quality, safe, collaborative and ethical care. Performance of clinical skills at an intermediate level is expected. Graded as Satisfactory/Unsatisfactory.

NURS 643. Family Primary Care Practicum I. 6 Hours.

Semester course; 270 clinical/lab hours. 6 credits (6 credits clinical/lab). Prerequisites: NURS 629 and NURS 630; corequisite: NURS 644. This precepted practicum course is designed to provide opportunities for students to develop beginning competencies as a family nurse practitioner. Critical-thinking and diagnostic-reasoning skills will be developed. Skills of advanced health assessment and knowledge of the management of common health problems will be applied in the clinical setting. Students will order, conduct and interpret appropriate screening and diagnostic tests, generate differential diagnoses and, in conjunction with the preceptor, determine diagnosis and management plan. Students will demonstrate effective case presentations to preceptor and document appropriately. A minimum of 45 practicum hours (135 hours total) in women's health, geriatrics and pediatrics will be completed between the two practicum courses. Graded as pass/fail.

NURS 644. Family Primary Care Seminar. 1 Hour.

Semester course; 1 seminar hour (15 lecture hours). 1 credit. Corequisite: NURS 643. Seminars will emphasize skill development in the teaching-coaching function. A case-study approach will provide the basis for in-depth assessment and discussion of health and illness problems. Case analysis and discussion will enhance the student's ability to manage the health and illness status of patients and families over time. Graded as pass/fail.

NURS 645. Family Primary Care Practicum II. 6 Hours.

Semester course; 270 clinical/lab hours. 6 credits (6 credits clinical/lab). Prerequisites: NURS 643, NURS 644; corequisite: NURS 646. This practicum course serves as the culminating experience in the family nurse practitioner concentration focused on skill refinement with increasing responsibility in the delivery of primary care to families. Students will work with clinical preceptors to assimilate practice management skills pertaining to economics, reimbursement for services and time management. Primary care skills including prioritization, management and coordination of both routine and complex episodic and chronic illness problems and technology utilization are refined. Interdisciplinary collaborative practice skills are emphasized. Configuration of practicum hours will be based on results of individualized assessment and evaluation performed in NURS 644. A minimum of 45 practicum hours (135 hours total) in women's health, geriatrics and pediatrics will be completed between the two practicum courses. Graded P/F.

NURS 646. Family Primary Care Final Synthesis Seminar. 1 Hour.

Semester course; 1 seminar hour (15 lecture hours). 1 credit. Prerequisites: NURS 643, NURS 644; corequisite: NURS 645. This seminar is designed to facilitate the student's ability to integrate theory, research and clinical practice. An in-depth analysis of the evaluative, consultative, systems leadership and advocacy functions of the nurse practitioner role within a professional, ethical and legal framework will be performed. Students will complete an evidence-based clinical project that demonstrates synthesis of knowledge, as well as written, oral and critical-thinking skills. Graded P/F.

NURS 647. Nursing Informatics and Data Utilization. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 credits lecture). Enrollment is restricted to students admitted to the master's program in the School of Nursing. This course focuses on the use of informatics in nursing practice. Students will explore the implications of legal, ethical, professional and regulatory standards for data utilization in health care settings.

NURS 648. Emerging Trends in Nursing Leadership. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 credits lecture). Enrollment is restricted to students admitted to the master's program in the School of Nursing. This course introduces nursing leadership and management principles and emerging trends. Emphasis is placed on the development of leadership skills and behaviors in the context of systems-based care in diverse settings.

NURS 649. Senior Synthesis for Direct Entry Students. 5 Hours.

Semester course; 225 clinical hours. 5 credits (5 credits clinical). Prerequisites: NURS 550 and NURS 551, or permission of the course faculty. This immersive clinical course builds on the knowledge and skills gained throughout the program to prepare the student to transition to practice as a novice nurse generalist.

NURS 650. Transition to the Nursing Profession. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 credits lecture). Prerequisites: NURS 550 and NURS 551, or permission of the course faculty. This course integrates and synthesizes the skills, knowledge and perspectives gained throughout the program of study. Students will prepare for licensure and transition to practice as novice nurse generalists.

NURS 651. Decision Analysis for Quality Outcomes Across Populations. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course focuses on managerial decision-making and planning. The main focus is to introduce widely used methods that aid in decision-making and planning, including intuitive approaches, quantitative methods (samples and probabilities, decision trees, tradeoff analysis) and applied approaches to evaluate problems as well as progress toward solutions (assessing risk, root cause analysis, gap analysis and benchmarking). Each method uses real-world illustrations. Students will have the opportunity to use applied approaches to pose solutions to problems faced by nurse managers and leaders.

NURS 652. Health Care Managerial Finance I: For Nurse Leaders. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course provides introductory business financial management training. The course describes opportunities for improving a health system's fiscal efficiencies and delivery by providing practical approaches to budgeting, financial analysis and the management of financial resources. The course provides instruction on the development and analysis of financial spreadsheets. Financial accounting principles are reviewed. Conceptual and real-world issues will be addressed using tools to analyze nursing and health care organizational performance, costs, budgets and variance.

NURS 653. Health Care Managerial Finance II: Economic Evaluation and Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: NURS 651 and NURS 652. This course presents an overview of the macro and micro economy as an influencing factor on health care delivery presented in the context of ethical considerations and techniques that enhance efficiency. The course covers various cost-effectiveness analysis tools that enhance the ability of decision-makers to assess efficiencies and effectiveness. The main goal for students is to understand the parameters for using these techniques and how they are applied in nursing as well as in interdisciplinary approaches in health care settings.

NURS 656. Diagnosis and Management of Psychiatric Disorders Across the Lifespan. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Prerequisite: NURS 657. Students will develop advanced practice psychiatric-mental health nursing knowledge related to the psychodiagnostic, psychopharmacologic and psychotherapeutic evaluation/treatment of psychiatric disorders across the lifespan. This course focuses on the neurobiological basis of psychiatric disorders and associated evidence-based treatments. Addresses knowledge needed for comprehensive and collaborative management of culturally diverse clients with psychiatric disorders in both acute and primary health care settings.

NURS 657. Advanced Practice Psychiatric Mental Health Nursing: Theory and Practice Across the Lifespan. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Prerequisite: NURS 504. Focuses on advanced psychiatric mental health nursing practice by integrating theoretical, clinical and research knowledge related to psychotherapeutic management of acute and chronic mental health problems and psychiatric disorders. Examines knowledge of theories and psychotherapeutic techniques for individuals, families and groups across the lifespan. Analyzes interprofessional practice as applicable to the psychiatric mental health setting.

NURS 658. Family Primary Care Practicum III. 4 Hours.

Semester course; 4 clinical hours (240 clinical contact hours). 4 credits (4 credits clinical). Prerequisites: NURS 590 and NURS 642. This course is the culminating experience for the family nurse practitioner student and focuses on skill refinement with increasing responsibility in the delivery of primary care to families. Students work with clinical preceptors to assimilate advanced clinical decision-making and knowledge of the health system. Primary care skills including prioritization, treatment and coordination of both routine and complex episodic and chronic illnesses. Interdisciplinary collaborative practice skills are emphasized. Technology utilization is refined. Graded as Satisfactory/Unsatisfactory.

NURS 659. Psychiatric Mental Health Practicum III. 4 Hours.

Semester course; 4 clinic hours (240 clinical contact hours). 4 credits (4 credits clinical). Prerequisites: NURS 598, NURS 602 and NURS 641, or permission of instructor. This course is the culminating experience for the psychiatric mental health nurse practitioner student and focuses on skill refinement with increasing responsibility in the delivery of psychiatric care across the lifespan through precepted practicum experiences. Graded as Satisfactory/Unsatisfactory.

NURS 661. DNP Residency I: Mentored Practicum. 6 Hours.

Semester course; 6 clinical/lab hours (270 clinical hours). 6 credits. Prerequisites: NURS 603 or NURS 608; and NURS 665. Enrollment is restricted to students in the D.N.P. program. This practicum provides the opportunity for students to lead change; refine their use of evidence to inform practice; and influence clinical and organizational outcomes that advance the well-being of populations. Students refine their competencies to prepare for practice roles commensurate with health system needs. Graded as Satisfactory/Unsatisfactory.

NURS 662. Care of the Adult-Gerontology Population in the Critical Care Setting. 4 Hours.

Semester course; 3.5 lecture and .5 laboratory hours (20 laboratory contact hours). 4 credits (3.5 credits lecture and .5 credits laboratory). Prerequisites: NURS 580 and NURS 619. This course addresses the diagnosis and management of selected common health and illness changes encountered in the adolescent through geriatric population in critical care settings. Students will increase their knowledge about the management of common critical illnesses encountered in the adult critical care environment.

NURS 663. DNP Residency II: Mentored Practicum. 6 Hours.

Semester course; 6 clinical/lab hours (270 clinical hours). 6 credits. Prerequisite: NURS 661. Enrollment is restricted to students in the D.N.P. program. This practicum provides the opportunity for students to lead change, translate evidence into practice, and influence clinical and organizational outcomes that advance the well-being of populations. Students refine their competencies to prepare for practice roles commensurate with health system needs. The capstone of the experience is for students to complete a scholarly project that culminates in meeting program objectives. Graded as Satisfactory/Unsatisfactory.

NURS 664. DNP Residency: Mentored Practicum. 1-6 Hours.

Semester course; 1-6 clinical/lab hours (45-270 clinical hours; delivered online). 1-6 credits. May be repeated for a maximum total of 18 credits. Prerequisites: NURS 605 and NURS 608; 500 clinical practice hours. Mentored study that facilitates student demonstration of DNP competencies through documented learning experiences and implementation of the DNP project. Practice setting and focus of residency hours are individualized to student's specific area of interest. Residency activities will be mutually developed by the student and faculty adviser, culminating in a professional portfolio that demonstrates achievement of all course objectives by the completion of the 12 required residency credits. Graded as Satisfactory/Unsatisfactory.

NURS 665. DNP Project I: Proposal Development. 3 Hours.

Semester course; 3 lecture/seminar hours (delivered online). 3 credits. Prerequisites: NURS 605, NURS 606, NURS 607 and NURS 608.

Provides the student with the support and direction needed to develop a comprehensive DNP project proposal. The DNP project is designed to improve quality and/or safety patient outcomes. Students use evidence-based practice to design the DNP project that is focused in a specialized clinical area. Students work in collaboration with their faculty adviser and DNP project team.

NURS 666. Strategic and Change Management for Quality Outcomes for Nurse Leaders. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: NURS 613. This course introduces strategic management principles, models and tools useful for implementing sustainable organizational change. Students will be able to align organizational and nursing-specific mission, vision and goals setting a strategic direction. Students gain applied practice in select strategic and change-management processes in real-world nursing contexts and discuss how these processes optimize or hinder quality patient care outcomes. Finally the course explores factors that facilitate sustaining a strategic direction and how sustainability builds markers of superior performance and quality.

NURS 668. Human Resource and Customer Relationship Management for Nurse Leaders. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: NURS 508 and NURS 609. Corequisite: NURS 613. This course examines the role of human resource management in health care and nursing organizations in meeting the challenge of continually improving patient care services. Students will gain an understanding about strategies useful to empower, motivate, hire and retain nursing talent. The course discusses topics in HR management appropriate for nurse leaders and frontline managers such as nursing workforce training, competencies, performance appraisals, recruitment and retention, and progressive disciplinary approaches. HR concepts about workforce capabilities and employee satisfaction will be discussed in relation to their association with patient satisfaction and health care delivery outcomes.

NURS 669. Adult-Gerontology Acute Care Practicum II. 4 Hours.

Semester course; 4 clinical hours (240 clinical contact hours). 4 credits (4 credits clinical). Prerequisite: NURS 581. This course focuses on acute care management of adolescents through geriatric population with complex acute, critical and chronic health conditions with particular emphasis on integrating health promotion, disease prevention and risk-reduction strategies through precepted clinical experiences. Graded as Satisfactory/Unsatisfactory.

NURS 675. Adult-Gerontology Primary Care Practicum II. 4 Hours.

Semester course; 4 clinical hours (240 clinical contact hours). 4 credits (4 credits clinical). Prerequisite: NURS 596. Focuses on primary care management of the adolescent through geriatric population throughout the wellness-illness spectrum with particular attention on integrating health maintenance and risk-reduction interventions for patients with comorbidities. Building on previous practicum experience, students implement health screening, health promotion and risk-reduction strategies for this population within the context of their current health issues and comorbidities. Provides opportunities to develop and carry out the plan of care incorporating evidence-based practice guidelines to improve patient outcomes. Graded pass/fail.

NURS 676. Adult-Gerontology Primary Care Practicum I. 1-3 Hours.

Semester course; 45-135 clinical hours. 1-3 credits (1-3 credits clinical practicum). Prerequisite: NURS 511. Focuses on providing primary care management of adolescent-older adults across the wellness-illness continuum through faculty-supervised clinical experiences with a preceptor. Provides opportunities to focus on the differing and unique developmental, life stage needs that impact a patient's care across the adult age spectrum and application of evidence-based strategies in directing health promotion, health protection, disease prevention and primary care management of injuries and disease. Students must demonstrate ability to synthesize theoretical, scientific and contemporary clinical knowledge for the assessment and management of both health and illness states and apply knowledge within the framework of different practice models and populations. Performance at a basic level is expected. Graded as pass/fail.

NURS 677. Adult-Gerontology Primary Care Practicum III. 5 Hours.

Semester course; 255 clinical hours. 5 credits (5 credits clinical practicum). Prerequisite: NURS 675. Focuses on advanced primary care management of adolescent-older adults with complex health issues and comorbidities through faculty-supervised clinical experiences with a preceptor. Building on previous practicum experience, students implement and evaluate health screening, health promotion, health protection, disease prevention, risk-reduction strategies and systems-based coordination in the management of adults-older adults with complex health conditions. Provides opportunities for leadership within the interprofessional health care team to direct quality improvement methods, implementation of evidence-based practice guidelines to address a clinical problem and evaluation of patient and systems-based outcomes. As the final practica course, performance at the advanced level is expected. Graded as pass/fail.

NURS 678. Adult-Gerontology Acute Care Practicum I. 1-3 Hours.

Semester course; 45-135 clinical hours. 1-3 credits (1-3 credits clinical practicum). Prerequisite: NURS 511. Focuses on providing acute care management of adolescent-older adults who are physiologically unstable, technologically dependent and highly vulnerable to complications through faculty-supervised clinical experiences with a preceptor. Provides opportunities to focus on the provision of a spectrum of care ranging from disease prevention to acute and critical care management. Students must synthesize theoretical, scientific and contemporary clinical knowledge for the assessment and management of both health and illness states and apply knowledge within the framework of different practice models and differing populations. Performance at a basic level is expected. Graded as pass/fail.

NURS 679. Adult-Gerontology Acute Care Practicum III. 5 Hours.

Semester course; 225 clinical hours. 5 credits (5 credits clinical practicum). Prerequisite: NURS 669. Focuses on advanced acute, critical and chronic management of adolescent-older adults who are physiologically unstable, technologically dependent and highly vulnerable to complications through faculty-supervised clinical experiences with a preceptor. Building on previous practicum experience, students integrate health screening, promotion, protection and disease-prevention interventions; safety principles; risk-reduction strategies; and systems-based coordination in the management of adults-older adults with complex acute, critical and chronic injuries and illnesses throughout the trajectory of resuscitation, stabilization and rehabilitation. Provides opportunities for leadership within the interprofessional health care team to direct quality improvement methods, implementation of evidence-based practice guidelines to address a clinical problem and evaluation of patient and systems-based outcomes. As the final practica course, performance at the advanced level is expected. Graded as pass/fail.

NURS 688. Adult-Gerontology Primary Care Practicum III. 4 Hours.

Semester course; 4 clinical hours (240 clinical contact hours). 4 credits (4 credits clinical). Prerequisite: NURS 675. Focuses on advanced primary care management of adolescent, adult and geriatric individuals with complex health issues and comorbidities through supervised clinical experiences. As the final practicum course, students implement and evaluate health screening, health promotion, health protection, disease prevention, risk-reduction strategies and systems-based coordination in care management. Provides opportunities to lead within the interprofessional health care team, direct quality improvement methods, implement evidence-based strategies to address clinical problems and evaluate patient and systems-based outcomes. Graded as pass/fail.

NURS 689. Adult-Gerontology Acute Care Practicum III. 4 Hours.

Semester course; 4 clinical hours (240 clinical contact hours). 4 credits (4 credits clinical). Prerequisite: NURS 669. This course focuses on advanced management of the adolescent through geriatric population with acute, critical or chronic conditions. Students work with clinical preceptors to assimilate advanced clinical decision-making and knowledge of the health system. Acute care skills including prioritization, treatment and coordination of both acute complex episodic and chronic illnesses. Interdisciplinary collaborative practice skills are emphasized. Technology utilization is refined. Graded as Satisfactory/Unsatisfactory.

NURS 695. Managing for Performance and Health Care Outcomes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: NURS 508 and NURS 512. This course synthesizes organizational systems approaches to design, identify, analyze and benchmark quality and safety initiatives in health care settings across the continuum. Students will gain an overview of how evidence drives decisions about and implementation of processes in organization performance improvement. Students will also apply principles in quality and safety project design to address a specific issue affecting patient care outcomes.

NURS 696. Practicum I: Comparative Health Care Delivery Systems for Nurse Leaders. 2 Hours.

Semester course; 90 clinical/lab hours. 2 credits. Prerequisites: NURS 609, NURS 613 and NURS 614. This practicum experience is designed to integrate theory with the reality of various organizational contexts impacting health care delivery systems, nursing systems and leadership. The overall purpose is to provide students with opportunities to compare how different systems influence nursing practice and nursing leadership. The practicum is designed with three separate units to give students opportunities to compare different health care settings, which may include local, regional, national and international contexts. Graded Pass/Fail.

NURS 697. Practicum II: Comparative Interdisciplinary Health Care Leadership Roles. 1 Hour.

Semester course; 45 clinical/lab hours. 1 credit. Prerequisite: NURS 696. In this course the student applies principles of professional inquiry and discovery to engage in dialogue with nurse leaders as well as interdisciplinary professional managers and leaders in ambulatory care settings. Students will also gain applied experience in ancillary department settings central to health care delivery that are important in maintaining organizational system efficiency and effectiveness but generally are outside the domain of nursing-directed patient care. Ancillary department experiences may take place in ambulatory or inpatient settings. Graded Pass/Fail.

NURS 698. Practicum III: Applied Integrative Health Care Delivery Leadership. 3 Hours.

Semester course; 135 clinical/lab hours. 3 credits. Prerequisite: NURS 697. In this course the student applies a broad range of managerial knowledge, skills and multidisciplinary theoretical constructs, e.g., nursing, business, organizational systems, organizational behavior, strategy and change management. Students will complete a formal organizational-level gap analysis and communicate formally and informally to others in the organization about a strategic and change-management plan to address the nursing issue(s) examined in the gap analysis. Students will gain guided experience from a nurse leader about management roles, the organizational perspective on strategic and change initiatives and implementation techniques. Graded Pass/Fail.

NURS 700. Scientific Integrity: Responsible Conduct of Research. 1 Hour.

Semester course; 1 lecture hour (delivered online). 1 credit. Enrollment is restricted to students admitted to a doctoral program. This course is intended for students to develop and refine their understanding of and skills in applying ethics and law of research, with a focus on the National Institute of Health's Office for Human Research Protections' responsible conduct of research topics.

NURS 701. Statistical Methods for Nursing Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Provides knowledge about data management, basic statistical tests, graphics and tables, and necessary software. Presents statistical tests: contingency table analysis, one- and two-sample t-tests, one- and two-factor analysis of variance, simple linear regression, multiple linear regression, and analysis of covariance. Defines selected statistical terminology and concepts. Uses data from relevant studies to illustrate various statistical tests and corresponding assumptions.

NURS 702. Advanced Statistical Concepts for Nursing Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisites: NURS 701. Presents advanced statistical methods and necessary statistical assumptions. Explains optimal modeling approaches for different data types and study designs. Data types: binary data, ordinal data, multinomial data, time-to-event data, longitudinal data, hierarchical data and multivariate data. Analytic methods discussed will include nominal, ordinal and multinomial logistic regression, Kaplan-Meier estimation, Cox proportional hazards model, mixed effects models, factor analysis, principal components, canonical correlation, classification and clustering.

NURS 703. Philosophy of Human Sciences. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisite: admission to the doctoral program in nursing. Critically analyzes philosophic perspectives and their relationship to human sciences; emphasizes analysis of the underlying epistemology and ontological assumptions of various philosophies. Explores philosophies of science and their influence on the emergence of knowledge in the human sciences, using nursing science as an example.

NURS 704. Analysis and Construction of Theory for Nursing Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisite: NURS 703. This course focuses on analysis and critique of theoretical and conceptual foundations of research and the development process associated with constructing nursing disciplinary knowledge. Emphasis is placed on the processes for concept and theory development within the context of a research trajectory relevant to the discipline.

NURS 706. Teaching in the Health Professions: Surviving and Thriving in Academia. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 credits lecture). This course examines the transition from health professions clinician to educator and introduces the multiple dimensions of the educator role. Practical information is presented for orienting to the academic environment and thriving in an academic career. Professional, legal and ethical principles associated with higher education are explored.

NURS 707. Scholarly Writing. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to graduate students or by permission of the instructor. This foundational course is designed to strengthen the ability of health sciences scholars to engage in effective writing through an emphasis on logical thinking as a critical element in the development and dissemination of knowledge. Learning experiences using online technologies will facilitate scholarly learning.

NURS 711. Conducting Mixed Methods Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits (3 credits lecture). Prerequisites: NURS 770 and NURS 772. Enrollment is restricted to students admitted to a doctoral program or with permission of the instructor. This course will cover the use of mixed methods to address complex research questions in nursing and health care. This course focuses on foundational issues, including the history of mixed methods, variations in the definition of mixed methods research, mixed methods research designs and the different paradigmatic foundations of mixed methods research. Problems of trying to merge methods and practical strategies for accomplishing this successfully, as well as paradigmatic issues, will be discussed.

NURS 712. Conducting Rigorous Health-related Intervention Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits (3 credits lecture). Enrollment is restricted to students admitted to a doctoral program or with permission of the instructor. This course provides an in-depth examination of theoretical and methodological issues in the conduct of rigorous intervention research (e.g., clinical trials with human subjects, systems-level interventions, complex interventions). It focuses on specific aspects of the design, development, implementation and evaluation of health-related interventions across the continuum of study designs/ phases. Students explore translational frameworks, hypothetical models and the state of the science to guide the rigorous design and testing of interventions in order to address specific research questions.

NURS 720. Foundations of Biobehavioral Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisite: NURS 704 or permission of instructor. This course provides a foundation for critically examining and developing research frameworks and models used to conduct biobehavioral research. The course explores assumptions about the dimensions, interactions and outcomes of biology and behavior from basic science through interventional approaches. This course discusses current applications of biobehavioral research including translational research to improve nursing practice and clinical outcomes.

NURS 721. Advanced Concepts in Biobehavioral Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisite: NURS 720 or permission of instructor. This course focuses on applying concepts and measures used in biobehavioral research. It also discusses biobehavioral research priority areas, current methods and data sources. In addition, students will evaluate the types of measures used in biobehavioral research and relate these to their own focus areas. Students will apply their knowledge from the prerequisite course to develop a research proposal incorporating a research framework, concepts and measures, and methods used in biobehavioral research.

NURS 725. Synthesis and Emerging Trends in Scientific Inquiry. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisite: NURS 720 and NURS 721, or NURS 731 and NURS 732, or permission of instructor. This course explores emerging trends in different areas of scientific inquiry to help students develop their understanding of the current and evolving research environment. Designed to synthesize the current state of the science and apply it to the student's area of research. In addition, the student will apply approaches to incorporating emerging trends into an individualized research program and strategic career development.

NURS 731. Foundations in Health Care Quality Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisite: NURS 704 or permission of instructor. This course provides a foundation for critically examining and developing research frameworks and models used to conduct health care quality of research. The course explores assumptions about health care quality, its dimensions and outcomes at the individual, organizational and population levels. Different approaches to health care quality research will be discussed. Finally, current applications of quality research to policy, health system accountability and various levels of the provision of health care are reviewed.

NURS 732. Advanced Concepts in Health Care Quality Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisite: NURS 731 or permission of instructor. This course focuses on applying concepts and measures used in quality health services research. It also discusses health care quality research priority areas, current quality and safety measures, and data sources. In addition, students will evaluate the types of quality and safety measures used in health care quality research and relate these to their focus areas. Students will apply their knowledge from the prerequisite course to develop a research proposal incorporating a research framework, concepts and measures, and methods used in health care quality research.

NURS 768. Teaching and Learning in the Nursing Discipline. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students admitted to a nursing or health sciences doctoral program. An exploration of human learning and methods to support instruction and learning among nursing students. Examines the application of a variety of teaching strategies applied in didactic, laboratory and clinical settings, including competency-based approaches. Also provides a summary of course management (planning, implementation and delivery) in higher education settings.

NURS 770. Quantitative Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisites: NURS 701 or permission of instructor; corequisite: NURS 702. This course provides knowledge and skills for identifying and selecting appropriate designs for quantitative health care research. The course analyzes major groups of research designs for fit with various types of research questions. This course examines strengths and weaknesses of the groups of research designs. Focuses on elements of research design that enhance rigor.

NURS 772. Qualitative Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. This course provides knowledge and skills for the design and implementation of qualitative health research and the management and analysis of qualitative data. The course analyzes various research designs for ability to generate scientifically rigorous findings related to nursing or health care. This course explores current challenges, debates and controversies in qualitative research.

NURS 787. Curriculum Development in Nursing Education. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students admitted to a nursing or health sciences doctoral program. Explores common curriculum frameworks and models used in nursing education. Examines the curriculum life cycle (design, evaluation and revision) with an awareness of internal and external forces – including standards – that influence the work. The role of faculty within the curriculum process is emphasized. Practical application is correlated with concepts presented.

NURS 789. Assessment and Evaluation of Learning: A Nursing Education Perspective. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students admitted to a nursing or health sciences doctoral program. Explores principles and methods used by nurse educators to assess and evaluate student learning. Use of established evaluation tools, such as rubrics and evaluation guides, is emphasized. The role of faculty in assessment and evaluation is highlighted, as well as the interconnection with the program development process.

NURS 791. Special Topics. 3-6 Hours.

Semester course; 3-6 lecture hours. 3-6 credits. May be repeated. Enrollment requires permission of the instructor. Explores specific topics related to the health sciences.

NURS 792. Directed Research Inquiry. 1-6 Hours.

Semester course; variable hours. 1-6 credits. Course may be repeated. A minimum of 3 credits is required as a substitute for a required focus of inquiry course. A maximum of 6 credits is allowed per semester. Prerequisite: admission to doctoral program in nursing and permission of the instructor. Provides a mentored independent study in a selected theoretical or conceptual area of inquiry within the context of a student's research focus. The purpose of this course is to increase the student's knowledge in a selected theoretical or conceptual area. This directed study will be developed under the supervision of a member of the graduate faculty. Graded as P/F.

NURS 796. Directed Research Experience. 1-9 Hours.

Semester course; variable hours. 1-9 credits. A minimum of 2 credits is required by the completion of course work. Prerequisite: admission to the doctoral program in nursing and permission of the instructor. Provides a mentored research experience in areas of faculty research expertise. The purpose of this course is to increase the student's exposure to and involvement in research under the direction of a graduate faculty member who is actively engaged in a research project. This mentored research experience will be developed under the supervision of a member of the graduate faculty. May be taken in the semester(s) the student is preparing for the comprehensive exam and for dissertation preparation prior to admission to candidacy. Graded as P/F.

NURS 797. Practicum in Nursing Research. 1-3 Hours.

Semester course; 1-3 practicum hours (45-135 clinical/lab hours; delivered online). 1-3 credits (1-3 clinical lab credits). May be repeated. Prerequisite: NURS 700 or permission of instructor. Enrollment is restricted to students admitted to a doctoral program and by permission of instructor. This course focuses on the development of skills and techniques for the conduct of research through active participation in either an ongoing faculty research project or an element of the student's research area. The practicum is structured individually through discussion with the supervising faculty member. Emphasis is on the practical application of research skills and growth in knowledge related to the conduct of research. Graded as Pass/Fail.

NURS 898. Dissertation. 1-13 Hours.

Semester course; 1-13 dissertation hours (delivered online). 1-13 credits. Enrollment restricted to students who have been admitted to candidacy. A minimum of 13 credits is required. Original research conducted under the supervision of an adviser and in conjunction with a dissertation committee. Graded as satisfactory/unsatisfactory.

School of Pharmacy

Medicinal Chemistry (MEDC)

MEDC 526. Research Techniques in Medicinal Chemistry. 1-4 Hours.

Semester course; 0-2 lecture and 2-8 laboratory hours. 1-4 credits. The theory and application of classical, instrumental, and computer techniques used in medicinal chemistry research are presented.

MEDC 527. Basic Pharmaceutical Principles for the Practicing Pharmacist. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines basic science principles in organic chemistry and biological chemistry as specifically related to the pharmaceutical treatment of disease.

MEDC 530. Bioinformatics and Genomics in Drug Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the basic elements of cellular pathways and drug interactions, and how modern genomics comes into play. Presents bioinformatics principles being used every day in data-intensive fields of research. Introductory and concept-oriented, the course will prepare students for grasping how bioinformatics is being used in many areas of biomedical sciences. Geared toward students coming from a variety of backgrounds in biology, biochemistry and chemistry. While many of the analytical approaches are statistical in nature, there is no requirement for a background in statistics or mathematics. Each student will have the opportunity to design a small project applying bioinformatics concepts. Crosslisted as: BNFO 530.

MEDC 532. Medicinal Chemistry for Nurse Anesthetists. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A review of the principles of organic chemistry and bio-organic chemistry presented as a series of lectures covering the structure-activity relationships, metabolism, and mechanism of action of selected agents.

MEDC 533. Pharmacognosy. 1-2 Hours.

Semester course; 1-2 lecture hour. 1-2 credits. Introduces the basic concepts of crude drugs, semi-purified and purified natural products and the basics of the regulation of herbal products. Important types of natural products and their impact on the modern medical sciences, and the evaluation of alternative and complementary medicine purity and bioavailability will be discussed.

MEDC 541. Survey of Molecular Modeling Methods. 1 Hour.

Semester course; lecture and laboratory hour. 1 credit. Introduces computational chemistry and molecular graphics with the current software used for drug design and small molecule/large molecule interactions. Computational chemistry problems will be emphasized in the laboratory.

MEDC 542. Biotechnology-derived Therapeutic Agents. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Provides the fundamentals of biotechnology-derived biological agents including structure, manufacture, stability, analysis, formulation and usage. Selected examples of biological agents in current and future therapy may also be covered.

MEDC 553. Concepts in the Medicinal Chemistry of Therapeutics Agents. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Introduces topics in medicinal chemistry common to all drug classes, including structure activity relationships, principles of drug action, drug design and drug metabolism. Drugs acting on the autonomic nervous system are presented as a case study illustrating applications of the general principles.

MEDC 555. Fundamentals of Drug Discovery I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Students will work individually or in groups to learn the fundamentals of medicinal chemistry and drug discovery. The course utilizes formal lectures, informal group discussions, literature research and formal oral and/or written assignments to impart knowledge and practice of drug discovery. The course focus will be on molecular biology and pharmacological aspects of medicinal chemistry.

MEDC 556. Fundamentals of Drug Discovery II. 3.5 Hours.

Semester course; 3.5 lecture hours. 3.5 credits. Students will work individually or in groups to learn the fundamentals of medicinal chemistry and drug discovery. The course utilizes formal lectures, informal group discussions, literature research and formal oral and/or written assignment to impart knowledge and practice of drug discovery. The course focus will be on methodologies and techniques of medicinal chemistry.

MEDC 591. Special Topics in Medicinal Chemistry. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. A course in which students may choose to participate in individual or group study in one or more areas of medicinal chemistry. The course can take the form of formal lectures, informal group discussions, literature research and/or laboratory research. Students must have the permission of the individual instructor before registering for this course.

MEDC 601. Advanced Medicinal Chemistry I. 2.5 Hours.

Semester course; 2.5 lecture hours. 2.5 credits. This course is designed to expose graduate students to the history and practice of medicinal chemistry with an emphasis on drug development, design, structure-activity relationship studies and their association with diseases to prepare students for future work in academia or industry.

MEDC 609. Advanced Organic Synthesis: A Target-oriented Approach. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. A study of chemical transformations in organic chemistry, their mechanisms and their application to the synthesis of complex target molecules.

MEDC 610. Advanced Medicinal Chemistry II. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: MEDC 601 or permission of instructor. Introduces concepts for understanding the medicinal chemistry of the central nervous system.

MEDC 614. Research Techniques. 1-4 Hours.

Semester course; variable hours. Variable credit. Credit will be given on the basis of 1 credit per 45 hours of laboratory time. Prerequisite: approval of research adviser. Provides new graduate student with the laboratory skills necessary to perform research in the chosen discipline. The training time required will depend upon the discipline. Graded as pass/fail. Crosslisted as: PCEU 614/PHAR 614.

MEDC 620. Advanced Medicinal Chemistry III. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: MEDC 601 or the permission of the instructor. Reviews the concepts necessary for enzyme inhibitor design. Emphasizes the design of new agents to treat disease states by enzyme inhibition.

MEDC 630. Theoretical Methods in Drug Design. 2 Hours.

Semester course; lecture and laboratory hours. 2 credits. Prerequisites: MEDC 601, MEDC 610 or MEDC 620, or permission of instructor. A study of the theoretical methods of drug structure-activity analysis, including molecular orbital theory, topological indexes and physical property correlations. Computational chemistry problems will be emphasized in the laboratory.

MEDC 642. Nucleoside, Nucleotide, Carbohydrate and Peptide Chemistry. 3 Hours.

Semester course; 1 lecture hour. 1 credit. Surveys nucleoside, nucleotide, carbohydrate and peptide chemistry with emphasis on their synthesis.

MEDC 643. Regioselective Drug Metabolism. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Surveys drug biotransformation reactions. Emphasizes the molecular aspects of Phase I and Phase II drug metabolism.

MEDC 644. Asymmetric Synthesis. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Reviews the major asymmetric chemical transformations, including mechanisms, scope and synthetic utility.

MEDC 645. Introduction to Heterocyclic Chemistry. 3 Hours.

Semester course; 1 lecture hour. 1 credit. Introduces the chemistry of heterocyclic compounds. Emphasizes heterocyclic nomenclature and the reactions/reactivity of heterocyclic systems.

MEDC 670. Advanced Molecular Modeling Theory and Practice. 3 Hours.

Semester course; 3 lecture/laboratory hours. 3 credits. Prerequisite: MEDC 641 or permission of instructor. Examines the principles and application of computational chemistry and molecular graphics to current problems in drug design. Lectures focus on the application of specific computational methods and techniques to solve problems in drug/molecular design. Workshop sessions provide hands-on experience using state-of-the-art hardware and software for molecular modeling.

MEDC 690. Departmental Research Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Reports presented by students, staff and visiting lecturers, current problems and developments in pharmaceutical and medicinal chemistry are discussed. Graded as PR in first semester of enrollment, with a letter grade assigned in the following semester.

MEDC 691. Special Topics in Medicinal Chemistry. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. Lectures, tutorial studies, and/or library assignments in selected areas of advanced study not available in other courses or as a part of the research training.

MEDC 697. Directed Research in Medicinal Chemistry. 1-15 Hours.

Semester course; 1-15 credits. Research leading to the M.S. or Ph.D. degree.

Pharmaceutical Engineering and Science (PESC)

PESC 505. Pharmaceutical Engineering Fundamentals I. 3 Hours.

Semester course; 3 lecture hours (delivered face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program or with permission of the instructor. This is an introductory course designed to expose students to basic concepts in drug discovery as well as principles in pharmaceutics, biopharmaceutics and pharmacokinetics that are fundamental to the development of various dosage forms. Topics to be covered include a general survey from drug discovery to clinical trials; omics-guided drug target identification and strategies for the design of new drugs; the physicochemical characteristics of drugs and excipients; formulation, manufacturing and packaging of pharmaceutical dosage forms; drug and dosage form stability and degradation; physicochemical mechanisms of drug absorption, distribution, metabolism and elimination; and mathematical models and physiological principles used to describe ADME. Prior basic knowledge (B.S.-level) in physical-chemistry, calculus and statistics is required. The course content is delivered through lectures, group discussions, in-class calculations, homework and online tools.

PESC 507. Pharmaceutical Engineering Fundamentals II. 3 Hours.

Semester course; 3 lecture hours (delivered face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program or with permission of the instructor. This is an introductory course designed to expose the students to basic concepts in materials balance, thermodynamics, reaction kinetics and transport processes applied to pharmaceutical processes. Students will be exposed to common problem-solving strategies common to pharmaceutical engineering problems and various tools (software) used to enhance their ability to solve these problems. These introductory steps will provide students with the required tools to address phase equilibrium problems based on a thermodynamic framework; tools to design reaction systems for the production of active pharmaceutical ingredients; and fundamental transport properties for the design systems for the purification and separation of active pharmaceutical ingredients.

PESC 515. Nanomedicine. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in pharmaceutical engineering or with permission of the instructor. This is an introductory course designed to expose students to basic concepts in nanomedicine. Topics to be covered include: introduction to nanocarrier-based drug delivery applications; design of nanocarriers for drug delivery applications; characterization of nanocarriers, including their spatial/temporal controlled-release properties and critical quality attributes; interaction of nanocarriers and the physiological environment; nanocarriers and their dosage forms; nanocarriers for pulmonary drug delivery; nanocarriers for ocular drug delivery; nanocarriers for systemic and lymphatic drug delivery; liposomal drug products; FDA guidance to industry.

PESC 605. Advanced Topics in Pharmaceutical Engineering I. 3 Hours.

Semester course; 3 lecture hours (delivered face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program or with permission of the instructor. This is an advanced course in pharmaceutical engineering covering relevant multidisciplinary topics that straddle the boundaries between pharmaceutics and engineering. Topics include process analytical technology (PAT, situ analytical tools) with a focus on analytical techniques, including particle size analysis, and IR and other in situ spectroscopic techniques; particle solid state characterization, with a focus on methods for characterization/quantification of polymorphs, crystallinity/amorphous ratio, size and size distribution, flowability; modeling, with a focus on modeling of pharmacokinetics, aerosol properties and omics; separations, with a focus on hardware and regulatory, including LC-MS, quality control; and advanced formulations, with a focus on nanomedicine, physiological barriers and sustained release.

PESC 607. Advanced Topics in Pharmaceutical Engineering II. 3 Hours.

Semester course; 3 lecture hours (delivered face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program or with permission of the instructor. This is an advanced course in pharmaceutical engineering covering relevant multidisciplinary topics that straddle the boundaries between pharmaceutics and engineering. Topics include process analytical technology (PAT, situ analytical tools) with a focus on data processing, including data analysis, data visualization and big data; particle formation and size control, with a focus on fundamentals of crystallization, size control operations and control of particle morphology; modeling, with a focus on fundamentals of chemical kinetics, crystallization and formulation processing; separations, with a focus on theory, including analytical, membrane separation and large-scale biosynthesis; advanced formulations, with a focus on engineering materials for the pharmaceutical industry, processing dosage forms for sustained release and transport properties across physiological barriers.

PESC 609. Pharmaceutical Engineering Laboratory I. 1 Hour.

Semester course; 3 laboratory hours. 1 credit. Didactic laboratory in pharmaceutical engineering. Laboratory experiments will be focused on three major themes based on the following routes of administration: pulmonary drug delivery (metered-dose and dry powder inhalers); oral drug delivery (tablets and capsules); parenteral drug delivery (sterile parenteral formulations). Experiments performed will focus on drug discovery, active pharmaceutical ingredient characterization and API pre-formulation; they will provide the platform for product formulation manufacturing in more open-ended experiments to be carried out on the same themes in subsequent courses. In situ analytical tools (process analytical technology) will be used in the laboratory experiments as appropriate.

PESC 690. Pharmaceutical Engineering Seminar. 0.5 Hours.

Semester course; .5 seminar hours (delivered face-to-face or hybrid). .5 credits. May be repeated for credit. Enrollment is restricted to students in the pharmaceutical engineering Ph.D. program or with permission of the instructor. This course will provide students an opportunity to develop their scientific seminar preparation and oral presentation skills, a forum for discussion of student research, and a mechanism to expose faculty and students to cutting-edge research in pharmaceutical engineering. Feedback from the seminar audience will be provided through discussions, question-and-answer sessions and an evaluation form so the student may benefit from the ideas and experience of the audience.

PESC 691. Special Topics in Pharmaceutical Engineering. 1-5 Hours.

Semester course; 1-5 lecture hours (delivered face-to-face or hybrid). 1-5 credits. Presentation of subject matter is by lectures, tutorial studies and/or library assignments in selected areas of advanced study not available in other courses or as part of the training in research. Graded as Pass/Fail.

PESC 697. Directed Research in Pharmaceutical Engineering. 1-15 Hours.

Semester course; 1-15 laboratory hours. 1-15 credits. May be repeated for credit. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program. Research leading to the Ph.D. in Pharmaceutical Engineering. Graded as Satisfactory/Unsatisfactory.

PESC 701. Post-candidacy Doctoral Research. 9 Hours.

Semester course; 9 research hours. 9 credits. May be repeated for credit. Enrollment is restricted to students who have been admitted to doctoral candidacy in the pharmaceutical engineering program and are graduate teaching assistants or graduate research assistants; registration requires approval from the student's current degree program coordinator. Students will participate in supervised discipline-specific research related to their dissertation topic. This course can be approved as a substitution for any post-candidacy degree requirement. Graded as Satisfactory/Unsatisfactory.

PESC 707. Process Analytical Technology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: Basic chemistry/instrumentation lab skills, basic statistics/programming. Enrollment is restricted to students in Ph.D. in Pharmaceutical Engineering. Students should have basic chemistry/instrumentation lab skills and be familiar with basic statistics/programming. Familiarizes students with process analytical instrumentation commonly used in industrial R&D and manufacturing for process monitoring and development and product quality control. Students will gain practical lab experience of important process analytical technology and develop a better understanding of technology principles and new perspectives on data collection, data comprehension and data analysis.

PESC 709. Pharmaceutical Engineering Laboratory II. 1 Hour.

Semester course; 1 laboratory hour. 1 credit. Prerequisite: PESC 609. Corequisites: PESC 605 and PESC 607. Enrollment is restricted to students in the Ph.D. in Pharmaceutical Engineering program or with permission of the instructor. This course is the second in a sequence. Didactic laboratory in pharmaceutical engineering. Laboratory experiments will be focused on formulation development and characterization/testing in the three major themes based on the following routes of administration: pulmonary drug delivery (metered-dose and dry powder inhalers); oral drug delivery (tablets and capsules); parenteral drug delivery (sterile parenteral formulations).

Pharmaceutical Sciences (PSCI)**PSCI 607. Introduction to Pharmaceutical Sciences From Bench to Shelf. 2 Hours.**

Yearlong course; 2 lecture hours. 2 credits. The purpose of this course is to familiarize students with the interdisciplinary nature of drug discovery and development, to acquaint them with where their research fits into the bigger drug discovery and development picture and to promote interdisciplinary discussions between the students and faculty. Current scientific, regulatory and health care trends impacting drug discovery, development and use will be discussed. Students will be introduced to current topics in the pharmaceutical sciences such as drug target selection, drug design, discovery and development, the drug approval process and regulatory sciences, product optimization, production, and marketing. Graded as CO in the fall semester with a letter grade and credits awarded in the spring.

PSCI 610. Frontiers of Pharmaceutical Research. 2 Hours.

Semester course; 2 lecture hours. 2 credits. May be repeated for a maximum of eight credits. This is a student-centered training course of scientific presentation and discussion for students using frontier research in pharmaceutical sciences. Students will present research data and/or literature and lead discussions among peer graduate students and faculty. Faculty may take a leading role in some of the classes. Students will also actively participate in small-group discussions led by peer graduate students and faculty.

PSCI 614. Research Techniques. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. This course provides new graduate students with the skill set necessary to perform research in their discipline within pharmaceutical sciences. The course will use a combination of lectures, assignments, one-on-one training, laboratory and/or group discussion.

PSCI 690. Seminars in the Pharmaceutical Sciences. 1 Hour.

Semester course; 1 seminar hour. 1 credit. Enrollment is restricted to graduate students in the pharmaceutical sciences programs. The goal for the seminar series is to provide students an opportunity for self-learning. The course will familiarize students with topics of current research interest within the pharmaceutical sciences and related biological sciences, as well as expose students to nationally and internationally renowned scientists.

PSCI 691. Special Topics in Pharmaceutical Sciences I. 0.5-5 Hours.

Semester course. 0.5-5 lecture hours. 0.5-5 credits. Subject matter is presented by lecture, tutorial studies and/or library assignments in selected areas of advanced study not available in other courses or as part of the research training. Graded S/U/F.

PSCI 692. Special Topics in Pharmaceutical Sciences II. 0.5-5 Hours.

Semester course; 0.5-5 lecture hours. 0.5-5 credits. Subject matter is presented by lecture, tutorial studies and/or library assignments in selected areas of advanced study not available in other courses or as part of the research training.

PSCI 701. Post-candidacy Doctoral Research. 9 Hours.

Semester course; 9 research hours. 9 credits. May be repeated for credit. Enrollment is restricted to graduate research assistants or graduate teaching assistants who have been admitted to doctoral candidacy in the School of Pharmacy. Students will participate in supervised discipline-specific research related to their dissertation topic. Students must have approval from their current degree program coordinator to register. This course can be approved as a substitution for any post-candidacy degree requirement (e.g. directed research). Graded as satisfactory/unsatisfactory.

Pharmaceutics (PCEU)**PCEU 507. Pharmaceutics and Biopharmaceutics I. 2.5-3 Hours.**

Semester course; 2.5-3 lecture hours. 2.5-3 credits. Designed to describe the physico-chemical and biopharmaceutical principles fundamental to the development of pharmaceutical dosage forms. Topics will include solid-, semi-solid and liquid-dosage forms that include solid-state, semi-solid and liquid properties in addition to topics that span these dosage forms including aerosols, drug degradation and stability, shelf-life, packaging, and control of pharmaceutical ingredients.

PCEU 508. Pharmacokinetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PCEU 507. Corequisite: PCEU 509. Major topics include the mathematical and physiological principles of pharmacokinetics related to the development and use of pharmaceutical dosage forms. Discussions will include compartmental modeling, physiological concepts of pharmacokinetics, and clearance and absorption concepts. Also includes material related to statistics.

PCEU 509. Pharmaceutics and Biopharmaceutics II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: PCEU 507. Designed to describe the biopharmaceutical principles fundamental to the development of pharmaceutical dosage forms, including parenteral products, solutions, disperse systems, semisolids, solids and novel drug delivery systems. The formulation, manufacture, control, biopharmaceutics and relevant patient-pharmacist interactions of the major dosage forms will be addressed and presented by route of administration.

PCEU 601. Applied Pharmacokinetics and Pharmacogenomics. 2.5 Hours.

Semester course; 2.5 lecture hours. 2.5 credits. Extends the concepts of pharmacokinetics as applied to physiological interpretation of pharmacokinetic properties and parameters, optimal dosage regimen design, pharmacokinetic variability in drug response, and drug interactions. Pharmacodynamic and pharmacogenomic principles include interpretation of genetic information and application to information in therapeutic decision-making.

PCEU 604. Molecular Pharmaceutics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of course coordinator. The student's basic biochemistry and pharmacy education will be expanded with emerging molecular concepts in enzyme and transporter structure and function, roles in drug disposition, pharmacogenomics, biochemistry, molecular biology, and experimental techniques.

PCEU 612. Advanced Physical Pharmacy and Biopharmaceutics. 3-5 Hours.

Semester course; 3 credits. Phase equilibria and phase transfer kinetics related to biopharmaceutics will be covered. The relationship between physicochemical properties of a drug dosage form and drug absorption, along with the correlation between in vitro tests used to evaluate dosage forms and in vitro measures of drug absorption will be covered. The course assumes that the student has a basic understanding of pharmacokinetics, physical chemistry and statistics.

PCEU 614. Research Techniques. 1-4 Hours.

Semester course; variable hours. Variable credit. Credit will be given on the basis of 1 credit per 45 hours of laboratory time. Prerequisite: approval of research adviser. Provides new graduate student with the laboratory skills necessary to perform research in the chosen discipline. The training time required will depend upon the discipline. Graded as pass/fail. Crosslisted as: MEDC 614/PHAR 614.

PCEU 615. Applied Pharmacokinetics. 2.5 Hours.

Semester course; 2.5 lecture hours. 2.5 credits. Extends the concepts of pharmacokinetics as applied to dosage regimen design, pharmacokinetic variability, drug interactions and statistical strategies for individualization of drug therapy. Lectures and conferences take place throughout the semester.

PCEU 621. Advanced Pharmaceutics and Drug Disposition. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Study at the advanced level of the relationships between the physicochemical properties of a drug and dosage form and the absorption, distribution, elimination and pharmacological effects of the drug. Current theory and methodology involved in solving problems at the research level are emphasized.

PCEU 622. Clinical Pharmacokinetics. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. The application of current pharmacokinetic theory to clinical problems involved in optimizing and monitoring drug use in patients. Particular attention is given to adjustment of drug dosage in individual patients with impaired drug elimination due to renal and hepatic dysfunction. (Nontraditional program).

PCEU 624. Advanced Pharmacokinetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An advanced treatment of the kinetics of drug absorption, distribution, and elimination utilizing mathematical models, and digital computers for analysis of linear and nonlinear biologic systems.

PCEU 625. Pharmaceutical Analysis. 4 Hours.

Semester course; 3 lecture and 1 laboratory hours. 4 credits. Theory and practice of selected analytical techniques for the quantitative analysis of drugs in body fluids and other matrices. Emphasis is on method validation, and immunoassay methodologies. Laboratory sessions will provide "hands on" experience with modern methods of drug analysis.

PCEU 626. Pharmaceutical Analysis Laboratory. 1 Hour.

1 lecture hour. 1 credit. Prerequisite: PHAR 625. A continuation of PHAR 625 with emphasis on providing advanced topics for analysis of drugs and metabolites.

PCEU 675. Proteomics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students, but senior-level undergraduate students in STEM majors will be considered on an individual basis. Introductory course in proteomics with an emphasis on mass spectrometry-based measurements including protein identification, quantification and post-translational modifications. The course will cover essential mass spectrometry instrumentation and separation science fundamentals, sample preparation, protein identification, protein quantification, post-translational modification enrichment strategies, and data analysis. Contemporary applications of proteomics in biology and biomedicine will be covered.

PCEU 690. Pharmaceutics Research Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Required of all graduate students in pharmaceutics. Research Seminar.

PCEU 691. Special Topics in Pharmaceutics. 1-5 Hours.

Semester course; 1-5 lecture hours. 1-5 credits. Presentation of subject matter is by lectures, tutorial studies, and/or library assignments in selected areas of advanced study not available in other courses or as part of the training in research.

PCEU 697. Directed Research in Pharmaceutics. 1-15 Hours.

Semester course; 1-15 credits. Research leading to the M.S., Pharm.D., or Ph.D. degree.

Pharmacy (PHAR)

PHAR 501. Pharmaceutical Calculations. 1 Hour.

Semester course; 1 lecture hour (delivered online). 1 credit. This course is designed in a student-centered learning format that supports self-directed learning. The course will help students develop the skill set needed to screen out the distractors from the determinant variables in a statement problem and guide their thought processes in sequential use of information to solve calculation problems seen in pharmacy practice.

PHAR 502. Introduction to Pharmacoeconomics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. The goal of the course is two-fold: 1) introduce students to the terms and processes of pharmacoeconomics and 2) inform students about the intersection between careers in health economics and pharmacy. Lecture, discussion and class assignments.

PHAR 503. Ethics and Equity. 1.5 Hour.

Semester course; 1.5 lecture hours. 1.5 credits. Enrollment is restricted to Pharm.D. students. This course is intended to help students recognize and address ethical dilemmas using a systematic approach. Students will be challenged to evaluate viable options for resolving ethical dilemmas with the needs of patients and other key stakeholders in mind. The intersection of bioethics, health equity and health disparities will be explored. Students will be expected to demonstrate conceptual understanding, self-awareness and critical-thinking skills through a series of individual and small group assignments, including reflective exercises and case-based discussions.

PHAR 505. Pathophysiology and Patient Assessment Skills. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course provides an in-depth exploration of patient assessment techniques and the understanding of pathophysiology underlying various diseases and conditions. Students will develop the necessary skills to perform comprehensive health and medication assessments, interpret clinical findings and understand the underlying physiological processes necessary in patient-centered pharmacy practice. Topics covered include health and medication history-taking, basic physical assessment techniques, interpretation of common laboratory and other objective data, and common disease processes and their impact on different body systems. This course will also build on communication and information skills presented in concurrent courses.

PHAR 506. Nonprescription Medications and Self-care. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to Pharm.D. students. Introduction to the concepts of self-care. In this course, students will learn how to identify signs and symptoms of problems that can be managed and treated through self-care, to determine which signs and symptoms are exclusions for self-care and to identify appropriate health care practitioners for referral. Students will also learn about non-medication methods to alleviate and prevent signs and symptoms of self-care problems. Additionally, students will be able to evaluate nonpharmacologic treatments that may be used to prevent and treat self-care issues. These concepts will be learned through the use of patient cases, self-care consultations, lectures, conferences and active participation in classroom and conference activities.

PHAR 507. Introduction to Health Informatics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to Pharm.D. students. This course provides an introduction to the field of health informatics, exploring the intersection of health care, information technology and data management. Students will develop an understanding of the key concepts, theories and applications of health informatics, and gain practical skills to analyze, design and implement health information systems. Topics covered include electronic health records, health data standards, health care analytics, privacy and security, telehealth, and emerging trends in health informatics. Graded Pass/Fail/Honors.

PHAR 508. Evidence-based Pharmacy I. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to Pharm.D. students. This course is part of a P2 year-long series that will teach students how to evaluate and apply the principles of evidence-based medicine to contemporary pharmacy practice. This course will focus on case reports, case series, cross sectional, qualitative, case control and cohort studies. Within each module, students will learn the principles of epidemiology, biostatistics, study design and drug literature evaluation and apply these principles to patient care and other contemporary pharmacy practice issues. The course will use lectures, outside readings, class discussions and pre-class and in-class exercises to accomplish these objectives.

PHAR 509. Evidence-Based Pharmacy I: Introduction to Pharmacy Information Skills. 1.5 Hour.

Semester course; 1.5 lecture hours. 1.5 credits. This is the first of a three-course series introducing students to information skills necessary for the practice of evidence-based pharmacy. Lecture topics include drug information resources, efficient information retrieval, assessment of drug information sources, relationship of pharmaceutical industry to drug literature, and basic laws and regulations associated with prescription processing. Class exercises will be used to promote the appropriate use of drug information resources in pharmacy practice.

PHAR 511. Evidence-based Pharmacy II. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to Pharm.D. students. This course is part of a P2 year-long series that will teach students how to evaluate and apply the principles of evidence-based medicine to contemporary pharmacy practice. This course will focus on randomized controlled clinical trials, systematic reviews and meta-analyses. Within each module, students will learn the principles of epidemiology, biostatistics, study design and drug literature evaluation and apply these principles to patient care and other contemporary pharmacy practice issues. The course will use lectures, outside readings, class discussions and pre-class and in-class exercises to accomplish these objectives.

PHAR 512. Health Promotion and Disease Prevention. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Introduction to the role of the pharmacist in health promotion and disease prevention. Skills for pharmacist involvement in implementing aspects of Healthy People 2010, educating patients and addressing health care disparities will be emphasized.

PHAR 513. Contemporary Pharmacy Practice. 2 Hours.

Semester course; 2 lecture hours. 2 credits. The goal of the course is to introduce students to basic principles of professional patient-centered pharmacy practice. The common thread between the various topics is the link between pharmacists' professionalism and effective medication use. Pharmacists who consistently engage in professional behaviors are better able to serve the health care needs of their patients.

PHAR 515. Continuous Professional Development I. 1 Hour.

Yearlong course; 1 lecture hour. 1 credit. This the first of four yearlong courses designed to advance students' professional development. The large- and small-group sessions and co-curricular activities encompass experiences that enhance self-awareness and professionalism in student pharmacists. Graded as CO with no credit for fall semester with a pass/fail and credit assigned for spring semester.

PHAR 523. Foundations I. 1.5-2 Hours.

Semester course; 4.5-6 laboratory hours. 1.5-2 credits. This competency-based course is intended to give the first-year pharmacy student an introduction to the pharmacy profession, emphasizing the skills and values that are necessary to be a competent, caring pharmacist. It is the first in a six-semester practice-based course sequence that introduces the language and tools of contemporary pharmacy practice with an emphasis on calculations, communication, medical terminology, drug information, prescription processing, health promotion, patient assessment and problem-solving.

PHAR 524. Foundations II. 1.5 Hour.

Semester course; 4.5 laboratory hours. 1.5 credits. This competency-based course is the second in a six-semester practice-based course sequence with an emphasis on the preparation and dispensing of selected extemporaneous compounds including liquid, solid and semisolid preparations and the appropriate use of selected OTC point-of-care devices.

PHAR 525. Communications in Pharmacy Practice. 2 Hours.

Semester course; 1.5 lecture hours and an average of 1 conference hour per week. 2 credits. A study of the theory and techniques of communication and counseling techniques related to pharmacy practice. Supervised practice in developing basic communication skills.

PHAR 526. Community Pharmacy Practice. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Helps students develop the necessary foundation for the management of activities in community pharmacy practice settings with many of the skills developed in this course being equally applicable to other practice settings. Focuses on financial management and managed care as it affects community practice.

PHAR 529. Clinical Therapeutics Module: Introduction to Special Populations. 2 Hours.

Module course; 2 lecture hours. 2 credits. Introduction to issues affecting the pharmacotherapy of special populations such as pediatric and geriatric patients.

PHAR 530. Introductory Pharmacy Practice Experience: Community Practice. 4 Hours.

Semester course; daily for 4 weeks. 4 credits. Students will meet with an assigned community pharmacist 5 days per week for 8 hours for 4 consecutive weeks at the end of the P-1 year. Students will practice pharmacy under supervision while learning about the medication use system in community pharmacy practice. Students will demonstrate core practice skills: communication, pharmacy calculations, ethics, medication safety, wellness and health promotion, informatics and critical thinking. Graded as honors, high pass, pass, fail.

PHAR 532. Introductory Pharmacy Practice Experience: Hospital Practice. 3 Hours.

Semester course; 40 hours per week for three weeks. 3 credits. Students will meet with an assigned hospital pharmacist for a three-week (120 hours) experience at the end of the P-2 year to practice pharmacy in a hospital environment and learn about hospital pharmacy management and medication distribution systems. Students will demonstrate core practice skills: communication, calculations, ethics, medication safety, technology, informatics and critical thinking. Graded as honors, high pass, pass, fail.

PHAR 533. Introductory Pharmacy Practice Experience: Patient Care. 0.5 Hours.

Semester course; 0.5 laboratory hours. 0.5 credits. Students will complete 20 hours of approved experiences under supervision. An orientation, reading assignments, mandatory class time and assessments will be conducted. Students will also prepare a reflection describing the benefits to the community when pharmacists engage in the health and education needs of the community. Students will develop a sense of personal responsibility for addressing the problems and needs of society. Graded as Pass/Fail.

PHAR 534. Foundations III. 1.5 Hour.

Semester course; 1 lecture and 2 laboratory hours. 1.5 credits. This competency-based course is the third in a six-semester, practice-based course sequence with an emphasis on the clinical application of medications in the management of various disease states. The second-year pharmacy student will develop skills in the assessment and therapeutic monitoring of selected disease states and drug therapies. Topics include cardiovascular, endocrine and pulmonology therapeutics.

PHAR 535. Foundations IV. 1.5 Hour.

Semester course; 1 lecture and 2 laboratory hours. 1.5 credits. This competency-based course is the fourth in a six-semester, practice-based course sequence. Introduces students to the skills required to practice in institutional settings such as hospitals and long-term care facilities and in home health care.

PHAR 540. Self-Care and Alternative and Complementary Treatments. 2.5 Hours.

Module course; variable lecture and conference hours. 2.5 credits. Introduction to the concepts of self-care and alternative and complementary treatments. Students will learn to distinguish treatable signs and symptoms of common diseases and exclusions for care that require referral to appropriate health care practitioners. Non-medication methods to alleviate and prevent self-care problems are reviewed. Patient cases, self-care consultations, lectures and conferences will be used to facilitate learning.

PHAR 541. Patient Assessment in Pharmacy Practice. 2 Hours.

Semester course; variable lecture and laboratory hours. 2 credits. Provides students with an introduction to patient assessment skills necessary in patient-centered pharmacy practice. Course topics include basic physical assessment techniques, interpretation of findings from laboratory tests or physical examinations and documenting findings from patient assessments. Laboratory time will be used to practice various assessment skills. The course will also build on communication and information skills presented in previous courses.

PHAR 544. Clinical Therapeutics Module: Cardiovascular. 4.5 Hours. Module course; variable hours. 4.5 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with cardiovascular diseases are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 545. The U.S. Health Care System. 1.5-2 Hours. Semester course; 1.5-2 lecture hours. 1.5-2 credits. Enrollment is restricted to Pharm.D. students. Designed to introduce the student to the components of the U.S. health care system and the interrelationships among health care consumers and providers. It also presents the organizational framework and regulatory and reimbursement mechanisms which are the foundations of the U.S. health care delivery system.

PHAR 546. Pharmacy-based Immunization Delivery. 1.5 Hour. Semester course; 1 lecture and .5 independent study hours. 1.5 credit hours. Enrollment is restricted to students in the Doctor of Pharmacy program. This course, which is based on the CDC's national educational standards for immunization, emphasizes a health care team approach, fosters interventions that promote disease prevention and public health, and prepares pharmacists with the comprehensive knowledge, skills and resources necessary to provide immunization services to patients. This course is associated with the American Pharmacists Association's Pharmacy-Based Immunization Delivery Certificate Program. Each student will receive a Certificate from APhA after successful completion of the course. This course combines self-study course work and didactic live education sessions, along with hands-on administration techniques. Graded as pass/fail.

PHAR 547. Managing Professional Patient-centered Practice. 1.5 Hour. Semester course; 1.5 lecture hours. 1.5 credits. Introduces pharmacy students to the basic principles of managing a professional pharmacy practice. Students will learn patient-centered practices associated with effective medication use and positive patient outcomes. Instruction will be through lectures, case discussions and portfolio assignments.

PHAR 549. Personalized Medicine. 1 Hour. Semester course; 1 lecture hour. 1 credit. Provides an introduction to personalized medicine as related to pharmacy practice. The course will be taught using lectures, individual work, small-group discussions and total classroom discussion using homework, in-class assignments and patient case scenarios.

PHAR 550. Pharmacy Practice Research. 3 Hours. Yearlong course; 3 lecture hours. 3 credits. Focuses on the development of skills necessary for identifying issues and questions related to pharmacy practice, evaluating the literature to identify possible solutions, designing a feasible research project, developing a data analysis plan and a formal written proposal for the project. Students will ultimately present their research proposals to faculty and students. The course is graded as CO with no credit for fall semester with a letter grade and credit assigned for spring semester.

PHAR 551. Pharmacy-based Point of Care Testing. 1.5 Hour. Semester course; 1.5 lecture hours. 1.5 credits. Enrollment is restricted to Pharm.D. students. This course will be based on the American Pharmacists Association and the University of Florida's Pharmacy-based Test and Treat certificate training program. Each student will receive a certificate from APhA after successful completion of the course. Students will complete the self-study over 10 weeks (asynchronously) prior to the five-week module. Graded as Pass/Fail.

PHAR 555. Clinical Therapeutics Module: Endocrinology. 2.5 Hours. Module course; variable hours. 2.5 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with endocrine diseases are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 556. Clinical Therapeutics Module: Neurology. 3.5-4 Hours. Module course; 3.5-4 lecture hours. 3.5-4 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with neurological diseases are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 565. Evidence-based Pharmacy II: Research Methods and Statistics. 2.5 Hours. Module course; variable hours. 2.5 credits. This is the second of a three-course series introducing students to the principles and practice of evidence-based pharmacy. Lecture topics include research methods, concepts and principles of study design, and appropriate use of statistics. Class exercises promote a working understanding of statistical principles and a general understanding of research methods.

PHAR 566. Evidence-based Pharmacy III: Drug Literature Evaluation. 2 Hours. Module course; variable hours. 2 credits. This is the third of a three-course series introducing students to the principles and practice of evidence-based pharmacy. Lectures, outside readings, class discussions and exercises will be used to develop the skills necessary for the evaluation of biomedical literature and application to pharmacy practice.

PHAR 602. Clinical Therapeutics Module: Psychiatry. 3 Hours. Module course; variable hours. 3 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with psychiatric illnesses are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 603. Clinical Therapeutics Module: Respiratory/Immunology. 2.5 Hours. Semester course; 2.5 lecture hours. 2.5 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with respiratory and immunologic illnesses are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 604. Clinical Therapeutics Module: Infectious Diseases. 4-4.5 Hours. Module course; 4-4.5 lecture hours. 4-4.5 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with infectious diseases are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 605. Clinical Therapeutics Module: Hematology/Oncology. 2.5 Hours.

Module course; variable hours. 2.5 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with hematologic diseases and cancer are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 606. Clinical Therapeutics Module: Nephrology/Urology. 2 Hours.

Module course; variable hours. 2 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with kidney and urologic diseases are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 607. Clinical Therapeutics Module: Dermatology/EENT. 2 Hours.

and Joint Module course; variable hours. 2 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with diseases of the bone, skin, ears, eyes, nose and throat are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 609. Clinical Therapeutics Module: Reproductive Health, Dermatology, EENT, Bone and Joint. 3.5 Hours.

Semester course; 3.5 lecture hours. 3.5 credits. Enrollment is restricted to Pharm.D. students. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in reproductive health issues, dermatology, EENT, joint and patients with bone diseases are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, nonprescription and complementary treatments will be reviewed.

PHAR 614. Research Techniques. 1-4 Hours.

Semester course; variable hours. Variable credit. Credit will be given on the basis of 1 credit per 45 hours of laboratory time. Prerequisite: approval of research adviser. Provides new graduate student with the laboratory skills necessary to perform research in the chosen discipline. The training time required will depend upon the discipline. Graded as pass/fail. Crosslisted as: PCEU 614/MEDC 614.

PHAR 615. Continuous Professional Development II. 1 Hour.

Yearlong course; 1 lecture hour. 1 credit. This the second of four yearlong courses designed to advance students' professional development. The large- and small-group sessions and co-curricular activities encompass experiences that enhance self-awareness and professionalism in student pharmacists. Graded as CO with no credit for fall semester with a pass/fail and credit assigned for spring semester.

PHAR 618. Clinical Therapeutics Module: Gastrointestinal/Nutrition. 2.5 Hours.

Module course; variable hours. 2.5 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with gastrointestinal diseases are integrated in this course. Nutrition will be covered. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 619. Clinical Therapeutics Module: Women's Health/Bone. 2 Hours.

Module course; variable hours. 2 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in women's health issues and patients with bone diseases are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, non-prescription and complementary treatments will be reviewed.

PHAR 620. Clinical Therapeutics Module: Critical Care/Toxicology and Complex Patients. 2.5 Hours.

Module course; 2.5 lecture hours. 2.5 credits. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with critical care diseases, toxicology emergencies and complex cases are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, nonprescription and complementary treatments will be reviewed.

PHAR 621. Pharmacoeconomics. 2 Hours.

Module course; variable hours. 2 credits. Introduces the terms and processes of pharmaceutical economics and pharmacoeconomics. Students learn to assess the impact of economics on pharmaceutical use, evaluate pharmacoeconomic studies and make decisions on the cost effectiveness of therapeutic alternatives. Lectures, discussion and class assignments.

PHAR 623. Patient Medication Safety. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Provides the fundamental background necessary to understand patient medication safety, including multidisciplinary responsibilities for medication safety and approaches to the management and prevention of medication errors. Current issues in medication safety and actual medication error cases will be used in the class.

PHAR 626. Advanced Pharmacotherapy Research Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of the instructor. This course focuses on research techniques used to assess the clinical response to drug therapy, including advantages and disadvantages of different techniques. Published clinical trails are evaluated to illustrate these concepts including statistical assessment. Recent FDA New Drug Applications are reviewed when appropriate to illustrate regulatory aspects of the evaluation of clinical trials.

PHAR 631. Advanced Pharmacy Practice Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Classical, social, and systems views of management are introduced with emphasis on the uses of implicit control. The sociology of professions and the nature of professional work are explored; the management of the professional's work is discussed in detail. Design and operation of integrated drug information, drug distribution, and drug use control systems is explored. (Nontraditional program).

PHAR 637. Introduction to Research Methods in Pharmaceutical Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Assists practicing pharmacist managers and researchers in the development, implementation, monitoring and evaluation of programs for the delivery of pharmaceutical care and the practice of pharmacy. Introduces students to the empirical method and to provide them with a fundamental knowledge base for developing salient research questions that could lead to the articulation of testable research hypotheses, accomplished by addressing those research techniques and designs most commonly used in pharmacy and health services research.

PHAR 638. Pharmaceutical Benefit Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Addresses the need for pharmacy benefit management, the types of organizations that use pharmacy benefit management and the primary tools, techniques and practices used to manage the pharmacy benefit. Presents through lectures, readings, class discussions and a research paper.

PHAR 640. Foundations V. 1.5 Hour.

Semester course; 1 lecture and 2 laboratory hours. 1.5 credits. This competency-based course is the fifth in a six-semester practice-based course sequence with an emphasis on the clinical application of medications in the management of various disease states. The third-year pharmacy student will develop skills in the assessment and therapeutic monitoring of selected disease states and drug therapies. Topics include psychiatry, neurology and oncology therapeutics.

PHAR 645. Foundations VI. 1.5 Hour.

Semester course; 1 lecture and 2 laboratory hours. 1.5 credits. This competency-based course is the final installment in a six-semester, practice-based course sequence. It is intended to give the third-year pharmacy student opportunities to improve acquired skills and gain additional skills necessary to provide the highest level of patient-centered care by optimizing drug therapy outcomes.

PHAR 646. Ambulatory Care Pharmacy in the Free Clinic Setting. 2 Hours.

Semester course; 1 lecture and 1 clerkship (experiential education) hour. 2 credits. Enrollment is restricted to current P3 students in the Pharm.D. program. This course includes lectures, case discussions, clinical experience, quizzes, reflections, student self-evaluation and case presentations. Students will participate in four six-hour sessions in an interprofessional practice at a free clinic over the semester, as well as periodic on-campus discussions to reinforce clinical learning. Class discussions may require prereadings and Blackboard readiness quizzes. Graded as pass/fail/honors.

PHAR 652. Health Promotion and Communication in Pharmacy Practice. 2-2.5 Hours.

Semester course; 2-2.5 lecture hours. 2-2.5 credits. Enrollment is restricted to Pharm.D. students. This course will provide a study of the theory and techniques of communications and counseling related to pharmacy practice. The course is designed to introduce students to the role of the pharmacist in health promotion and disease prevention and build communication skills to help prepare students for practice. Students will learn the knowledge and skills required for pharmacist involvement in these activities as well as obtain practical experience in the development and delivery of these services. Upon successful completion of this course, students will be recognized as trained "lifestyle coaches" eligible to deliver the evidence-based National Diabetes Prevention Program.

PHAR 660. Community Pharmacy Practice Management II. 1.5 Hour.

Semester course; 1.5 lecture hours. 1.5 credits. Enrollment is restricted to Pharm.D. students. This course helps students develop the necessary foundation for the management of activities in community pharmacy and any other practice settings. The course focuses on helping students understand what it takes to offer clinical services in pharmacy settings and be able to develop plans to implement them.

PHAR 663. Advanced Diabetes Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An in-depth study of the care of patients with metabolic syndrome and diabetes. The etiology, pathophysiology, clinical course, clinical manifestations, prevention and management of diabetes will be reviewed through the use of online didactic presentations, patient cases, self-directed learning and active participation in classroom discussion. Emphasis is placed on the use of data to optimize pharmacotherapy for patient scenarios.

PHAR 664. Making Medicines: The Process of Drug Development. 1 Hour.

Semester course; 1 lecture hour (delivered online). 1 credit. This is a self-paced, eLearning course developed in collaboration with a team of academic leaders designed to deliver a scientific education curriculum highlighting the fundamental processes and rigor drug manufacturers undertake to research, develop and deliver new medicines to patients. Graded as Pass/Fail.

PHAR 665. Residency and Fellowship Preparatory. 1 Hour.

Semester course; 1 lecture hour (delivered online or face-to-face). 1 credit. Intended for third-year Pharm.D. students interested in pursuing postgraduate training (residency, fellowship, etc.). This course will include readings, lectures, topic discussions, panel discussions, classroom activities and out-of-class assignments. Some of the topics include, but are not limited to, letters of intent, reference letters, interviewing and preparing for American Society of Health-System Pharmacists midyear clinical meeting and/or personal placement service. Graded as Pass/Fail/Honors.

PHAR 666. Advanced Topics in Pharmacy. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Presentation of pharmacy subject matter by lectures, conferences or clinical site visits in selected areas of advanced study providing a discussion of topics beyond that provided in the required curriculum.

PHAR 667. Seven Habits of Effective Pharmacists. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course is intended to provide students with an overview of what constitutes emotional intelligence and how they can harness that knowledge to become better practitioners. Structured around Stephen Covey's "7 Habits of Highly Effective People," students will spend time learning how to understand and use EI skills in their own personal, as well as professional, life's journey. Graded as Pass/Fail/Honors.

PHAR 668. Academic Pharmacy. 3 Hours.

Semester course; 2 lecture and 1 practicum hours. 3 credits. Prerequisite: PHAR 523 with a minimum grade of B. Enrollment requires approval by course coordinators. This course is for third-year Doctor of Pharmacy students interested in exploring or pursuing a career in academia. Students will learn the structure of academia, types of research, teaching methods and core concepts of academia through weekly two-hour didactic instruction and service in PHAR 523 as small-group facilitators, volunteer patients, proctors and classroom facilitators. Graded as Pass/Fail/Honors.

PHAR 669. Pediatric Pharmacy Practice. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Students will develop and apply a systematic process for assessing, treating and creating a monitoring plan for a pediatric patient. Students will be required to integrate new knowledge regarding the pathophysiology, clinical presentation and treatment of selected pediatric diseases with the basic principles of pediatric clinical pharmacology previously learned in the core Doctor of Pharmacy curriculum. The course will be taught through lecturers with expert pediatric knowledge in their respective specialties. Student and faculty will deliver presentations, case workshops, drug information questions and individual quizzes, and a post-assessment examination will be used to help students learn and apply basic course concepts. Students interested in specializing in pediatric pharmacy or who would like to gain more experience in pediatrics are the intended audience. Graded as Pass/Fail/Honors.

PHAR 670. Geriatrics – Demystifying a Population. 2 Hours.

Semester course; 2 lecture hours. 2 credits. This course employs an interprofessional team approach to teach key concepts in comprehensive geriatric care. The course aims to develop students' geriatric knowledge base and clinical reasoning skills. Students will also gain experience working in teams and sharing information.

PHAR 671. Applied Pharmacoeconomics and Outcomes Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Presents theoretical and practical topics relating to pharmacoeconomics and health outcomes research. Students will learn to critically appraise and discuss pharmaceutical outcomes research through lectures, readings, class participation and projects. Requires students to plan, initiate and present an outcomes research project that considers both clinical and economic issues of product or service selection.

PHAR 672. Advances in Mental Health Pharmacy Practice. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Students choose the topics for discussion in this elective course. They actively learn through small group discussions of the pharmacotherapy of psychiatric disorders. Students gain experience in patient rounds, practice-based projects, interpretation of clinical practice guidelines, use of the Internet and computer presentations.

PHAR 673. Advanced Cardiovascular Pharmacotherapy. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PHAR 544. Students will gain a broader knowledge and deeper understanding of the etiology, pathophysiology, clinical course, clinical manifestations, prevention and management of cardiovascular disorders through the use of online didactic presentations, videos, patient cases, self-directed learning and active participation in classroom discussion.

PHAR 677. Advanced Infectious Diseases Pharmacotherapy. 2 Hours.

Semester course; 2 lecture hours. 2 credits. The specialty of infectious diseases includes diagnosis, pathophysiology, treatment and monitoring of patients with infections. It also includes ensuring appropriate use of antimicrobials in order to mitigate antimicrobial resistance progression. The pharmacist's contribution in this area is primarily in the appropriate selection, use and monitoring of antimicrobial therapy. This course serves as an advanced introduction to the use of antimicrobial agents, with emphasis on selected disease states, microbiological and laboratory aspects and antimicrobial stewardship principles.

PHAR 685. Contemporary Topics in Pharmacy. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Explores how pharmacists prepare for and respond to the issues that affect the practice of pharmacy. Contemporary issues that relate to major health care needs, government health care activities, views by health professionals, health policies, health care economics, pharmacist attitudes and behaviors, pharmacy laws and regulations, pharmacy traditional views and opinions will be examined. Discussion and debate on these issues will help to prepare students for their future in pharmacy practice.

PHAR 688. Applied Pharmacoepidemiology Research Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EPID 571 and BIOS 544 or permission of instructor. Provides an overview of the field of pharmacoepidemiology and its relationship to health care and research. Topics including selecting data sources, study design, data manipulation and analytical issues relevant to the conduct of pharmacoepidemiology research are covered. Students complete exercises to reinforce these topics, as well as prepare a formal project proposal. Research studies are also reviewed to help students develop skills in the critical evaluation of the pharmacoepidemiology literature.

PHAR 689. Pharmaceutical Policy Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ECON 500 or ECON/HADM 624, or permission of instructor. Examines a breadth of pharmaceutical policy issues pertaining to stakeholders in health care including the federal government, state governments, the pharmaceutical industry, pharmacies and pharmacists, and consumers. Using an economic approach to policy analysis, various competing thoughts and challenges to health care will be presented. Special attention will be paid to theoretical foundations and scientific rigor in approaching policy analysis.

PHAR 690. Pharmacy Research Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Required of all graduate students in pharmacy. Research seminar.

PHAR 691. Special Topics in Pharmacy. 1-5 Hours.

Semester course; 1-5 lecture hours. 1-5 credits. Presentation of subject matter is by lectures, tutorial studies and/or library assignments in selected areas of advanced study not available in other courses or as part of the research training. Graded as honors, high pass, pass, fail.

PHAR 697. Directed Research in Pharmacy. 1-15 Hours.

Semester course; 1-15 credits. Research leading to the M.S., Pharm.D., or Ph.D. degree.

PHAR 702. Pharmacy Practice Management. 2.5 Hours.

Semester course; 2.5 lecture hours. 2.5 credits. Enrollment is restricted to Pharm.D. students. The goal of the course is to develop the necessary foundation for the management of activities in pharmacy practice settings. This course focuses on financial management and managed care as it affects community practice, however many of the elements of this course can be applied to multiple settings. It is not the purpose of this course to make students management or economic experts. Equipped with this essential information, students will be able to apply principles of financial management to pharmacy practice related problems and, by understanding principles of managed care pharmacy, will be better able to understand and practice in the current pharmacy practice environment.

PHAR 703. Clinical Therapeutics Module: Complex Patient Cases and Critical Care. 3.5 Hours.

Semester course; 3.5 lecture hours. 3.5 credits. Enrollment is restricted to Pharm.D. students. The principles of medicinal chemistry, pharmacology, pharmaceuticals, pathophysiology and pharmacotherapy to the application of drug therapy in patients with critical care diseases, toxicology emergencies and complex cases from throughout the curriculum are integrated in this course. The clinical presentation, course of illness, prevention and treatment of diseases using prescription, nonprescription and complementary treatments will be reviewed.

PHAR 715. Continuous Professional Development III. 1 Hour.

Yearlong course; 1 lecture hour. 1 credit. This the third of four yearlong courses designed to advance students' professional development. The large- and small-group sessions and co-curricular activities encompass experiences that enhance self-awareness and professionalism in student pharmacists. Graded as CO with no credit for fall semester with a pass/fail and credit assigned for spring semester.

PHAR 724. Pharmacy Law. 2.5 Hours.

Semester course; 2.5 lecture hours. 2.5 credits. A study of federal and state laws, including statutes, regulations and cases, affecting the practice of pharmacy and the distribution of drugs. This course includes material on ethics.

PHAR 730. Continuous Professional Development IV. 0.5 Hours.

Yearlong course; 0.5 lecture hours. 0.5 credits. This the fourth of four yearlong courses designed to advance students' professional development. The large- and small-group sessions and co-curricular activities encompass experiences that enhance student pharmacists. Graded as CO with no credit for fall semester with a pass/fail and credit assigned for spring semester.

PHAR 760. Acute Care Pharmacy Practice I. 5 Hours.

Semester course; daily for 5 weeks. 5 credits. This course consists of 200 hours of advanced pharmacy practice experience in an acute care hospital setting. Students will actively participate in the delivery of patient care on a general medicine service. Students may participate in the following types of activities: rounding with a health care team, obtaining patient histories, identifying problems requiring therapeutic interventions, solving problems, consulting with physicians, monitoring patient outcomes and providing educational sessions for the professional staff. These services are expected to be integrated with the hospital pharmacy services. Graded as H/HP/P/F.

PHAR 761. Advanced Hospital Pharmacy Practice. 5 Hours.

Semester course; daily for 5 weeks. 5 credits. This course consists of 200 hours of advanced pharmacy practice experience in a hospital pharmacy department. Students will actively participate in pharmacy operations and services relating to systems for drug distribution and drug control, scope of clinical services provided by the department, management of the department, and department relationships within the institution and health system. Graded as H/HP/P/F.

PHAR 762. Geriatrics Pharmacy Practice. 5 Hours.

Semester course; daily for 5 weeks. 5 credits. This course consists of 200 hours of advanced pharmacy practice experience in a variety of settings with a predominately geriatric focus. These sites may include community pharmacies, specialty clinics, rehabilitation hospitals, skilled nursing facilities, home-based consult services and assisted living facilities. Students will focus on the unique medication-related needs of seniors and actively apply that special knowledge to provide quality pharmacy care to older adults. Graded as H/HP/P/F.

PHAR 763. Ambulatory Care Pharmacy Practice. 5 Hours.

Semester course; daily for 5 weeks. 5 credits. This course consists of 200 hours of advanced pharmacy practice experience in an ambulatory care, multidisciplinary practice setting. These sites may include hospital-based clinics, physician group practices, safety net clinics and managed care facilities that provide health care directly to patients. Students will actively participate in obtaining patient medical and medication histories, evaluating drug therapies, developing pharmacy care plans, monitoring patients' therapeutic outcomes, consulting with physicians and non-physician providers and providing education to patients and health care professionals. Graded as H/HP/P/F.

PHAR 764. Community Pharmacy Practice. 5 Hours.

Semester course; daily for 5 weeks. 5 credits. In this course, students will participate in all facets of pharmacy practice in the community pharmacy setting. Students will be involved in dispensing, compounding, telephone consultation, patient counseling and nonprescription drug recommendations. Students also will be involved in patient assessment, monitoring intervention and follow-up care designed to improve the outcomes of drug therapy. Graded as H/HP/P/F.

PHAR 765. Elective I. 5 Hours.

Semester course; daily for 5 weeks. 5 credits. In this course, students will be able to participate in a variety of pharmacy practice settings. Graded as H/HP/P/F.

PHAR 766. Elective II. 5 Hours.

Semester course; daily for 5 weeks. 5 credits. In this course students participate in a variety of pharmacy practice settings. Graded as H/HP/P/F.

PHAR 767. Clinical Selective I. 5 Hours.

Semester course; daily for 5 weeks. 5 credits. Restricted to Pharm.D. dual-degree candidates. In this course students participate in a clinical rotation and may choose one of these pharmacy practice settings: ambulatory care, acute care, advanced community, institutional or geriatric. Graded as H/HP/P/F.

PHAR 768. Advanced Community Pharmacy Practice. 5 Hours.

Semester course; daily for 5 weeks. 5 credits. This course consists of 200 hours of advanced pharmacy practice experience in a community pharmacy setting. Students will focus primarily on patient care services and secondarily on patient-focused dispensing functions in these pharmacies. These services will focus on the identification, resolution and prevention of medication-related problems dealing with general medicine issues and medication therapy management. Students will actively participate in the following types of activities: interacting with patients, caregivers and prescribers; counseling, self-care consults and recommendations; administration of immunizations; and health and wellness screenings and information. Graded as H/HP/P/F.

PHAR 769. Clinical Selective II. 5 Hours.

Semester course; daily for 5 weeks (200 clinical hours). 5 credits. Restricted to Pharm.D. dual-degree candidates. In this course students participate in a clinical rotation and may choose one of these pharmacy practice settings: ambulatory care, acute care, advanced community, institutional or geriatric. Graded as H/HP/P/F.

PHAR 771. Student Pharmacist Professionalism. 1 Hour.

Continuing course; variable hours. 1 credit at end of four-year curriculum. Selected presentations and activities related to the development and enhancement of professional behavior in student pharmacists. Graded as CO until final semester, with pass/fail awarded on completion.

PHAR 773. Acute Care Pharmacy Practice II. 5 Hours.

Semester course; daily for 5 weeks. 5 credits. This course consists of 200 hours of advanced pharmacy practice experience in an acute care hospital setting. Students participate in the delivery of patient care in a general medicine or a medical specialty service. Students may participate in the following types of activities: rounding with a health care team, obtaining patient histories, identifying problems requiring therapeutic interventions, solving problems, consulting with physicians, monitoring patient outcomes and providing educational sessions for the professional staff. These services are expected to be integrated with the hospital pharmacy services. Graded as H/HP/P/F.

School of Population Health

Biostatistics (BIOS)

BIOS 512. Basic Mathematical Statistics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The course builds the basics of probability theory and applications of probability theory toward statistical inference. Students will learn about the mathematical paradigm behind most statistical inference used in basic data analysis, estimation and hypothesis testing.

BIOS 513. Mathematical Statistics I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrolling students should have completed both univariate and multivariate calculus. Probability, random variables and their properties, expectations, moment generating functions, common families of distributions, multiple random variables, and sample statistics and properties. Crosslisted as: STAT 513.

BIOS 514. Mathematical Statistics II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 513/BIOS 513. Sufficient statistics, completeness, likelihood functions, point estimators and their properties, hypothesis tests, confidence intervals, and limit theorems. Crosslisted as: STAT 514.

BIOS 516. Biostatistical Consulting. 1 Hour.

Semester course; 1 lecture hour. 1 credit. The principles dealing with the basic art and concepts of consulting in biostatistics. The nonstatistical course discusses the roles and responsibilities of biostatisticians, building relationships with collaborators, communicating results to various audiences, and other topics contributing to the professional development of biostatisticians.

BIOS 524. Biostatistical Computing. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Techniques for biostatistical computing are presented by way of contemporary statistical packages. Students learn how to create and manage computer data files. Methods for data entry, preparation of data for analysis and summarive procedures are covered. Students learn the basics of random number generation and its applications, numerical methods for statistical algorithms, and concepts of numerical accuracy and stability. Advanced topics include interactive matrix and macro languages. Emphasis is placed on computational methods and data management rather than on statistical methods and procedures.

BIOS 531. Clinical Epidemiology. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. This course is intended primarily for clinicians. Permission of the course coordinator is required for others interested in registering. Epidemiological concepts necessary for evidence based studies of medicine. Specific topics will include: cause and effect criteria, demographic rates, measures of association or effect, study designs, decision trees, meta-analysis, evaluation of the literature, sources of data, reliability and validity, bias, confounding and effect modification, screening and diagnostic tests, sensitivity, specificity, false positives, false negatives, applications of the above to diagnosis and treatment, treatment efficacy and improved patient care.

BIOS 535. Behavioral Measurement. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Introduces theories and applications of the development and evaluation of measures and tests in the social and behavioral sciences. Classical test theory and item response theory are covered, including the topics of reliability, validity, item and test development, testing biases and standardization of tests. Students will gain experience applying methods in commonly used statistical packages.

BIOS 543. Graduate Research Methods I. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Enrollment is restricted to students with graduate standing, or one course in statistics and permission of instructor. This course is intended for graduate students and researchers without formal training in the statistical and biostatistical sciences. Students enrolled in this course will study various aspects of the research process, from creating the research question to publication. Particularly, students will learn sampling theory, the roles of probability, chance and variability in measurement and decision-making, study design characteristics and validity, basic data management, visualization and summarization, simple techniques for analyzing categorical data (e.g., chi-square test, exact tests), common techniques for analyzing continuous data (t-tests, analysis of variance, correlation and simple linear regression), and statistical decision-making. These topics will be covered through a variety of approaches, including traditional lecture, group discussion and in-class activities, and students will be assessed on their ability to understand statistical considerations in the study design process, appropriately perform simple statistical procedures and report statistical findings using the IMRaD format. The appropriate use of data management and statistical procedures will be modeled using several commonly used software packages. Students may receive degree credit for only one of BIOS 543, STAT 441, STAT 541, STAT 543 or STAT 641. BIOS 543 is not applicable toward the M.S. degree in mathematical sciences or the M.S. degree in computer science.

BIOS 544. Graduate Research Methods II. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Prerequisite: BIOS 543 or STAT 543 or permission of instructor. This course is intended for graduate students and researchers without formal training in the statistical and biostatistical sciences. Students enrolled in this course will study various aspects of statistical model-building, including adjusting estimates for other measurements, creating multivariate models, analyzing noncontinuous outcomes and summarizing results. Particularly, students will learn multiple linear regression, multifactor analysis of variance, analysis of covariance, random and mixed effects models, repeated measure and longitudinal data analysis, logistic and Poisson regressions, and time-to-event analysis. These topics will be covered through a variety of approaches, including traditional lecture, group discussion and in-class activities, and students will be assessed on their ability to understand statistical considerations in the model-building process, appropriately perform intermediate statistical procedures and report statistical findings using the IMRaD format. The appropriate use of data management and statistical procedures will be modeled using several commonly used software packages. Students may receive degree credit for only one of BIOS 544 or STAT 544.

BIOS 549. Spatial Data Analysis. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Prerequisites: BIOS 543 and BIOS 544 or permission of instructor. Introduces students to spatial data and the statistical methods to appropriately analyze them. Covers spatial data visualization and manipulation, spatial point pattern analysis, interpolation and geostatistics for point-referenced data, and spatial regression modeling of areal data. Includes the use of a statistical software package for data analysis.

BIOS 601. Analysis of Biomedical Data I. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. This course provides an overview of the analysis of continuous response data. The material begins with a brief review of theoretical tools used in inference and segues into common univariate and bivariate statistical methodologies for the analysis of continuous response data. Model-based statistical methods including linear regression, ANOVA, ANCOVA and mixed-effect models will also be covered. Practical consideration and usage of statistical methods, utilizing commonly used statistical software packages, will be emphasized over theoretical underpinnings of the methods.

BIOS 602. Analysis of Biomedical Data II. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Prerequisites: BIOS 601. This course provides an overview of the analysis of categorical data. The course begins with a brief review of commonly used probability distributions for binary, ordinal, count and time-to-event measurements, then segues into chi-square and tabular testing. Model-based statistical methods including logistic regression, Poisson regression, log-linear modeling and survival analysis will be covered. Practical consideration and usage of statistical methods, utilizing commonly used software packages, will be emphasized over the theoretical underpinnings of the methods.

BIOS 603. Biostatistical Consulting. 1 Hour.

Semester course; 1 lecture hour (delivered online or face-to-face). 1 credit. The principles dealing with the basic art and concepts of consulting in biostatistics. The nonstatistical course discusses the roles and responsibilities of biostatisticians, building relationships with collaborators, communicating results to various audiences, and other topics contributing to the professional development of biostatisticians.

BIOS 606. Clinical Trials. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Concepts of data management and statistical design and analysis in single-center and multicenter clinical trials. Data management topics include the collection, edition and validation of data. Statistical design topics include randomization, stratification, blinding, placebo- and active-control groups, parallel and crossover designs, and power and sample size calculations. Statistical analysis topics include sequential and group sequential methods.

BIOS 610. Research Processes and Methods for the Health Professions. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOS 531 or permission of instructor. Focus on research processes, methods and research proposal (R01) writing for the health professions. Course will emphasize conceptual underpinnings of research; the continuum of methodologies, including qualitative data collection; and development of a relevant research question – all toward writing a fundable proposal. Topics include framing a relevant research question, writing a problem statements and aims, synthesizing and critiquing relevant literature, project management, developing project budget and justification, as well as critically reviewing grants and serving on a mock study section.

BIOS 615. Advanced Inference. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Prerequisite: BIOS/STAT 513, BIOS/STAT 514 or permission of instructor. Mathematical preliminaries: probability and expectation, modes of convergence, delta method, statistical limit theorems; ARE; asymptotic likelihood-based procedures. Decision theoretical approach to statistical inference; decision rules; admissibility. Bayes procedures. Point estimation; unbiasedness; efficiency. Hypothesis testing: the Neyman-Pearson theory; unbiasedness and invariant tests; conditional tests; likelihood-based tests. Nonparametric statistics: U statistics, rank-based tests, permutation test. Interval estimation; confidence sets; relationship between confidence sets and families of tests. Algorithms in statistical computation: EM algorithm, Newton Raphson method. Modern methods for controlling false discovery rate.

BIOS 621. Nonparametric Statistical Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: any two courses of statistics or permission of instructor. Estimation and hypothesis testing when the form of the underlying distribution is unknown. One-, two- and k-sample problems. Tests of randomness, Kolmogorov-Smirnov tests, analysis of contingency tables and coefficients of association. Crosslisted as: STAT 621.

BIOS 625. Categorical Data Analysis and Generalized Linear Models. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Prerequisites: BIOS 514, 554 and 572. Introduction to the theory and methods of analysis of categorical data. Topics include exact and asymptotic analysis of contingency tables; measures of association and agreement; theory and applications of generalized linear models, maximum likelihood estimation and related numerical methods; linear models with different link functions and distributions; model fitting; and diagnostics.

BIOS 631. Mixed Models and Longitudinal Data Analysis. 4 Hours.

Semester course; 4 lecture hours (delivered online, face-to-face or hybrid). 4 credits. Prerequisites: BIOS/STAT 514, STAT 546 and BIOS 654. Introduction to longitudinal data structures and statistical inference. Multivariate theory and applications of normal mixed models, generalized linear mixed models, mixed models for categorical data, nonlinear mixed models and multiple imputation methods for missing data.

BIOS 632. Multivariate Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOS/STAT 514 and 654. One- and two-sample multivariate tests; invariance; MANOVA, MANCOVA and multiple design models; nonparametric methods; inference with covariance matrices; principal components; factor analysis; discriminant analysis; clustering.

BIOS 635. Structural Equation Modeling. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Prerequisites: two graduate-level statistics courses or permission of instructor. This course provides an overview of the principals and applications of the general statistical framework structural equation modeling. The course provides an introduction to the concepts, methods, problems and applications of SEM. Topics covered include the modeling of observed variables, consequences of measurement error, modeling of latent variables and longitudinal structural equation models.

BIOS 647. Survival Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOS 514 and 554 or permission of instructor. The analysis of survival (or failure time) data, with/without censoring. Actuarial and life-table methods, nonparametric and parametric estimation of survival functions, and comparison of survival curves; regression methods, such as the Cox proportional hazards model; competing risks; sequential models; applications to clinical trials.

BIOS 649. Advanced Spatial Data Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOS 543, BIOS 544, BIOS 549 or permission of instructor. This course focuses on the development and application of advanced statistical models for spatial and spatial-temporal data in a Bayesian hierarchical modeling framework. The data considered in this course include spatially referenced normal, binary, count and time-to-event health outcomes. Statistical methods covered include linear and Poisson regression, spatial survival analysis, spatial longitudinal analysis, multivariate disease modeling and spatio-temporal disease mapping. Students will gain practical experience in the application of the methods in commonly used software packages.

BIOS 650. Design and Analysis of Response Surface Experiments. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students with graduate status in mathematical sciences or systems modeling and analysis, or by permission of the instructor. Philosophy, terminology and nomenclature for response surface methodology, analysis in the vicinity of the stationary point, canonical analysis, description of the response surface, rotatability, uniform information designs, central composite designs and design optimality. Crosslisted as: STAT 650.

BIOS 653. Biostatistical Methods I. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Introduces applied biostatistical concepts intended primarily for graduate students in the Department of Biostatistics. Topics include linear algebra for statistical algorithms, distributions of quadratic forms, simple and multiple linear regression, model selection and regression diagnostics, analysis of variance and covariance, and linear mixed effects models.

BIOS 654. Biostatistical Methods II. 4 Hours.

Semester course; 4 lecture hours. 4 credits. Prerequisite: BIOS 653. Continued study of applied biostatistical concepts intended primarily for graduate students in the Department of Biostatistics. Topics include categorical data analysis, generalized linear models, generalized linear mixed models, generalized additive models, nonlinear regression and survival analysis.

BIOS 658. Statistical Methods for High-throughput Genomics Data I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOS 524; and BIOS 544 or BIOS 654. Provides a detailed overview of all aspects pertaining to the preprocessing and analysis of data from high-throughput genomic experiments, such as normalization techniques, expression summaries, quality control assessments and data reduction methods. Presents strategies for class and identification of important molecular features. Includes hands-on experience using statistical software for processing and analyzing genomic data.

BIOS 660. Sequential Analysis and Advanced Design and Analysis of Clinical Trials. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOS 514 and BIOS 654. Sequential methods versus fixed sample methods; the sequential probability ratio test with extensions and modifications; some applications of Cox's theorem; overview of analysis of clinical trials; closed and truncated tests; group sequential tests in clinical trials; sequential monitoring; sequential estimation; other topics with emphasis in clinical trials.

BIOS 667. Statistical Learning and Data Mining. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisites: BIOS/STAT 514, BIOS 524 and BIOS 654. Provides a detailed overview of statistical methods used to discover the underlying structure of large complex datasets. Specific topics will include discrimination analysis, k-nearest neighbors, naive Bayes classifiers, classification and regression trees, ensemble methods, random forests, L1 penalized models, bootstrap and cross-validation methods. The course includes hands-on experience using statistical software for each method.

BIOS 668. Statistical Methods for High-throughput Genomic Data II. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Prerequisite: BIOS 658. A continuation of the prerequisite course that will introduce methods of additional high-throughput genomic assays, including comparative genomic hybridization for copy number change analysis and next generation sequencing methods. Methods that will be addressed include issues in mapping reads, variability in representation of sequences, normalization of raw count data, ChIP-Seq analysis and RNA-Seq analysis.

BIOS 671. Nonlinear Models. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOS 554. Nonlinear modeling is an important tool for biostatisticians working with clinical and pre-clinical applications of dose responsiveness. Addresses issues regarding estimation, inference and experimental designs associated with nonlinear models. Special attention is paid to sigmoid-shaped models and threshold or piecewise models. Both the generalized nonlinear least-squares and quasi-likelihood estimation criteria are developed for these models. In addition to the usual univariate data structure, nonlinear mixed models are described and illustrated with examples. Includes hands-on experience with available SAS software for data analyses.

BIOS 688. Applied Bayesian Biostatistics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces the basic paradigm of Bayesian statistics along with the tools toward application of the methods in various data analysis situations. Covers Bayesian point estimation, interval estimation and model selection in univariate and multiparameter cases. Both conjugate and nonconjugate problems will be discussed. Modern Bayesian computation tools, such as rejection sampling, importance sampling, Gibbs sampling and Metropolis-Hastings algorithm, will be introduced with details of applied examples. A first introduction to Bayesian nonparametrics will also be done.

BIOS 690. Biostatistical Research Seminar. 1 Hour.

Semester course; 1 lecture hour (delivered online or face-to-face). 1 credit. Talks by the students, faculty, and visitors describing recent research or reviewing topics of mutual interest.

BIOS 691. Special Topics in Biostatistics. 1-4 Hours.

Semester course; lecture and laboratory hours by arrangement. 1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized biostatistical procedures not available in other courses or as part of the research training.

BIOS 692. Special Topics. 1-3 Hours.

Semester course; 1-3 variable hours. 1-3 credits. Lectures, tutorials, library assignments in selected areas not available in other courses or as part of the research training. Graded as S/U/F.

BIOS 697. Directed Research in Biostatistics. 1-15 Hours.

Semester course; 1-15 credits. Research leading to the M.S. or Ph.D. degree and elective research projects for other students.

Epidemiology (EPID)**EPID 548. Applied Data Analysis Lab. 3 Hours.**

Semester course; 3 laboratory hours. 3 credits. Prerequisite: BIOS 543 with a minimum grade of B. Corequisite: BIOS 544. Enrollment is restricted to graduate students in the Master of Public Health program; other graduate students may enroll with permission of instructor and program administrator. Lab sessions will focus on hands-on data analysis and presentation techniques using SAS statistical software. Techniques and approaches include basic SAS principles such as data manipulation, descriptive procedures, testing, data visualization, linear and logistic regression, model building, Poisson regression and survival analysis. The labs will also provide exercises to help students more fully understand the statistical principles presented in the corequisite biostatistics lecture course.

EPID 571. Principles of Epidemiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Offers the theoretical foundations, concepts and principles of epidemiological research methods utilized to examine the distribution and determinants of diseases or other health problems. Entails understanding of measures of disease frequency and association, descriptive and analytic studies, community surveys, sampling, bias, confounding surveillance, outbreak investigation, screening and research proposal writing. Also provides basic foundations for data analysis and its translation into health care planning, management and policy formulation.

EPID 580. Public Health Ethics. 1 Hour.

Semester course; 1 lecture hour (delivered online, face-to-face or hybrid). 1 credit. Enrollment is restricted to graduate students, specifically, public health majors and clinical research certificate students. This course explores basic theoretical perspectives, values and principles underlying the field of public health ethics, and examines: the Public Health Code of Ethics; differences between public health ethics and medical ethics; ethical aspects of federal and state public health practices, including legal powers given to public health, and related privacy and confidentiality issues; social justice and the effects of structural bias, inequity and racism; application of ethical analysis frameworks to public health issue analysis and decision-making; barriers to the ethical practice of public health; and how to respond to unethical events.

EPID 593. Foundations of the Public Health Profession. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Enrollment is restricted to M.P.H. program students (public health majors). The purpose of this course is to provide students with insight into (1) public health as a discipline and the work of public health organizations and (2) knowledge of and skill in some of the practical and professional skills necessary for the field. The course addresses public health history, philosophy, and values, roles and responsibilities, including the 10 Essential Public Health Services. Students learn about the varied roles of state, local and non-governmental agencies through sessions with public health professionals. This course also provides students with training in the appropriate policies and procedures for the conduct of human subjects research protection; basic leadership principles for effectively leading work and other teams; effective approaches for conducting difficult conversations; techniques for negotiation and conflict mediation; and approaches for effective resource management for a project or organization.

EPID 600. Introduction to Public Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Describes the public health system in the United States. Explores the disease prevention and philosophy and foundations of public health management, economics, law, ethics and education. Examines the use of epidemiology and statistics to determine personal, environmental, and occupational health problems.

EPID 601. Contemporary Issues and Controversies in Public Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course introduces students to current issues and controversies in public health such as HIV transmission risk behavior, poverty, globalization, gun control, health care access and obesity. Students will be able to describe these controversies and argue differing perspectives on the major issues.

EPID 603. Public Health Policy and Politics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EPID 580 or permission of instructor. Provides an understanding of the public health policy development process, the influence of politics and special interest groups on this process, and current governmental policies for the provision of major public health services. The legislative process is a major focus of the course.

EPID 604. Principles of Environmental Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The course is designed to provide an overview of environmental health. It provides an introduction to the methods used to understand the impact of environmental hazards on human health, such as toxicology, exposure assessment and environmental epidemiology; surveys the nature and control of environmental hazards that may cause or exacerbate health issues; and touches on some hot topics and current controversies in the field. In addition to providing a broad introduction to environmental health, this course aims to teach students how to research environmental health topics and critically assess environmental health literature.

EPID 606. Epidemiologic Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOS 543, EPID 548 and EPID 571, all with minimum grade of B. Focuses on examining the design, conduct and analysis of major epidemiologic studies and the methods to deal with the problems of bias, confounding and effect modification; using multivariate modeling techniques to build logistic regression and Cox proportional hazards models to answer relevant research questions; solving meta-analytic problems using fixed and random effects models; understanding specific research areas of disease screening and exposure assessment; writing a research paper based on literature review and data analyses of a large dataset demonstrating application of essential epidemiologic and biostatistical principles.

EPID 620. Cancer Epidemiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EPID 571 and BIOS 543, both with a minimum grade of B. Enrollment is restricted to students in the doctoral program in epidemiology and the Master of Public Health program. Students review the epidemiology of major cancers by anatomic site and discuss seminal studies and current issues in cancer epidemiological research, including methodology, cancer surveillance, international studies, observational studies and intervention trials. The course will include an overview of basic concepts pertinent to cancer epidemiology research and prevention including biology, descriptive statistics, risk factors and genetics. Selected publications from epidemiological literature provide examples for student-faculty discussion.

EPID 622. Maternal and Child Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EPID 548, EPID 571 and BIOS 543, all with minimum grades of B; or permission of instructor. Exposes students to current issues in maternal and child health in the U.S., taking an applied approach that balances discussion of literature, applications to public health practice and practical data experience. The course will explore how policies and social determinants of health influence MCH outcomes. Students will learn about key MCH topics including intergenerational risk factors, low birth weight, infant mortality, developmental disabilities and injury and violence prevention. Students will use epidemiological methods to evaluate MCH data to determine risk and protective factors for women and children and describe how these data guide public health policy and program-planning efforts.

EPID 623. Injury and Violence Epidemiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EPID 548 and EPID 571, both with a minimum grade of B. Enrollment is restricted to majors in public health and epidemiology; others by permission of instructor. This course will introduce students to current issues and methods in injury and violence epidemiology using primarily a domestic focus. Students will learn about key injury-related topics, including motor vehicle traffic crashes, drug overdoses, drowning, traumatic brain injuries, suicide and self-harm, homicide/assault, and intimate partner violence, with an emphasis on methods commonly used to conduct surveillance and analyze data, as well as related prevention strategies and theories of causation. Students will be able to describe how epidemiological methods are used to determine incidence and prevalence within populations, identify risk and protective factors, and describe how injury and violence surveillance data guide public health policy and program planning efforts.

EPID 624. Chronic Disease Epidemiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EPID 571 with a minimum grade of B or permission of the instructor. Course will cover the contribution of chronic diseases to population disease and disability as well as identify the incidence, prevalence and financial impact of each of the model diseases addressed. At the conclusion of the course, the student should be able to apply the concepts to all chronic diseases. The student will analyze selected current research in the area and determine points at which translational research is likely to improve the ability of the health care system to manage these problems.

EPID 626. Environmental Epidemiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EPID 571 and BIOS 543 with a minimum grade of B. Enrollment is restricted to graduate students. Students will gain an understanding of epidemiologic methods specific to Environmental Health. The course provides a conceptual framework for the study of health effects in populations resulting from exposure to physical, chemical, and biological agents. This includes the contribution of health effects of water and air pollution, radiation threats and exposures, social, economic, and cultural factors (e.g., urbanization, transportation, agriculture, manufacturing, energy production) related to those exposures. The goal of this course is for students to develop a current understanding of the relationships between environmental exposures and health outcomes through the use of epidemiologic methods and provides the opportunity for students to focus in-depth on a particular area of interest.

EPID 628. Public Health Program Planning and Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: EPID 571 and EPID 593. Enrollment is restricted to graduate students in any concentration within the Master of Public Health program; other graduate students may enroll with permission of instructor and program administrator. This course provides an overview of the process of public health program planning, including assessment, design, planning, implementation and evaluation. Students examine the methods frequently used to determine whether health-related programs are achieving their objectives. Students will gain practical experiences through a series of in-class and team-based exercises and will leave the course with an understanding of how to implement public health programs and evaluate their effectiveness.

EPID 645. Public Health Genomics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course provides an overview on the influence of genetic and environmental factors and their role in population health. Students will learn fundamental concepts in genetics and genomics, including advances in genomic technologies, and examine the challenges of integrating genetic and genomic technologies into clinical practice and public health and the impact of such applications on society. Learning approaches will include didactic lectures, case studies, readings, practical activities and an exploration of genomic test results.

EPID 646. Epidemiology of Psychiatric and Substance Use Disorders. 3 Hours.

Semester course; 2 lecture and 1 laboratory hours. 3 credits. This course is intended to introduce the descriptive and analytic epidemiology for major mental disorders of childhood, adulthood and late adult life. The course will address three main topics: (1) conceptual and methodological considerations in psychiatric epidemiologic research, (2) the descriptive epidemiology of major psychiatric and substance use disorders and (3) the analytic epidemiology of major psychiatric and substance use disorders. The course will also examine issues of classification and the nosology of psychiatric disorders as well as operational case definitions and the measurement techniques for field surveys and risk-factor research. Students will become familiar with epidemiologic surveys appropriate for risk factor research for psychiatric and substance use disorders. Prerequisite for master's students: EPID 571 with a minimum grade of B; prerequisite for doctoral students: EPID 650 with a minimum grade of B; or permission of instructor.

EPID 649. Analysis of Health Datasets. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Corequisites: EPID 650 and STAT 643, or permission of instructor. Epidemiologic research, health services research and social/behavioral science research very often conduct "secondary analysis" of existing population-level datasets, as well as different forms of health care data (claims data, electronic prescribing data, electronic medical records). At the end of the course, students will be familiar with the scope of available large, population-based public datasets for health care and public health research. They will understand the strengths and limitations of using these datasets for secondary research and be able to apply this understanding to decisions regarding research questions, dataset use and analysis plans. In the process, they will also develop skills in manipulating complex administrative data sources (including claims data, electronic prescribing data and electronic medical records). Students will acquire knowledge to deal with potential challenges in implementing case-control or cohort studies based on data collected for reasons other than for research. Competencies in sampling methods, weighting, small area estimation techniques, probabilistic matching, multiple imputation methods, geocoding and other issues will be emphasized. Students will download, link and analyze several data sets to understand the advantages of these data. Familiarity with statistical analysis software is required.

EPID 650. Epidemiologic Methods for Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the doctoral program in epidemiology; other doctoral students require permission of the instructor. Students will learn principles of epidemiologic methods and their application for analysis and interpretation of public health data. This course provides advanced introductory training for conducting epidemiologic investigations of disease etiology, surveillance and health care services, as well as for interpretation of published epidemiologic studies. Upon completion, students should be sufficiently familiar with epidemiologic research methods to begin applying these methods in their own work. The course is intended for doctoral students in epidemiology or related disciplines.

EPID 651. Intermediate Epidemiologic Methods for Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: EPID 650, minimum grade of B. Course will provide in-depth understanding of epidemiologic methods and their application for analysis and interpretation of public health data. This course emphasizes decision-making in research methods to increase the efficiency of study design by reducing bias. Students will gain expertise in methodologic thinking as applied to their own work. Nonexperimental study designs are the focus of the class. Course provides opportunities for students to develop expertise in reading epidemiologic methods research. Upon completion, students should have attained expertise in epidemiologic research methods to apply in their own work. The course is intended for doctoral students in epidemiology or related disciplines.

EPID 652. Advanced Epidemiologic Methods and Data Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOS 573 or BIOS 602; and EPID 651, both with a minimum grade of B. Focuses on development of analytical strategies for data analysis guided by epidemiologic principles. Specific statistical modeling will be tailored for analysis of data from cross-sectional, case-control and cohort studies with emphasis on causal inference, prediction, controlling for confounding and assessment of interaction and intermediate effects. Course topics include logistic regression, Poisson regression, Cox proportional hazards model, propensity score method, generalized estimating equations and path analysis technique.

EPID 690. Journal Club. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Talks given by students and faculty describing and critiquing recent published research or review articles. Graded as S/U/F.

EPID 691. Special Topics. 1-6 Hours.

Semester course; variable hours. 1-6 credits. This course provides the opportunity for students to focus in depth on a particular area of interest and allows students to tailor their education to their specific needs and interests. Such flexibility adds strength to the program and promotes the independence of dedicated students. Arrangements are made with the appropriate faculty member.

EPID 692. Independent Study. 1-6 Hours.

Semester course; variable hours. 1-6 credits. Provides the opportunity for students to explore a topic of interest under the direction of a faculty member. A proposal must be submitted for approval and credits are assigned commensurate with the complexity of the project. Arrangements are made directly with the appropriate faculty member and graduate program director.

EPID 693. Public Health Internship. 1-3 Hours.

Semester course; 1-3 field experience hours. 1-3 credits (60 hours per credit). Prerequisites: 18 credits in the M.P.H. program; EPID 571, BIOS 543 and SBHD 605, all with minimum grades of B. Students will spend 180 hours in a planned, supervised experience working to support a community agency or organization. Such agencies might include a nonprofit organization such as the Institute for Public Health Innovation or a local, state or federal public health agency. Graded as S/U/F.

EPID 694. MPH Capstone Project. 1-3 Hours.

Semester course; 1-3 field experience, independent study or research hours. 1-3 credits. Enrollment is restricted to students the M.P.H. program (any concentration) and requires submission of a program-approved capstone project proposal and agreement form and approval by the program director. Each student will complete a research project that demonstrates the application of the knowledge acquired in the MPH program. The student will answer one or more relevant research or applied practice questions; the final product is a scholarly written report of publishable quality. A proposal must be submitted for approval and credits are assigned commensurate with the complexity of the project. Arrangements are made directly with a faculty member and approved by the graduate program director.

EPID 696. Special Topics. 1-3 Hours.

Semester course; 1-3 variable hours. 1-3 credits. Provides the opportunity for students to focus in depth on a particular area of interest and allows students to tailor their education to their specific needs and interests. Such flexibility adds strength to the program and promotes the independence of dedicated students. Arrangements are made with the appropriate faculty member. Graded as S/U/F.

EPID 697. Directed Research in Epidemiology. 1-15 Hours.

Semester course; 1-15 credits. Research leading to the Ph.D. degree. Graded as "S," "U" or "F".

Healthcare Policy and Research (HCPR)**HCPR 601. Introduction to Health Policy. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. The course will familiarize students with the major players and issues in health care policy, using health reform in the U.S. as a framework through which to analyze the issues of cost, quality and access, and will focus on the roles of payers, providers and patients in the health care system. This course is interactive and uses studies from the scientific literature, class discussion and lectures from experts in the field. Students are required to write a paper evaluating the challenges regarding a public health policy topic in the U.S. and prepare a group presentation addressing questions related to key issues of the U.S. health care system.

HCPR 610. Foundations in Health Services Research Methods. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Will provide students with the opportunity to learn and apply basic data analysis skills and statistical methods common in health services research including programming, data cleaning and fundamental approaches in univariate, bivariate and multivariate analyses.

HCPR 691. Special Topics in Healthcare Policy and Research. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for a maximum of 6 credits. Prerequisite: permission of instructor. The course may include discussion of research topics of emerging interest/ importance and published papers of current interest; new findings in health services research, health economics and health policy; and the application of research methods and study design to current topics within the broad field of healthcare policy and health services research, focusing on interdisciplinary research and applied methods. Graded S/U/F.

HCPR 692. Special Topics in Healthcare Policy and Research. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for a maximum of 6 credits. Prerequisite: permission of instructor. The course may include discussion of research topics of emerging interest/ importance and published papers of current interest; new findings in health services research, health economics and health policy; and the application of research methods and study design to current topics within the broad field of healthcare policy and health services research, focusing on interdisciplinary research and applied methods.

HCPR 697. Independent Study in Healthcare Policy and Research. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for a maximum of 6 credits. Provides the opportunity for students to conduct research under the direction of a faculty member. A proposal for a course of study must be submitted to and approved by the program director of the Ph.D. in Healthcare Policy and Research. Credits will be assigned commensurate with the complexity of the project. Arrangements are made directly with the appropriate faculty member and department chair. Graded as S/U/F.

HCPR 699. Departmental Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Students will attend seminars presented by faculty and invited guests on topics and trends within health policy and health services research. Students and faculty will meet weekly to discuss the theoretical concepts and papers presented and other related topics. Graded as S/U/F.

HCPR 701. Health Services Research and Policy I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The first course of a two-semester sequence intended to familiarize students with the major players and issues in health care policy, using health reform in the U.S. as a framework through which to analyze the issues of cost, quality and access and to help students develop an independent research proposal. The focus is on the roles of payers, providers and patients in the health care system. This course will be interactive and use studies published in the scientific literature, policy briefs, government reports and textbooks about the health care system as teaching tools. Students will be required to write several short response papers addressing questions related to key issues under health reform as well as develop a research topic and conduct a literature review related to that topic.

HCPR 702. Health Services Research and Policy II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HCPR 701 or permission of instructor. The second course of a two-semester sequence intended to familiarize students with the major health care providers and issues in health care policy and health services in the U.S. The course will mainly focus on health care delivery and quality of care and also introduce the issues of costs and access. The course will be interactive and use studies published in the scientific literature. Students will be required to critique and present research articles related to the topics studied while developing conceptual frameworks, hypotheses and key measures of quality, cost or access for their own research papers.

HCPR 703. Health Economics: Theory and Principles. 3 Hours.

Semester course; 3 lecture hours. 3 credits. A doctoral-level course in health economics with a focus on the theory and principles forming the basis of the field. Students will study foundational theory and research as well as recent applied studies contributing to the current knowledge in the field. Upon completing the course, students should have the theoretical grounding to allow them to frame applied research questions in health economics in terms of past theory and research as well as a sense of where further evidence is needed.

HCPR 720. Social and Economic Determinants of Health Disparities. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires students have completed a graduate course in biostatistics, epidemiology or econometrics. This doctoral-level survey course is designed to study social and economic determinants of health inequities and approaches to addressing them. Integrating perspectives from various disciplines, including sociology, psychology, epidemiology and health services research, students will examine root causes of health inequities and evaluate solutions. Invited expert guest lecturers will enhance the students' learning experience during the course. Students will be expected to participate in all class discussions and activities; present a research topic of their choosing; and complete a hypothesis-driven research project that will demonstrate the ability to use theoretically grounded approaches to the empirical study of health disparities.

HCPR 730. Survey Research Methods and Analysis for Health Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ECON 612 or equivalent or permission of instructor. This course is intended to familiarize students with the design and use of surveys for health services research and health policy; to understand the strengths and limitations of health surveys; and to compare and contrast health surveys with other data sources such as administrative records, claims data and electronic medical records. The course is designed to focus more on the applied use of health surveys for research and less on the theoretical aspects of survey and sample design. Class lectures and assignments are designed to guide students incrementally through the actual development and completion of a research project using publicly available survey data.

HCPR 731. Principles of Programming for Health Services Research. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Data analysis in health services research requires data management, organization and manipulation. This course introduces principles of programming for health services researchers with applications in SAS and Stata. Upon completion, students should be familiar with techniques to load, clean, manage and manipulate data in preparation for data analysis.

HCPR 732. Research Design and Proposal Preparation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on the design of experimental, quasi-experimental and nonexperimental studies in the healthcare field. Issues related to measurement will be stressed. Specific learning objectives include exploring the methodological issues in health services research; assessing scientific research and causal inference; evaluating a research problem and developing testable hypotheses; conducting data collection and assessing the sampling process; evaluating variable definition in terms of validity and reliability; assessing the various facets of experimental, quasi-experimental and observational designs; and preparing a healthcare research proposal.

HCPR 733. Statistical Methods in Analysis of Healthcare Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOS 553; ECON 612; and one of BIOS 625, BIOS 631, BIOS 646 or ECON 642; or permission of instructor. Exposes students to large survey and administrative databases that are commonly used in health services research. Students will learn how to organize files, protect data and link databases from multiple sources by applying state-of-the-art deterministic and probabilistic linkage methods. Students will check the quality of merged datasets and learn the advanced techniques used in handling common problems such as missing data, selection bias and handling extreme outliers. Students will also apply the statistical methods that meet the qualities of these data in order to evaluate healthcare interventions and policies. This will be a hands-on course requiring students to download and manipulate data. While the primary emphasis is not on mathematical theory, a certain amount of theoretical background may be presented for some topics.

HCPR 734. Economic Evaluation and Decision Analysis in Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires an introductory course in probability and statistics. Introductory economics is recommended but not required. Introduces doctoral students to the methods, theory and growing range of applications of economic evaluation and decision analysis for health care technology assessment, health policy analysis, medical decision-making and health resource allocation.

HCPR 735. Health Policy in Virginia. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course introduces students to legislative processes in Virginia, particularly as they relate to health policy-making. Students will learn how bills become law in Virginia, how to track their progress, how citizen and lobbyist input influences the legislative process. Students will also learn how to draft policy briefs to communicate research to a wide array of stakeholders.

HCPR 899. Directed Research. 1-9 Hours.

Semester course; 1-3 variable hours. 1-3 credits. Prerequisites: completion of required course work and comprehensive examination. Students are required to conduct and prepare a written dissertation under the guidance of a faculty committee. The dissertation is written in traditional academic style, consists of three papers and must be orally defended. Students must be continually enrolled in this course until the dissertation is successfully completed and approved. A minimum of nine dissertation credits must be taken. Graded S/U/F.

Social and Behavioral Health (SBHD)**SBHD 501. Topics in Cancer Disparities. 1 Hour.**

Semester course; 1 lecture hour (delivered online). 1 credit. This course will provide an overview of cancer health topics to students from diverse disciplines, including the humanities and sciences, where they will learn more about the continuum of cancer research and various cancer topics. The course will be highly interactive, with emphasis placed on engaging the learner with the course materials. Students will meet every other week to attend a zoom session where they will hear from a guest lecturer about a cancer topic. All other assignments will be completed online.

SBHD 502. Principles of Community-engaged Research. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. This course will provide an introduction to the principles of community-engaged research to students from diverse disciplines. Students will be introduced to key community-engaged research competencies, including the fundamental principles, identifying key stakeholders and developing a basic understanding of collaborations with community partners relevant to social and behavioral sciences. Students will complete the course with the skills necessary to identify the key concepts, barriers and opportunities to engage different stakeholders and to communicate with different audiences for health education and promotion purposes. This course will be highly interactive, and students will participate in online discussion groups and complete various assignments, which will provide ample opportunities for the practical application of the key principles in community-engaged research with relevance to public health and health promotion efforts. Students will have the opportunity to use technology to create an interactive learning environment and apply concepts to the various community-based scenarios to demonstrate an understanding of the material. Importantly, students will have the opportunity to learn from and with community members to further inform their understanding of community-engaged research within the context of social and behavioral sciences.

SBHD 605. Introduction to Social and Behavioral Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course addresses the influence of social and behavioral factors impacting public health, covering both historical perspectives and current issues. Topics covered include the theoretical foundations of social and behavioral health; the sociocultural context of health, health promotion and disease prevention interventions; and special populations and topics.

SBHD 608. Health Communication. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Basic course for students in public health with limited experience conducting public health research. Focuses on the history and theories of health communication, social marketing and media advocacy, audience research and segmentation, entertainment education, e-health, provider/patient communication, technology transfer to service providers, media relations and media monitoring, emergency risk communication, and evaluating communication campaigns. Students plan an entire social marketing campaign.

SBHD 609. Research Methods in Social and Behavioral Health I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students. Recommended preparation: SBHD 605. A didactic and experiential course that provides an introduction to applying social and behavioral qualitative, quantitative and evaluation research methods to public health issues.

SBHD 610. Behavioral Measurement. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Recommended preparation: SBHD 605. Introduces students to theories and applications of measuring constructs in social and behavioral sciences. Examines test theories, processes involved in developing tests and the standards against which tests are compared.

SBHD 611. Health Literacy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Designed to provide doctoral students an overview of health literacy and its relationship to health outcomes and health disparities. Class material will cover the research and theories in contemporary literature in health literacy.

SBHD 612. Fundamentals of Cancer Health Equity. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to graduate students. This course is designed to provide students with training and skills development focused on the fundamentals of cancer prevention and control, and to specifically do so through a lens of health equity. The course takes a multidisciplinary approach to facilitate the understanding of the distribution of several types of cancer from local to global settings and how to identify their causes (risk factors). Students will learn about the national and international systems of cancer surveillance, how these sources of data drive research across multiple levels from patient-facing clinical settings to communities to those that inform policy-making. The course will also highlight the gaps in the current surveillance infrastructure and the limits of the data they produce as well as opportunities to improve their impact on the health of persons diagnosed with cancer. With a foundation in the principles of health equity, students will learn how to identify compelling research questions with real-world implications for improving public health across diverse communities, especially those who are most affected by cancer. This includes developing an understanding of the importance of ensuring equitable access to care across the cancer-control continuum – from cancer prevention to screening and diagnosis of cancers, through treatment, survivorship and up to palliative care at the end of life.

SBHD 613. Community-engaged Research and Cancer Disparities. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to graduate students. This course is designed to engage students from diverse disciplines, including social sciences, public health and basic sciences, to learn more about community-engaged research as a viable approach to address cancer health disparities. The course provides an overview of community-engaged research, of cancer health disparities and of understanding the significant role of social determinants as a contributing factor – as well as a viable conceptual framework to addressing – cancer disparities. The focus of this class is on learning to apply community-engaged research approaches to address cancer disparities. Community-engaged research is framed as an evidentiary approach that strongly aligns with the translational research continuum. This course will be highly interactive with a strong emphasis placed on engaging the learner with the course materials. Students will use VoiceThread (freely available to VCU students), a web-based application that allows them to use images, slides, videos and documents to create presentations that will allow others to view and respond as part of an asynchronous conversation. As part of their engaged experience, students will interview two cancer survivors to learn more about their experiences and to obtain their input on areas of improvement along the continuum of cancer prevention and control. Finally, students will develop a cancer research plan that provides the opportunity to apply their community-engaged research knowledge to address a cancer disparity of their choice.

SBHD 619. Research Methods in Social and Behavioral Health II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SBHD 609. Enrollment restricted to graduate students. Advanced application of social and behavioral qualitative, quantitative, intervention and evaluation research methods to public health issues.

SBHD 630. Theoretical Foundations of Social and Behavioral Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course addresses the theoretical foundations of social and behavioral health, discussing both classic and emergent theories. The course begins with an overview of theoretical concepts, constructs and variables; how to construct theoretical statements; and how to evaluate social science theories. The majority of the course is spent describing theories and models at the individual, interpersonal and community level and evaluating their utility in changing health behavior. The course concludes with a discussion of the state of the discipline and future directions in health behavior change theory and research.

SBHD 631. Disseminating, Adopting and Adapting Evidence-based Prevention Programs. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Preventive interventions that have been evaluated and found to be effective should serve as the standard for community-based public health practice. This advanced seminar will examine theories relevant to the diffusion of these evidence-based interventions (EBI), EBI dissemination procedures and policy, and evaluation of EBI adoption, fidelity monitoring and adaptation.

SBHD 632. Health Disparities and Social Justice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This seminar is designed to provide students with an understanding of the concept of health disparities, reasons for disparities and how social factors contribute to disparities in health care and outcomes. The material will cover the research and theories in contemporary medical, epidemiologic and social justice literature.

SBHD 633. Structural Equation Modeling. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces students to principles and applications of structural equation modeling for testing theories in social and behavioral sciences. Examines latent variables with continuous and discrete distributions, multimethod measurement modeling under the latent variable framework, latent variable modeling of longitudinal measurement designs and testing mediation and moderation using structural equation modeling.

SBHD 634. Patient-Provider Interaction. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the social and behavioral sciences or healthcare policy and research Ph.D. programs or with permission of the instructor. This course will cover theories, principles and applications used to produce high quality research in patient-provider communication. The course will educate students on communication theories that support this research, practical applications of these theories and different methodologies to guide research. The course will provide an overarching focus on health disparities and research conducted in particular topic areas to ameliorate disparities in the experience of minority patients including, but not limited to, racial, sexual and gender, and socioeconomic equality and the intersection between these domains. Students will have the opportunity to analyze published research as well as develop their own plans for a research project.

SBHD 635. Anthropology and Public Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: doctoral student or M.P.H. student or permission of instructor. Provides students with an advanced introduction to anthropology as a means for exploring public health. Through ethnographic case studies (articles, books and films), the course examines cultural dimensions of illness experience and diverse models of healing and treatment, paying particular attention to political, economic, spiritual and other cultural factors that influence health inequalities, treatment and health behaviors. Approximately 80 percent of the course material focuses on international health. The course is a readings seminar rather than a methodological course; however, students will be asked to think critically about the ways that anthropological methods can contribute to public health practice.

SBHD 636. Community-based Participatory Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: doctoral student in social and behavioral health or permission of instructor. This seminar provides students with an understanding of the theories, principles and strategies of conducting CBPR. This class will meet once a week for approximately three hours. Although some lectures will be presented, the main format for the class will reflect the participatory as well as critical reflectiveness required to conduct CBPR. Co-learning will be emphasized against a backdrop of health research. The second major component of this class will be an interactive and hands-on field experience where students will experience the context and learn the methods to use when conducting participatory research for health. Students will work closely with a community partner and will use participatory research methods to address a community partner need.

SBHD 637. Program Evaluation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students admitted to the doctoral program in social and behavioral sciences or with permission of the instructor. This course examines the evaluation methods used to determine whether – and how – health-related programs are achieving their objectives. Several types of evaluations will be covered, with a focus on process and outcome evaluations. Topics relevant to evaluation practice, including evaluation design and result dissemination, will be addressed. Students will learn how to judge the quality of evaluation designs, distinguish appropriate from inappropriate evaluations and be given the opportunity to apply the principles and techniques of evaluation science to the creation of a detailed evaluation plan. Materials will be presented in several ways, including lectures, guest lectures, in-class exercises, student presentations, classroom discussions and written assignments.

SBHD 638. Applications in Qualitative Research Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: doctoral student in social and behavioral health or permission of instructor. This course will cover theories, principles and applications to enable high quality research using qualitative research methods. This course will educate students on theories of qualitative research, different methodologies used to gather qualitative data and practical applications of these theories and methods to guide research development in this area. Students will be given the opportunity to analyze published research, conduct qualitative analyses using previously collected data, code and quantify qualitative data, and develop their own plans for a research project.

SBHD 639. Intervention Development and Implementation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: doctoral-level course work in research methods and health behavior theory; permission of instructor. The goal of this course is to provide students with knowledge and applied skills in the development and implementation of behavioral interventions to promote health and prevent disease. Students will receive training in evidence-based behavioral medicine approaches and best practice methods for effectively promoting behavior change in individuals and families. The course takes a sequential and hands-on approach in which students will learn about each step of the intervention development and implementation process and will gain experience applying what they learn to the development of their own intervention. Relevant methodological issues will be covered, with an emphasis on design and methods for randomized controlled trials testing individual-level behavioral interventions across settings. Students will learn to think critically about how to balance theory, empirically supported strategies and pragmatic considerations in the development and execution of intervention trials, with an emphasis on achieving maximum impact in their work. Course objectives will be achieved through lectures, experiential in-class activities, informal Q&A with Pls about their experiences developing and implementing intervention trials, student presentations, classroom discussion and written assignments that map on to key sections of a grant proposal.

SBHD 640. Seminar in Mixed Methods Research. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisites: SBHD 609, SBHD 619 and SBHD 638, or permission of instructor. This course provides an overview of best practices in mixed methods research in the social and behavioral sciences and serves as a methods capstone course for SBS doctoral students who have completed the foundational research methods and applications in qualitative research methods courses.

SBHD 690. Departmental Seminar. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Students and faculty meet weekly to discuss new research and literature in the field of social and behavioral health. Talks given by students and faculty will cover recent articles and trends in the field. Graded as S/U/F.

SBHD 691. Special Topics. 0.5-4 Hours.

Semester course; 0.5-4 lecture hours. 0.5-4 credits. Lectures, tutorial, workshops and/or library assignments in selected areas of advanced study which are not available in other courses or as part of the research training. Graded as S/U/F.

SBHD 692. Special Topics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This letter-graded course will include lectures and other activities in areas of advanced study which are not available in other courses or as part of research training.

SBHD 693. SBHD Internship. 1-3 Hours.

Semester course. variable hours (60 hours per credit). 1-3 credits. Students will spend 60 to 180 hours in a planned, supervised experience with a community agency. Such agencies might include a local free clinic or other nonprofit organization, such as the American Cancer Society, or a local, state or federal public health agency. Graded as S/U/F.

SBHD 694. MPH Project. 1-6 Hours.

Semester course; variable hours. 1-6 credits. Each student will complete a research project that demonstrates the application of the knowledge acquired in the M.P.H. program. The student will answer one or more relevant research questions. The final product is a scholarly written report of publishable quality. A proposal must be submitted for approval and credits are assigned commensurate with the complexity of the project. Arrangements are made directly with the faculty adviser. Graded as S/U/F.

SBHD 695. Independent Study. 1-3 Hours.

Semester course; 1-3 independent study hours. 1-3 credits. Provides the opportunity for students to explore a special topic of interest under the direction of a faculty member. A proposal for a course of study must be submitted to and approved by the program director of the social and behavioral science doctorate; credits will be assigned commensurate with the complexity of the project. Arrangements are made directly with the appropriate faculty member and the program director. Graded as S/U/F.

SBHD 697. Directed Research in Social and Behavioral Health. 1-15 Hours.

Semester course; variable hours. 1-15 credits. Requires students to conduct and prepare a written dissertation under the guidance of a faculty committee. The dissertation is written in traditional academic style and must be orally defended. Students must be continually enrolled in this course until successfully completed and approved. A minimum of 9 credits of this course must be taken to complete the degree. Graded as Pass/Fail.

School of Social Work

Social Work (SLWK)

SLWK 601. Human Behavior in the Social Environment I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Provides a multidimensional theoretical and evidence-based approach to understanding the complex interactions of biological, psychological, spiritual, economic, political and sociocultural forces on the lives individuals, families and groups in a multicultural society. Required core curriculum course.

SLWK 602. Policy, Community and Organizational Practice I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. First of two generalist courses on social policy, policy practice and practice in communities and organizations. Surveys historical evolution of social welfare policy and contemporary provision of social welfare services, including the role of values in policy formulation and principles of social and economic justice. Introduces the social work role as change agent in legislative, community and organizational arenas. Uses social/behavioral knowledge and social work intervention models and applies analytical frameworks for assessing program, organizational and policy effectiveness. Develops skills in identification of need, designing strategies for change and policy analysis. This is a required curriculum course.

SLWK 603. Power, Privilege and Oppression. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enhances understanding of and appreciation for diversity in self and others. Addresses issues of power, inequality, privilege and resulting oppression. Analyzes oppression resulting from persistent social, educational, political, religious, economic and legal inequalities. Focuses on the experiences of oppressed groups in the U.S. in order to understand their strengths, needs and responses. Uses a social justice perspective for the study of and practice with oppressed groups. Required direct practice core curriculum course.

SLWK 604. Social Work Practice with Individuals, Families and Groups I. 3 Hours.

Semester course; 3 lecture hours. 3 credit hours. Pre- or corequisites: SLWK 601, SLWK 602 and SLWK 603. Introduces basic knowledge, skills and values necessary to provide a range of restorative, rehabilitative, maintenance and enhancement services in social work practice with individuals, families and groups. Introduces selected practice theories and models to guide intervention. Emphasizes the multidimensional and diverse contexts in which problems and needs are assessed and in which intervention occurs. Required direct practice core curriculum course.

SLWK 605. Social Work Practice with Individuals, Families and Groups II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SLWK 604 with minimum grade of C. Extends application of beginning knowledge and skills to the phases of intervention with groups and families. Presents knowledge and skills of environmental intervention and termination. Introduces additional selected theories and models for social work practice with individuals, families and groups with attention to special populations and practice evaluation. Required direct practice core curriculum course.

SLWK 606. Policy, Community and Organizational Practice II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SLWK 602 with minimum grade of C. The second of two generalist courses on social policy, policy practice and practice in communities and organizations. Examines values and ethical dilemmas facing professional social workers in organizations, communities and policy-making arenas. Explores legislative/political processes. Develops skills in legislative lobbying, advocacy, design of change strategies and tactics, policy analysis and task group leadership. Emphasizes reciprocal effects of policy on social work practice and implications for social and economic justice.

SLWK 607. Social Work Practice with Individuals, Families and Groups for Advanced-standing Students. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Corequisites: SLWK 608, SLWK 611 and SLWK 612. Enrollment requires admission to the advanced standing program. Students review approaches, principles, techniques and theories of micro social work practice and human behavior. Emphasis is on commonalities and differences among practice modalities, including differential assessment, intervention and evaluation of outcomes. Course includes weekly field instruction integrating seminar. This is a required advanced-standing core curriculum course.

SLWK 608. Social Work Practice in Organizations and Communities for Advanced-standing Students. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Corequisites: SLWK 607, SLWK 611 and SLWK 612. Enrollment requires admission to the advanced-standing program. Presents social work theory and practice focusing on social policy, communities, agencies and interventions in light of principles of social and economic justice. Introduces and analyzes the social work role of policy practitioner with its specific skills and tasks. Demonstrates the importance of understanding the community and the agency in social work practice. Provides skill building in advocacy, planned change, and policy and organizational analysis, as well as weekly field instruction seminar. This is a required advanced-standing program core curriculum course.

SLWK 609. Foundations of Research for Social Work Interventions and Services. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces students to basic research concepts needed to understand and assess social work interventions and services. Students completing this course will understand how to ask questions and develop a feasible methodology to answer questions. This course emphasizes critical-thinking skills and encourages attentiveness to issues of diversity, equity and inclusion. Additionally, this course emphasizes the use of professional social work values when assessing social work programs and services.

SLWK 610. Human Behavior in the Social Environment II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SLWK 601 minimum grade of C. Covers the life course from conception through late adulthood and/or death. Focuses on the influences of biological, psychological, spiritual, economic, political and sociocultural forces on individual and family coping and adaptation. Provides a multidimensional, multicultural perspective on the behavior of individuals and families based on theory and research with identification of the risk and protective mechanisms that influence development. Required core curriculum course.

SLWK 611. Social Work Research for Advanced-standing Students. 3 Hours.

Semester course; 3 credits. Prerequisite: admission to the advanced standing program. Corequisites: SLWK 607, 608 and 612. Reviews approaches to scientific inquiry in the development of knowledge for social work practice; problem formulation; concepts and operational definitions; measurement validity and reliability; selected social work research designs; planned data collection strategies and procedures. Required advanced standing program core curriculum course.

SLWK 612. Advanced Standing Field Instruction. 3 Hours.

Semester course; 3 field experience hours. 3 credits. Corequisites: SLWK 607, SLWK 608 and SLWK 611. Enrollment is restricted to students admitted to the advanced standing program. Reviews generalist-level knowledge, attitudes and skills acquired through social work education at the undergraduate level. Requires application, refinement and the active use of content from the advanced standing curriculum through practice under the direction of an agency-based field instructor, monitored by a faculty field liaison. Emphasizes integration of content from all areas of the generalist foundation curriculum.

SLWK 692. Independent Study. 1-6 Hours.

Semester course; 1-6 credits. Maybe be repeated for credit. Prerequisites: M.S.W. foundation standing and permission of instructor and M.S.W. program director. The student will be required to submit a proposal for study in an identified practice area or for exploration of a specific problem in social work not ordinarily included in the Master of Social Work curriculum. The results of the student's study will be presented in a format determined by the instructor and student to be most effective for assessing study educational objectives/competencies and outcomes. A maximum of four independent study courses may be included in a student's educational program.

SLWK 693. Generalist Field Instruction I. 3 Hours.

Semester course; 3 field experience hours. 3 credits. Pre- or corequisite: SLWK 604. Provides opportunities to master essential social work knowledge, values and skills through practice under the direction of an agency-based field instructor, monitored by a faculty field liaison. Emphasizes integration of content from all areas of the generalist curriculum.

SLWK 694. Generalist Field Instruction II. 3 Hours.

Semester course; 3 field experience hours. 3 credits. Prerequisite: SLWK 693 with minimum grade of C. Pre- or corequisite: SLWK 605. Provides opportunities to master essential social work knowledge, values and skills through practice under the direction of an agency-based field instructor, monitored by a faculty field liaison. Emphasizes integration of content from all areas of the generalist curriculum.

SLWK 695. Block Generalist Field Instruction. 6 Hours.

Semester course; 6 field experience hours. 6 credits. Pre- or corequisite: SLWK 605. Provides opportunities to master essential social work knowledge, values and skills through practice under the direction of an agency-based field instructor, monitored by a faculty field liaison. Emphasizes the integration of content from all areas of the generalist curriculum.

SLWK 703. Mental, Emotional and Behavioral Disorders. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Pre- or corequisites: SLWK 693 and SLWK 694, or SLWK 695, or SLWK 612. This course reviews the epidemiology, etiology, classification (using the current edition of the Diagnostic and Statistical Manual of Mental Disorders) and course of a range of mental, emotional and behavioral disorders and conditions across the life span and the relevance of this knowledge to social work across practice settings. It emphasizes a biopsychosocialspiritual assessment, a risk and protective factors framework, a critical analysis of existing and emerging theory, the impact of difference and diversity, an appreciation of the lived experience of these challenges for clients and their families, and the practical implications of this knowledge for relationship-building and treatment planning as well as interdisciplinary collaboration. Introduces knowledge of psychopharmacology. Required advanced clinical core curriculum course.

SLWK 704. Clinical Social Work Practice I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Pre- or corequisite: SLWK 703. Provides a multitheoretical orientation to intervention across fields of practice with individuals, families, couples and groups. Emphasizes contemporary psychodynamic and cognitive behavioral approaches and their empirical support. Focuses on multidimensional assessment and the differential application of therapeutic, supportive, educational and resource-management strategies to complex problems of children, youth and adults. Required advanced clinical core curriculum course.

SLWK 705. Clinical Social Work Practice II. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Prerequisite: SLWK 704. Continues a multitheoretical orientation to intervention across fields of practice with emphasis on integrated family systems theory and multidimensional family assessment. Focuses on differential application of psychodynamic, cognitive-behavioral, and family systems theories to a range of complex client problems and concerns with attention to diversity populations. Required advanced clinical core curriculum course.

SLWK 706. Research for Clinical Social Work Practice I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Review of statistical inference and decision-making using univariate and bivariate techniques. Introduction to computer applications for quantitative data and methods of analysis of qualitative data. Application of ethical standards for research involving human participants. Further development of critical-thinking skills in using empirical literature. Required advanced clinical core curriculum course.

SLWK 707. Research for Clinical Social Work Practice II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SLWK 706 with minimum grade of C. Further development of critical-thinking skills for translating research findings into practice principles and measuring outcomes of clinical practice. Focus on data collection, data analysis, presentation of visual and statistical techniques for qualitative and quantitative research methods, and utilization of findings for improving clinical social work practice. Continued application of statistical inference, integration of empirical research findings and decision-making. Required advanced clinical core curriculum course.

SLWK 709. Specialization Research for Understanding and Assessing Social Work Interventions and Services. 3 Hours.

Semester course; 3 lecture hours (delivered online or face-to-face). 3 credits. Prerequisites: SLWK 693 and SLWK 694; or SLWK 695; or SLWK 612. Students will deepen their understanding of social work service delivery processes by using research concepts to examine data and apply research findings to inform and improve practice, policy and programs. Skills such as data analysis, translating findings into practice and presenting data to diverse constituent groups are stressed. Additionally, this course emphasizes the use of professional social work values when assessing social work programs and services and encourages students to be attentive to issues of diversity, equity and inclusion.

SLWK 710. Concentration Social Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Focuses on advanced policy analysis through an in-depth, focused examination of a particular social policy area or population. Extends basic knowledge and skills of policy formulation, development and impact analysis/evaluation, as these affect practice on behalf of clients. Examines diversity of policy sources; value, political and economic determinants; policy formulation processes; the policy basis for current services; a broad range of potential need domains; and current programs and laws. Integrates knowledge of human behavior and the social environment relevant to the focal policy areas and pays special attention to issues of social and economic justice. Examines current policy issues, advocacy efforts related to these issues and practice strategies for effecting change.

SLWK 711. Strategies for Social Work Planning and Administrative Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Develops leadership and planning skills that guide the implementation of policy and practice in community and organizational settings. Present problem-solving strategies for planning, administration and management of community and organizational resources. Emphasizes planning context for diverse settings. Provides knowledge and skill for human and fiscal resource responsibilities, including fund raising. Examines ethical and justice implications of planning and administrative practice.

SLWK 712. Social Work Planning and Administrative Practice I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Pre- or co-requisites: SLWK 711 and SLWK 714. Presents knowledge and skills for social work leadership in administering, developing and advocating social service policies and programs that are socially and economically just. Examines underlying assumptions, political, value and ethical considerations in social service planning. Presents knowledge of organizational theories and analyzes the political context of problem solving in the internal and external environments of organizations and programs. Focuses on community and organizational planning theories and models of intervention in assessing needs, analyzing problems, determining feasibility and identifying emergent dilemmas. Emphasizes development of critical thinking and self-awareness about role responsibilities and ethical positions for organizational and community leadership at local, state, national and international levels.

SLWK 713. Social Work Planning and Administrative Practice II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SLWK 712 with minimum grade of C. Continues development of knowledge and skills begun in prerequisite course. Examines traditional and alternative strategies in formulating proposals to address human needs. Emphasizes multiple program designs (e.g., direct service, advocacy, staff development and training, and community empowerment programs). Incorporates understandings of policies, community, and organizational behavior and change, and leadership styles and skills. Analyzes feasibility of interorganizational partnerships and community relationships. Focuses on financial and human resource acquisition and mobilization, monitoring, accountability and evaluation.

SLWK 714. Research for Social Work Administration, Planning and Policy Practice I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. This course provides students with advanced knowledge and skills to carry out evaluations of social work programs and services. Building on the contents covered in SLWK 609 or equivalent, the course helps students to design and execute an independent research project. Major topics include types of evaluation, evaluation theory and design, and research proposal development that can be employed to improve the quality and delivery of social work policy, programs and services. Special attention is given to the student's quest to understand and apply statistical analyses to questions of interest. The course will also address social and economic justice, value and ethical concerns involving human participants, and issues related to diverse populations at risk that arise in evaluation research.

SLWK 715. Research for Social Work Administration, Planning and Policy Practice II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SLWK 714 with minimum grade of C. This course provides students with advanced knowledge and skills to carry out evaluations of social work programs and services. Building on the contents covered in SLWK 609 or equivalent, the course helps students to design and execute an independent research project. Major topics include types of evaluation, evaluation theory and design, and research proposal development that can be employed to improve the quality and delivery of social work policy, programs and services. Special attention is given to the student's quest to understand and apply statistical analyses to questions of interest. The course will also address social and economic justice, value and ethical concerns involving human participants, and issues related to diverse populations at risk that arise in evaluation research.

SLWK 716. Concentration Social Policy for Social Work Administration, Planning and Policy Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite(s): SLWK 693 and 694; or SLWK 695; or SLWK 612. Extends SLWK 602 through 606 content on policy practice, organizations, communities and advocacy. Critically analyzes traditional and alternative theories and models of the policy-making process. Demonstrates how the policy process is the core principle for decision-making in agencies, communities and legislatures. Develops advanced skills in policy analysis, policy formulation and place practice including advocacy. Emphasizes the relationship and impact of economic policies on clients, communities and agencies in light of principles of social and economic justice. Analyzes current regulatory and agency policies and their implications for policy practice/advocacy for effecting change.

SLWK 717. Social Work Practice in the School Setting. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisites: SLWK 693 and 694, SLWK 695, or SLWK 612, or permission of the M.S.W. program director. Emphasizes knowledge and skills of school social work practice with diverse populations in urban and rural school settings. Uses an ecological explanatory theoretical perspective to conceptualize the interdependence of school, family and community as complex interdependent systems that guide evidence-based practice interventions. Integrates a strengths-based social justice perspective for school-based concerns related to violence, racism, sexism, poverty and their impact on children and youth in educational settings.

SLWK 718. Social Work Practice in Child Welfare. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students pursuing a graduate degree in social work or the child welfare certificate or by permission of the program director. Identifies the major social, demographic and economic changes in child welfare services that impact children – a vulnerable population – and their families. Builds on explanatory theories and related skill sets required for effective service delivery. Primary service areas are intervention, family preservation, child protection and permanency planning.

SLWK 719. Gender and Substance Abuse: Social Work Practice Issues. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Based on the social work person-in-environment explanatory multitheoretical perspective and current research to provide a multidimensional understanding of the influence of gender roles and biological sex in vulnerability to substance abuse and related problems. Evidence-based theory approaches are utilized to identify and address the effects of substance abuse and related problems for men, women and children. Advanced clinical elective course.

SLWK 725. International Social Work Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SLWK 694, SLWK 695 or SLWK 612. This course is to build students' competencies in international social work practice at micro, mezzo and macro levels, while providing opportunities to apply social work theories, values and concepts to various global social justice issues, both local and international. Students will gain knowledge and skills for critically examining various approaches to intervening in global social issues as well as experience in analyzing the efficacy of such interventions and policy. Students will also build cross-/multicultural competencies for working with international communities and linking local and international efforts to empower socially and economically disadvantaged communities and advance human rights and global, social, economic and environmental justice.

SLWK 726. Social Work Practice and Health Care. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Focuses on social work practice in a variety of health care settings with a range of explanatory theories conceptualizing health care issues and identifies related interventions from prevention and health promotion to end-of-life care. Explores ethical and legal issues and introduces frameworks for addressing ethical dilemmas. Examines the role of the social worker on an interdisciplinary team. Examines the influence of economics, political decisions, technology, changing demographics and cultural, social and spiritual/religious experiences on individual health care decisions, access to health care and definitions of health and illness. Advanced clinical elective course.

SLWK 727. Trauma and Social Work Practice: Theory, Assessment and Intervention. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Provides advanced explanatory theoretical knowledge and skills to explain, identify, assess and provide effective and competent evidence-based trauma intervention services to survivors of complex traumatic experiences. Focuses on the evidence-based biopsychosocial consequences of childhood sexual and physical abuse and military/war trauma experiences in daily functioning on individuals, families and groups. Advanced clinical elective course.

SLWK 729. Substance Misuse Prevention. 3 Hours.

Semester course; 3 lecture hours (delivered online). 3 credits. Prerequisites: SLWK 693 and SLWK 694; or SLWK 612; or SLWK 695, each with a minimum grade of C. Enrollment is restricted to students in their specialization year or by permission of the instructor. Focuses on models and theories regarding the etiology and prevention of substance misuse and the level of empirical evidence that exists for each. Extends knowledge of diversity to substance misuse etiology, assessment and prevention approaches. Examines evidence-based prevention interventions and policies and other environmental change efforts that affect the reduction of substance misuse. Considers effective strategies for implementing evidence-based approaches in local communities.

SLWK 742. Core Concepts of Child and Adolescent Trauma. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students pursuing a graduate degree in social work or the child welfare certificate or by permission of the program director. This course will introduce students to the core concepts (explanatory theory and foundational knowledge) that inform evidence-based assessment and intervention with traumatized children and adolescents. Strength-based practice will be highlighted along with a focus on the identification of protective and promotive factors that foster resiliency and post-traumatic growth. Trauma is broadly defined, and subjects include children and adolescents exposed to traumatic events including, but not limited to natural disasters, war, abuse and neglect, medical trauma, and witnessing interpersonal crime (e.g. domestic violence) and other traumatic events. The course will highlight the role of development, culture and empirical evidence in trauma-specific interventions with children, adolescents and their families. It will address the level of functioning of primary caregiving environments and assess the capacity of the community to facilitate restorative processes.

SLWK 743. Spirituality and Social Work Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Designed to educate students for advanced social work practice with persons of diverse religious and nonreligious perspectives of spirituality. It provides a comprehensive introduction to spiritually sensitive social work and is intended to expand the explanatory theories that inform professional social work practice. The concepts of person-in-environment and strengths become vivid as the student in practicum assesses how individuals may use spirituality to establish meaning and purpose in relation to their goals of daily living.

SLWK 744. The Dynamics of the Social Worker/Client Relationship. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SLWK 612, SLWK 694 or SLWK 695. Enrollment restricted to students in a field placement or work setting in which they are currently delivering clinical services directly to clients. The effectiveness of all types of direct social work practice depends at least in part on the nature of the relationship between the social worker and client. This course examines in depth the many forms that such relationships can take in the context of various theories, models and strategies common to social work practice. The course reviews the positions of those theories and models with respect to the relationship with an in-depth focus on the processes of relationship development and sustainment and the complex interpersonal dynamics that can arise depending on how the social worker and client experience each other.

SLWK 745. Social Work Practice in Community Mental Health. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Provides the specialized knowledge, values and skills requisite in community mental health settings. Builds on the explanatory biopsychosocial model of mental health/illness. Focuses on current evidence-based psychotherapeutic, psychoeducational, and skill-training models and approaches used with individuals, families and groups experiencing or affected by a range of mental health problems. Examines interdisciplinary teamwork, case management, advocacy and medication management roles. Advanced clinical elective course.

SLWK 746. Social Work Practice and Psychopharmacology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Reviews the historical, political and ethical context of psychotropic medications in social work practice. Provides an explanatory theoretical overview of psychopharmacology and social work roles and skill sets in medication management for effective collaboration with clients, families and other mental health practitioners on medication-related issues. Advanced clinical elective course.

SLWK 747. Social Work Intervention With Adolescents. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 610; and SLWK 693 and SLWK 694, SLWK 695, or SLWK 612, each with minimum grade of C. This course builds upon foundational social work practice knowledge, values, methods and skills in providing a concentration on clinical practice interventions with adolescents. Three general dimensions of adolescent functioning and adaptation are addressed from a multidimensional, biopsychosocial perspective: 1) behavioral and emotional issues that fall within a range of typical adolescent adjustment; 2) internalizing problems of adolescents that interfere with functioning in interpersonal, academic and family contexts; and 3) externalizing problems of adolescence that manifest in conflictual relations with others, as well as in breaches in societal norms and rules. The course introduces and explores evidence-based practice methodologies in addressing behavioral, emotional and situational problems of adolescents and their families in a range of social work intervention settings and includes a focus on individual, family and group intervention modalities.

SLWK 748. Group Methods in Social Work Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Presents several conceptual models of therapeutic groups that explain group dynamics and processes, including evidence-based treatment, educational and mutual aid/self-help. Covers agency conditions affecting practice with groups, the planning of new groups, the multiple phases of group process, and related theory-based interventions and techniques of work with groups and group practice evaluation. Advanced clinical elective course.

SLWK 749. Social Work Intervention in Substance Abuse. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Provides students with the physiological, emotional and behavioral manifestations of substance abuse, DSM-IV-TR-based assessment, a range of relevant evidence-based intervention strategies and the role of social workers in evaluation and intervention. Covers explanatory theory models that guide substance abuse intervention and presents screening, assessment and interventional techniques. Current research and controversies in the field are also emphasized. Advanced clinical elective course.

SLWK 755. Social Work Practice in Organizing for Social Change. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. An advanced practice course that recognizes the central role of social action in social work practice, no matter the context, and the value of social justice, no matter what client population. Built on the idea of multiple perspectives and using the Rothman model of organizing, it assumes students already possess basic policy practice and direct practice skills in order to focus on the dimensions of social action and locality development.

SLWK 759. Art Therapy in Social Work Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Focuses on explanatory theory supporting art therapy as an evidence-based approach to clinical social work intervention. Explores the models, principles and techniques of art therapy in social work practice. Examines assessment, intervention, termination and evaluation strategies that supplement traditional social work treatment, including research and specific evidence-based practice strategies for individuals, families, groups and diverse populations.

SLWK 761. Interpersonal Violence in Clinical Social Work Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and SLWK 694; or SLWK 695; or SLWK 612, each with minimum grade of C. The purpose of this course is to increase clinical social work students' theory-based and practice knowledge and understanding of interpersonal violence as it relates to various client systems throughout the lifespan to include: prenatal exposure to interpersonal violence, child abuse and neglect, teen dating violence, intimate partner violence, children's experience with intimate partner violence, and elder abuse. The course will highlight victim and perpetrator experiences related to interpersonal violence. The course will emphasize resiliency as well as the experiences of diverse populations from a person-in-environment perspective. The course will also consider prevention strategies and relevant policy issues related to interpersonal violence.

SLWK 770. International Social Work Study Abroad. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. International study. Examines social work clinical and policy practice, social pedagogy and the social welfare system of another country that includes a field trip to the country. Examines a range of issues pertaining to the country, including: society, culture and history; social work education; the social welfare system; selected social programs; social work clinical and policy practice; and comparisons of these topics between the country and the U.S. Requires completion of several course units before the study abroad program.

SLWK 791. Topical Seminar. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with minimum grade of C. Presents and analyzes current social work practice theories and/or issues in specialized areas of interest to social work. Advanced clinical curriculum elective course.

SLWK 792. Independent Study. 1-6 Hours.

Semester course; 1-6 lecture hours. 1-6 credits. Prerequisites: SLWK 693 and 694, or SLWK 695, or SLWK 612, each with a minimum grade of C. The student is required to submit a proposal, guided by theory, for investigation in an identified practice area or problem in social work not ordinarily included in the regular M.S.W. curriculum. The topic is proposed by the student; the number of credit hours is determined by the instructor and approved by the M.S.W. program director. The results of the study are presented in a format determined by the instructor and student and approved by the M.S.W. program director. Concentration year elective course.

SLWK 793. Specialization Field Instruction I. 3 Hours.

Semester course; 3 field experience hours. 3 credits. Pre- or corequisite: SLWK 704. First of a two-course sequence that provides opportunities to master advanced social work application of theory knowledge, values and skills through practice under the direction of an agency-based field instructor, monitored by a faculty field liaison. Emphasizes integration of content from all areas of the specialization curriculum.

SLWK 794. Specialization Field Instruction II. 3 Hours.

Semester course; 3 field experience hours. 3 credits. Prerequisite: SLWK 793 with minimum grade of C. Pre- or corequisite: SLWK 705. Second of a two-course sequence provides opportunities to master advanced social work application of theory knowledge, values and skills through practice under the direction of an agency-based field instructor, monitored by a faculty field liaison. Emphasizes integration of content from all areas of the specialization curriculum.

SLWK 795. Specialization Block Field Instruction. 6 Hours.

Semester course; 6 field experience hours. 6 credits. Prerequisite: SLWK 704 with a minimum grade of C. Pre- or corequisite: SLWK 705. Advanced block field instruction. Provides opportunities to master advanced social work knowledge, values and skills through practice under the direction of an agency-based field instructor, monitored by a faculty field liaison. Emphasizes integration of content from all areas of the specialization curriculum. Not available during summer terms.

SLWK 796. Specialization Field Instruction Extended Semesters I. 2 Hours.

Semester course; 2 field experience hours. 2 credits. Pre- or corequisites: SLWK 703, SLWK 704 and SLWK 705, SLWK 706 and SLWK 707, SLWK 710, and electives; or SLWK 710, SLWK 711, SLWK 712 and SLWK 713, SLWK 714 and SLWK 715 and electives; or generalist curriculum; or permission of the instructor and M.S.W. program director. Course provides opportunities to master advanced social work application of theory knowledge, values and skills through practice under the direction of an agency-based field instructor and monitored by a faculty field liaison. Emphasizes integration of content from all areas of the specialization curriculum.

SLWK 797. Specialization Field Instruction Extended Semesters II. 2 Hours.

Semester course; 2 field experience hours. 2 credits. Prerequisite: SLWK 796 with minimum grade of C. Pre- or corequisites: SLWK 703, SLWK 704 and SLWK 705, SLWK 706 and SLWK 707, SLWK 710, and electives; or SLWK 710, SLWK 711, SLWK 712 and SLWK 713, SLWK 714 and SLWK 715, and electives; or generalist curriculum; or permission of the instructor and M.S.W. program director. Course provides opportunities to master advanced social work application of theory knowledge, values and skills through practice under the direction of an agency-based field instructor and monitored by a faculty field liaison. Emphasizes integration of content from all areas of the specialization curriculum.

SLWK 798. Specialization Field Instruction Extended Semesters III. 2 Hours.

Semester course; 2 field experience hours. 2 credits. Prerequisite: SLWK 797 with a minimum grade of C. Pre- or corequisites: SLWK 703, SLWK 704 and SLWK 705, SLWK 706 and SLWK 707, SLWK 710, and electives; or SLWK 710, SLWK 711, SLWK 712 and SLWK 713, SLWK 714 and SLWK 715, and electives; or generalist curriculum; or permission of the instructor and M.S.W. program director. Course provides opportunities to master advanced social work application of theory knowledge, values and skills through practice under the direction of an agency-based field instructor and monitored by a faculty field liaison. Emphasizes integration of content from all areas of the specialization curriculum.

Social Work – Doctorate (SWKD)**SWKD 701. Introduction to Advanced Quantitative Methods. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Corequisite: SWKD 702. Enrollment is restricted to students with master's-level course work in research methods and introduction to statistics, graduate standing in social work or permission of the instructor. Focused on concentrated study of principles of the quantitative, scientific method for knowledge building, and practice- and policy-related research. Special emphasis on the different stages of research methods, including problem formulation, sampling, measurement, design and data collection within the context of professional values, ethics and commitment to social justice.

SWKD 702. Introduction to Quantitative Data Analysis. 4 Hours.

Semester course; 3 lecture and 1 laboratory hours. 4 credits. Corequisite: SWKD 701. Enrollment is restricted to students with master's-level course work in research methods and introduction to statistics, graduate standing in social work or permission of the instructor. A required foundation course in a sequence focused on concentrated study of principles of quantitative scientific method for knowledge-building and research. Lab sessions will complement content covered in class and, primarily, involve "hands-on" application of statistical software for data analysis. Special emphasis on the application of descriptive and inferential statistical techniques within the context of applied social work research.

SWKD 704. Introduction to Qualitative Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students admitted to the doctoral program or with permission of the instructor. This course introduces students to theories, methods and practice in qualitative research. The goal is to draw on classic and contemporary theories and methods from interactionist and interpretivist traditions to better understand and effect change in the social world. Topics include philosophical foundations; question formulation; major approaches, i.e., narratives, ethnography, grounded theory, case studies and focus groups; and strategies for gathering, making sense of and applying evidence.

SWKD 705. Multivariate Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: SWKD 701 and SWKD 702 or equivalents. Enrollment is restricted to students who have master's-level course work in research methods and introduction to statistics and graduate standing in social work or by permission of instructor. This course focuses on the concentrated study of principles of the quantitative, scientific method for knowledge building and practice- and policy-related research. Special emphasis on the application and interpretation of multivariate statistical techniques within the context of applied social work research.

SWKD 706. Proseminar I. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course will introduce first-year Ph.D. students to the interrelated components of the social work doctorate and stimulate and foster their development as research scholars in the profession. Additionally the seminar will provide academic advising for first-year students. Graded as Pass/Fail.

SWKD 707. Proseminar II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: SWKD 706. The purpose of this course is to further introduce first-year Ph.D. students to the interrelated components of the social work doctorate and to stimulate and foster their development as research scholars in the profession. Building on the objectives covered in the prerequisite, this course further defines first-year student research questions and methodological approaches as they begin planning their independent research. And students will continue to receive academic advising as first-year students. Graded as Pass/Fail.

SWKD 709. History and Philosophy of Social Work. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students admitted to the doctoral program or with permission of the instructor. This seminar focuses on the intellectual and sociopolitical foundations of the social work profession and its evolution, primarily in the U.S. Students will examine the role of key individuals, ideas, institutions, events and movements leading up to and ensuing since the profession's inception in the late 19th century. The co-evolution of social science philosophy will provide a corollary framework for interpreting historical and contemporary social trends and for understanding social work's changing practice, policy and research agendas for ongoing and emerging social problems.

SWKD 711. Social and Behavioral Science Theory for Social Work Research and Practice. 3 Hours.

Semester course; 3 lecture hours. 3 credits. The first-year required seminar will introduce students to foundations of social and behavioral science theory and the use of theory in social work research and practice. Students will identify and critique key theories in their area of substantive interest. They will select, justify and apply appropriate theories in modeling a solution to a social problem or human challenge. The process of theorizing in novel and emergent areas of social work inquiry will also be examined.

SWKD 713. Social Policy Theory and Analysis. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students admitted to the doctoral program or with permission of the instructor. Grounded in social work values and drawing on interdisciplinary approaches to policy sciences, this course introduces students to the ideological foundations of social policy and guides them in the application of theories that drive analyses of policy issues in their substantive area. The course covers approaches to the policy-making process, including critical analyses of proposals, implementation and evaluation of current policy. Students analyze policy at the local, national or international level, with an emphasis on their specialized substantive area.

SWKD 716. Measurement in Social and Behavioral Sciences. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or corequisite: SWKD 705 or permission of instructor. This course introduces students to the importance of measurement in scientific inquiry, and will emphasize the core concepts and technical skills needed to evaluate the quality of social and behavioral measures. Students will review basic principles and procedures of measurement theory and learn practical, usable research skills through hands-on experience in developing and evaluating a measure. Students will review and discuss content on classical test and item response theories and their application to instrument development and validation. They will learn to operationalize latent variables in conceptual models and use theoretical and practical knowledge to generate items, develop and format questions, and begin to construct a scale that can be tested for reliability and validity. Students will also learn how to minimize and address threats to the utility and validity of their measure (e.g., respondent bias, measurement error). This course will examine advanced methods for testing psychometric properties of measures, including reliability statistics, confirmatory and exploratory factor analysis and IRT analysis.

SWKD 726. Seminar on Social Work Education and Teaching. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment requires Ph.D. program standing or permission of program director. This doctoral seminar prepares students to become effective and ethical social work educators. The course focuses on teaching and learning approaches in higher education, assessment of educational outcomes, curriculum design and course development, roles and responsibilities of faculty members, and historical and contemporary trends in social work education.

SWKD 728. Academic Writing: Effective Writing, Manuscript Preparation and Publication. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students admitted to the Ph.D. program in social work or with permission of the instructor. This course provides the opportunity for doctoral students to enhance and refine the academic writing skills necessary for productive social work scholarship. The course focuses on understanding and mastering the structure, process and elements of high-quality academic writing as well as respectful and helpful reviewing. Students will especially examine scholarly writing in and for journal articles, books, book reviews and doctoral dissertations. Students will be exposed to the literature on the "how tos" of scholarly writing itself and develop their own skills in being a juror/professional reviewer. Special emphasis is placed on the development of an intellectual community in which excellence in written expression is valued. The explicit goal is established that each student should use the course to prepare one or more scholarly products during the course related to her/his/their substantive area.

SWKD 730. Applied Quantitative Research Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: SWKD 705 (or equivalent) or permission of instructor. This course requires students to conduct an independent research project using existing data relevant to their substantive interests. To achieve the objective of producing a publishable paper, students will develop an empirical question that can be examined with existing quantitative data; manage, analyze and interpret the data; synthesize data analysis with research methods; and integrate these components into a scholarly paper. This course is not a traditional research methods or statistics course.

SWKD 791. Topical Seminar. 3 Hours.

Semester course; 3 lecture hours. 3 credits. May be repeated once for credit. Prerequisite: permission of instructor. Study of the current state of knowledge and research within a specialized area of concern to social policy and social work.

SWKD 792. Independent Study. 1-3 Hours.

Semester course; 1-3 independent study hours. 1-3 credits. May be repeated for a maximum of six credits. Enrollment requires permission of the program director. Independent reading and study in selected areas under the supervision of a member of the faculty.

SWKD 797. Directed Research. 3 Hours.

Semester course; 3 credits. Prerequisite: completion of first-year Ph.D. courses in social work or permission of program director. The course provides doctoral students the opportunity to do hands-on research prior to the dissertation project that is relevant to their substantive area or individual learning needs. The topic and specific project will be initiated by the student and implemented in collaboration with a School of Social Work faculty member. A proposal for a directed research course must be submitted that specifies how the student will gain experience, knowledge and skills in one or more aspects of conducting a research project, including conceptualization of the question; development of a graphic or visual schema; measurement design and/or instrument development; qualitative, quantitative or mixed-methods research design and implementation; data collection or data management; data analysis; and dissemination of findings. Students may create their own project or dovetail with existing student or faculty projects.

SWKD 890. Qualifying Examination. 3-6 Hours.

Semester course; 3-6 independent study hours. 3-6 credits. May be repeated for a total of six credits. Enrollment is restricted to students who have completed required course work and hold graduate standing in social work. Covers proposal development under the direction of a faculty adviser, writing of the independent qualifying paper and oral examination. Graded as Pass/Fail.

SWKD 896. Social Work Teaching Practicum. 3 Hours.

Semester course; 3 practicum hours. 3 credits. Enrollment is restricted to students who have completed all required course work. The purpose of this required teaching practicum is to prepare future social work educators through a mentored classroom teaching experience. Students will work directly with a full-time faculty member who is teaching a baccalaureate- or master's-level course, either face-to-face or online. While there will be some standardized requirements, the practicum is individually tailored to enhance students' preparation for teaching based on an assessment of their prior teaching experience and skills, as well as current interests. Students will devote approximately 10 hours per week to the practicum and will also participate in a bi-monthly seminar to facilitate and support their development and learning. Graded as Pass/Fail.

SWKD 898. Dissertation Research. 1-9 Hours.

Semester course; 1-9 dissertation hours. 1-9 credits. Enrollment is restricted to students who have successfully completed their qualifying paper and who hold graduate standing in social work. A minimum of nine dissertation hours is required for the Ph.D. Covers dissertation research under the direction of a faculty adviser. Graded as satisfactory/unsatisfactory.

VCU Life Sciences

Bioinformatics (BNFO)

BNFO 501. Introduction to Physical Implementation of Databases. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: permission of instructor. Basic searching and sorting algorithm design, and advanced data structures including hashing and B-trees.

BNFO 505. Essentials of Statistics in Bioinformatics. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisites: Statistics and permission of instructor. An intensive course designed for graduate students in either the biology/genomics or the computational science tracks of the bioinformatics program, aimed at providing the background in statistical concepts necessary for them to participate in graduate-level courses involving statistics. The course will focus on areas of particular interest in bioinformatics, including probability, combinatorics and linear models.

BNFO 507. Essentials of Molecular Biology in Bioinformatics. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisites: Cell biology and permission of instructor; Pre- or corequisite: Organic chemistry or permission of instructor. An intensive course designed for graduate students in either the quantitative/statistics or the computational science tracks of the bioinformatics program, aimed at providing the background in molecular biology necessary for them to participate in graduate-level courses involving molecular biology. The course will focus on areas of particular interest in bioinformatics, including DNA, RNA and protein synthesis, gene structure, function and regulation, protein structure, activity and regulation, and the tools by which formation in these areas has been discovered.

BNFO 508. Introduction to Bioinformatics Research. 2 Hours.

Semester course; lectures and 3 laboratory hours. 2 credits. Prerequisites: graduate status and permission of instructor. Introduction to all active research programs in bioinformatics. Presentations of research programs by investigators and rotation of students through track-appropriate faculty labs to gain direct exposure to individual research projects. Graded as S/U/F. Required of all first-year students pursuing the thesis option (M.S.).

BNFO 514. Modeling Biocomplexity. 3 Hours.

Semester course; 2.5 lecture and .5 laboratory hours. 3 credits. Prerequisite: one year of calculus. Introduction to the modeling and simulation of the behavior of complex biological systems, including models in both continuous and discrete time. Numerical methods using mathematica, analytical methods using calculus and laboratory experiments using computer interfaces will be used to study population dynamics and the behavior of physiological systems exhibiting such properties as oscillations and chaotic biological dynamics. Crosslisted as: PHYS 514.

BNFO 530. Bioinformatics and Genomics in Drug Research. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Covers the basic elements of cellular pathways and drug interactions, and how modern genomics comes into play. Presents bioinformatics principles being used every day in data-intensive fields of research. Introductory and concept-oriented, the course will prepare students for grasping how bioinformatics is being used in many areas of biomedical sciences. Geared toward students coming from a variety of backgrounds in biology, biochemistry and chemistry. While many of the analytical approaches are statistical in nature, there is no requirement for a background in statistics or mathematics. Each student will have the opportunity to design a small project applying bioinformatics concepts. Crosslisted as: MEDC 530.

BNFO 531. Quantitative Methods in Bioinformatics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students with graduate status or permission of instructor. Students will be introduced to quantitative methods including probability and statistical theory in order to recognize and interpret the underlying mathematics behind common bioinformatic analyses. Students will learn to apply these bioinformatic data analysis principles using packages and tools in the R software environment. Topics covered include regression, differential expression, t-SNE and principal component analyses.

BNFO 540. Fundamentals of Molecular Genetics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 310 or consent of instructor. The basic principles and methodologies of molecular biology and genetics are applied to genome organization, replication, expression, regulation, mutation and reorganization. Emphasis will be placed on a broad introduction to and integration of important topics in prokaryotic and eukaryotic systems. Crosslisted as: BIOL 540.

BNFO 541. Laboratory in Molecular Genetics. 2 Hours.

Semester course; 1 lecture and 4 laboratory hours. 2 credits. Pre- or corequisite: BIOL 540 or equivalent. Experiments are designed to apply advanced techniques and concepts of molecular biology and genetics using prokaryotic and eukaryotic systems. Emphasis will be placed on experimental design, integrating results throughout the semester, making use of relevant published literature, scientific writing and providing hands-on experience with advanced equipment and methodologies. Crosslisted as: BIOL 541.

BNFO 591. Special Topics in Bioinformatics. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated for a maximum total of eight credits, with the provision that no more than eight combined credits of BNFO 591 and BNFO 593 can apply toward graduation. Adviser's approval is required for counting each special topics course toward meeting specific requirements of the master's program. An introductory, detailed study of a selected topic in bioinformatics unavailable as an existing course. If multiple topics are offered, students may elect to take more than one.

BNFO 592. Independent Study. 1-9 Hours.

Semester course; 1-9 independent study hours. 1-9 credits. Determination of the amount of credit and permission of instructor, adviser and curriculum committee must be obtained prior to registration for this course. Designed to provide an opportunity for independent study at an introductory graduate level in a bioinformatics-related area of interest and significance to the student outside what is available through the courses and other options in the Bioinformatics Program. Graded as satisfactory/unsatisfactory.

BNFO 593. Special Topics in Bioinformatics. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated for a maximum total of eight credits, with the provision that no more than eight combined credits of BNFO 591 and BNFO 593 can apply toward graduation. An advanced, detailed study of a selected topic in bioinformatics unavailable as an existing course. If multiple topics are offered, students may elect to take more than one. Adviser's approval is required for counting each special topics course toward meeting specific requirements of the B.S. or M.S. programs. Graded as satisfactory/unsatisfactory.

BNFO 600. Basic Scripting Languages. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Basics of programming in Python or other appropriate scripting language.

BNFO 601. Integrated Bioinformatics. 4 Hours.

Semester course; 3 lecture and 3 laboratory hours. 4 credits. Enrollment requires permission of instructor. Presents major concepts in bioinformatics through a series of real-life problems to be solved by students. Problems addressed will include but not be limited to issues in genomic analysis, statistical analysis and modeling of complex biological phenomena. Emphasis will be placed on attaining a deep understanding of a few widely used tools of bioinformatics. Crosslisted as: BIOL 601.

BNFO 620. Bioinformatics Practicum. 3 Hours.

Semester course; 3 lecture hours. 3 credits. BNFO 601/BIOL 601 or permission of instructor. Practical application of bioinformatics to genomic, proteomic and pharmacogenomic analyses. Students will work in small groups to plan, develop and execute a project designed to solve practical challenges in the realm of bioinformatics. Proficiency in various aspects of bioinformatics will be developed.

BNFO 621. Business and Entrepreneurship Essentials for Life Scientists. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Consists of presentations on the core concepts of business, including intellectual property, patents and patent law, entrepreneurship, launching a "start up," raising capital, financial management, marketing, managerial accounting, planning, and project management. Course includes lectures and discussions on core concepts of business and their real-world application. Students will develop a business plan and/or a plan to manage a research project. Business case studies and team projects with presentations are required. Focus is on the biotechnology and pharmaceutical industries.

BNFO 637. Networks Biology. 3 Hours.

Semester course; 2.5 lecture hours. 3 credits. Prerequisite: prior course work in cell biology or molecular biology, or permission of instructor. Covers in detail networks as a basic tool for the systems biology approach to biology and medicine, particularly on the molecular level. Qualitative and quantitative aspects of biological systems and processes will be identified and analyzed. The course focuses on the biochemical networks formed in the cell from genes, proteins and metabolites. Network structure and dynamics will be characterized proceeding from graph theory and other mathematical methods. Essential part of the course is the practical work with basic software for building, manipulation and analysis of biological networks, as well as for identifying structural motifs and modules, and comparative network organisms (human, drosophila, yeast, *C. elegans*).

BNFO 650. Sequence Analysis in Biological Systems. 3 Hours.

Semester course; 1 lecture and 2 laboratory hours. 3 credits. Prerequisite: BNFO 601/BIOL 601 or permission of instructor. This course will treat the computational theory behind algorithms that are used for nucleic acid and protein sequence analysis. Students will be exposed to the theory and methodology of computational biology that has led to the development of current sequence analysis software. The objective of the course is to provide students with a basic knowledge of how current software tools have been developed and how they function, which will permit them to then apply this knowledge to the development of new algorithms and technology.

BNFO 653. Advanced Molecular Genetics: Bioinformatics. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: Cell/molecular biology or permission of instructor. An advanced course on contemporary bioinformatics. Topics covered include the principles and practice of DNA, RNA and protein sequence analysis, computational chemistry and molecular modeling, expression array analysis and pharmacogenomics. The course includes lectures, reading, computer lab, homework problem sets and projects.

BNFO 690. Seminars in Bioinformatics. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Presentation and discussion of research topics of current interest in the field of bioinformatics. Graded as satisfactory/unsatisfactory.

BNFO 691. Special Topics in Bioinformatics. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated for a maximum total of eight credits, with the provision that no more than eight combined credits of BNFO 691 and BNFO 693 can apply toward graduation. Adviser's approval is required for counting each special topics course toward meeting specific requirements of the master's program. An advanced, detailed study of a selected topic in bioinformatics unavailable as an existing course. If multiple topics are offered, students may elect to take more than one.

BNFO 692. Independent Study. 1-9 Hours.

Semester course; variable hours. Variable credit. Determination of the amount of credit and permission of the instructor, adviser and curriculum committee must be obtained prior to registration for this course. A course designed to provide an opportunity for independent study in a bioinformatics-related area of interest and significance to the student outside what is available through the courses and other options in the Bioinformatics Program.

BNFO 693. Special Topics in Bioinformatics. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated for a maximum total of eight credits, with the provision that no more than eight combined credits of BNFO 691 and BNFO 693 can apply toward graduation. Adviser's approval is required for counting each special topics course toward meeting specific requirements of the master's program. An advanced, detailed study of a selected topic in bioinformatics unavailable as an existing course. If multiple topics are offered, students may elect to take more than one. Graded as satisfactory/unsatisfactory.

BNFO 697. Directed Research in Bioinformatics. 1-9 Hours.

Semester course; variable hours. 1-9 credits. May be repeated for credit. Directed research leading to the M.S. degree in bioinformatics. Graded as S/U/F.

BNFO 700. Externship in Bioinformatics. 1,2 Hour.

Semester course; variable hours. 1 or 2 credits. Prerequisites: BNFO 601/BIOL 601 and BNFO 620, or permission of instructor. Typically off-campus planned experiences for advanced graduate students designed to extend professional competencies, carried out in a professional setting under supervision of an approved professional. Externship activities monitored and evaluated by university faculty. Plan of experience designed by extern and external adviser with prior approval of department. An externship class will meet weekly using online technology to accommodate students doing out-of-town summer externships. Each externship will be a defined project leading to a required final report or product and offering real potential benefits to the sponsoring company/lab. Subsequent to the externship, a presentation to program faculty and students is required.

Environmental Studies (ENVS)**ENVS 510. Stream Surveys. 3 Hours.**

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Prerequisite: BIOL 317 or permission of the instructor. This course will cover basic and advanced methods used to study fishes and benthic macroinvertebrates in small, wadeable streams. Topics covered will include qualitative and quantitative field surveying methods, fish and invertebrate specimen identification, and data analysis of original field data.

ENVS 515. Tropical Field Ecology. 4 Hours.

Semester course; 3 lecture and 3 laboratory hours. 4 credits. Study abroad at a tropical location. This course provides students with an immersive study of tropical ecology and conservation through a unique blend of rigorous science and community engagement. While studying abroad, students learn about tropical ecosystems by collecting data on both organisms and their habitats and by reading and discussing scientific papers. Students also engage with local conservation organizations leading efforts to protect habitats. Progress and research findings are intended to be presented in a symposium format. See the Schedule of Classes for specific regions and topics.

ENVS 521. Introduction to Geographic Information Systems. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. An introduction to creating and using geographically referenced databases for urban and environmental analysis and planning. Includes geographic and remote sensing data structures, global positioning systems, spatial analysis, geographic data standards, public domain software and data resources, and principles of cartography design. Lab exercises in the use of geographic information systems software tools. Crosslisted as: URSP 521.

ENVS 531. Landscape Ecology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: ENVS 421 or ENVS 521; and ENVS 343 or ENVS 543. This class provides a foundation in the major concepts and applications of landscape ecology as a framework for research, analysis and management. Topics covered will include the causes of landscape pattern, quantifying landscape pattern, spatial statistics, the effects of landscape pattern on organisms and ecological processes, and using landscape ecology to inform conservation.

ENVS 541. Principles of Waste Management. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Design and operation of waste treatment, storage, disposal and control processes will be covered. Design tanks, landfills and incinerators will be discussed in detail. Data acquisition and interpretation methods needed for process control and monitoring will be examined.

ENVS 543. Environmental Data Literacy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing, or those with one course in statistics and permission of instructor. Develop quantitative skills for the visualization, manipulation, analysis and communication of environmental "big data." This course focuses on spatial environmental data analysis, interpretation and communication, using real-time data from the Rice Rivers Center and the R statistical analysis environment.

ENVS 550. Ecological Risk Assessment. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: course work in ecology, or permission of instructor. Ecological risk assessment provides an introduction to the concepts and practice of risk assessment as applied to ecological applications, focusing on the United States. The course will examine the history of risk assessment in U.S. environmental regulation and policy, development and practice of ecological risk assessment and application to regional issues. All students will conduct a risk assessment for a regional case study.

ENVS 556. Historical and Cultural Landscapes. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Open only to seniors who have completed ANTH 302 or 303 and graduate students with permission of instructor. Students will study historical and contemporary landscapes as the products of the producers of human culture, with particular attention to riverine landscapes. Focus will be on the ways in which humans shape and respond to their ecosystems. Students will participate in an active field research program, including the archaeological recovery and analysis of historical landscapes. Crosslisted as: ANTH 556.

ENVS 575. Avian Ecology and Conservation. 4 Hours.

Semester course; 3 lecture and 1 laboratory/field experience hour. 4 credits. Prerequisites: BIOL 317 or ENVS 102; and STAT 314 or ENVS 343. This extends frameworks of ecological theory and conservation practice within the broad context of wildlife ecology and conservation using birds as the focal group. Topics include population dynamics, dispersal/migration, effects of habitat alteration (e.g., fire, timber harvest and fragmentation), climate change impacts and species interactions. Field and laboratory sessions focus on building skills in bird identification, survey/data collection, and data analysis and interpretation.

ENVS 590. Research Seminar in Environmental Studies. 1 Hour.

An interdisciplinary examination of problems and issues related to environmental studies.

ENVS 591. Topics in Environmental Studies. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated with different topics for a maximum of 12 credits. An in-depth study of a selected environmental topic. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

ENVS 601. Survey in Environmental Studies. 3 Hours.

Provides a foundational understanding of issues central to environmental studies. Lectures will address the theoretical and scientific basis for a variety of pertinent issues, including: and water quality and quantity, pollution prevention, environmental law and policy, population growth, global climate change, conservation, and human and ecological health.

ENVS 602. Environmental Technology. 1-3 Hours.

This course gives students the opportunity to develop skills not available in the traditional academic setting. Students take two to four workshops offered by the Center for Environmental Studies in its Environmental Technology Training Workshop series. Students will complete an additional project related to each workshop or series of workshops for evaluation purposes.

ENVS 603. Environmental Research Methods. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 543, STAT 543 or permission of instructor. Provides students with an understanding of statistical and research methods as they apply to environmental research. This course emphasizes the application of current data analysis methodologies, including the graphical display of summary data, statistical modeling and prediction, and geographic information systems.

ENVS 627. Infographics: Visualization of Scientific Data. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will introduce graduate students in the natural sciences to some of the modern tools used by designers for data visualization and digital communication. The course is a mix of traditional lecture and computer lab exercises, but also makes use of the sketchbook and reflective writing. Students will proceed through a series of projects that sequentially build their technical skills in Adobe Creative Suites (particularly Illustrator and Photoshop) as well as their knowledge of fundamental concepts in graphic design and the communication arts.

ENVS 628. Environmental Policy and Administration. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course explores the relationship between environmental policy and its implementation within a democratic political system. It includes an investigation of basic concepts that underlie environmental policy and the difficulties encountered when attempting to apply them in a real-world setting. It also surveys a variety of tools and methodologies that may be useful in attempting to develop and implement environmental policy. Crosslisted as: PADM 628.

ENVS 640. River Policy. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Examines public policy related to rivers and watersheds. Uses the James River for exploring and illustrating generic river policy issues. Crosslisted as: GVPA 640.

ENVS 650. Pesticides, Health and the Environment. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: Course work in toxicology, chemistry or permission of instructor. This course is a balanced overview of the benefits and adverse effects of pesticides in the environment and as related to human health. The class provides an interdisciplinary study of pesticide use, fate, exposure, transport and effects.

ENVS 654. Environmental Remote Sensing. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 602, or permission of the instructor. This course provides a basic and applied understanding on the use of digital remote sensor data to detect, identify and characterize earth resources. Students are required to demonstrate an understanding of the spectral attributes of soils, vegetation and water resources through various labs involving both image- and non-image-based optical spectral data. Crosslisted as: URSP 654/BIOL 654.

ENVS 655. Hydrogeology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Focuses on the fundamental concepts of groundwater flow and contaminant transport with an emphasis toward environmental issues such as waste disposal, surface water hydrology, groundwater hydrology and wells, environmental impacts and hydrogeological systems. Allows students to understand and interpret the basic environmental hydrogeologic characteristics of a site and to use that knowledge to provide an informed opinion on protection and remediation.

ENVS 660. Virginia Environmental Law. 3 Hours.

Semester course; 3 lecture hours. 3 credits. An overview of relevant Virginia environmental law and regulations in the fields of environmental planning, management and policy. Provides students with working knowledge of documentation necessary for compliance with state environmental programs.

ENVS 670. Pollution Physiology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: Course work in: ecology, toxicology or animal physiology; or permission of instructor. Courses provides an in-depth presentation of the physiology of animals in polluted habitats and examines the responses of aquatic organisms exposed to pollutants and other environmental stressors, including: thermal and salinity changes, anoxia and hypoxia, hypercapnia, chemical contamination, sedimentation and microbial contamination. The course takes a comparative approach and focuses on non-human systems. Both laboratory and field experiences are provided.

ENVS 675. Advanced Environmental Applications of GIS. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 521 or ENVS 602. The objective of this course is to give students a greater understanding of advanced GIS topics using environmental data. Knowledge gained in this course will give students the tools required to address complex natural resources and environmental issues by providing experience in advanced spatial and geostatistical analysis and environmental modeling. Students will also be exposed to programming, open source tools and interfaces that are used to disseminate large environmental data sets.

ENVS 691. Topics in Environmental Studies. 1-4 Hours.

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated with a different topic for a maximum of 12 credits. Provides an in-depth study of a selected environmental topic. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

ENVS 692. Independent Study. 1-3 Hours.

Variable hours. 1-3 credits per semester. May be repeated with different topics for a maximum of 6 credits. An in-depth study of a selected environmental topic.

ENVS 693. Internship in Environmental Studies. 1-3 Hours.

Each credit hour represents 60 clock hours of work. Provides students with a workplace experience in a public or private agency related to Environmental Studies.

ENVS 697. Research. 1-3 Hours.

Planning, preparation, completion, and presentation of research in environmental studies.

ENVS 698. Thesis. 1-3 Hours.

Planning, preparation, completion, and presentation of research in environmental studies.

Life Sciences (LFSC)**LFSC 510. Biological Complexity. 3 Hours.**

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: physics and calculus, or permission of instructor. Open only to graduate students and qualified seniors. An introduction to the basis of complexity theory and the principles of emergent properties within the context of integrative life sciences. The dynamic interactions among biological, physical and social components of systems are emphasized, ranging from the molecular to ecosystem level. Modeling and simulation methods for investigating biological complexity are illustrated. Crosslisted as: BIOL 545.

LFSC 520. Bioinformatic Technologies. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: BIOL 545/ LFSC 510 or permission of instructor. Introduction to the hardware and software used in computational biology, proteomics, genomics, ecoinformatics and other areas of data analysis in the life sciences. The course also will introduce students to data mining, the use of databases, meta-data analysis and techniques to access information. Crosslisted as: BIOL 548.

LFSC 591. Special Topics in Integrative Life Sciences. 1-4 Hours.

Semester course; variable hours. 1-4 credits. A 500-level study of a selected topic in integrative life sciences. Students will find specific topics and prerequisites for each Special Topics course listed in the Schedule of Classes. If multiple topics are offered, students may elect to take more than one.

LFSC 610. Analytical Methods in Biocomplexity Analysis. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: LFSC 510/ BIOL 545 or equivalent, or permission of instructor. An introduction to mathematical and computational methods in biocomplexity analysis and the mathematical and computational simulation of biological systems. Topics include methods for dynamical systems analysis, nonlinear systems analysis, gene sequencing, fractals and chaos, and pattern recognition. Students will be exposed to Maple, Matlab, SPSS, E-cell, BioPerl, Epigram, and C.

LFSC 630. Integrative Life Sciences Research. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Restricted to integrative life sciences doctoral students. An introduction to integrative research in the life sciences from the molecular to ecosystem level. The course will include presentations on ongoing interdisciplinary and systems-oriented life sciences research by faculty members and discussion and analysis of classic interdisciplinary research projects.

LFSC 631. Student Seminar in Integrative Life Sciences. 1 Hour.

Semester course; 1 seminar hour. 1 credit. May be repeated for credit. The ability to present and evaluate independent research across diverse disciplines is imperative to scientists in the life sciences, where collaboration and integrated thinking is essential. This seminar will provide this opportunity from both perspectives with oral informal presentations to a peer graduate student audience, who will provide peer evaluations and critical feedback. Graded as S/U.

LFSC 690. Research Seminar in Integrative Life Sciences. 1 Hour.

Semester course; 1 lecture hour. 1 credit. May be repeated for credit. Presentation and discussion of research topics of current interest in the life sciences. Graded as "S," "U" or "F".

LFSC 691. Special Topics in Integrative Life Sciences. 1-4 Hours.

Semester course; variable hours. 1-4 credits. Prerequisite: Permission of instructor required. Advanced graduate study of a selected topic in integrative life sciences. Students will find specific topics and prerequisites for each Special Topics course listed in the Schedule of Classes. If multiple topics are offered, students may elect to take more than one.

LFSC 697. Directed Research in Integrative Life Sciences. 1-15 Hours.

Semester course; 1-15 research hours. 1-15 credits. May be repeated for credit. Directed research in interdisciplinary and integrative life sciences. Graded as S/U.

LFSC 701. Post-candidacy Doctoral Research. 9 Hours.

Semester course; 9 research hours. 9 credits. May be repeated for credit. Enrollment is restricted to students who have been admitted to doctoral candidacy in the integrative life sciences doctoral program. Registration requires approval from the integrative life sciences program director. Students will participate in supervised, discipline-specific research related to their dissertation topic. This course can be approved as a substitution for any post-candidacy degree requirement. Graded as Satisfactory/Unsatisfactory.

da Vinci Center for Innovation Innovation in Product Design and Development (INNO)

INNO 501. Arts Principles for Product Innovation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the Master of Product Innovation program or with approval of the instructor. Introduces studio-based arts instruction to individuals with a background in business, engineering or other non-arts discipline. Lectures and assignments expose students to a broad range of skills and vocabulary, enabling them to comprehend, analyze and communicate visually. Working individually and in teams, the core experience will be formed through iterative making, via direct, hands-on material experience.

INNO 502. Business Principles for Product Innovation. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to students in the Master of Product Innovation program, the Graduate Certificate in Health Care Innovation and the Master of Science in Nursing with a concentration in nursing leadership and organizational science or with approval of the instructor. Introduces theoretical frameworks and practical applications of innovation strategy. This fast-paced class introduces business model innovation and explores the different areas of product innovation that improve the likelihood of success. Topics include customer segmentation, value proposition development, financial considerations, operations, internal innovation, emerging technology and change management.

INNO 503. Technology Principles for Product Innovation. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the Master of Product Innovation program or with approval of the instructor. Introduces technology and technological principles to students with non-engineering-related degrees. A particular focus is learning and applying a technology problem-solving process to different types of open-ended problems. The process includes the steps of needs identification, information gathering, idea generation, evaluation and selection.

INNO 590. da Vinci Project. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students enrolled in the Master of Product Innovation program, the Nursing, Master of Science (M.S.) with a concentration in nursing leadership and organizational science and the M.B.A. dual degree with the Master of Product Innovation or with approval of instructor. Students will engage in an interdisciplinary product innovation project with a corporate sponsor under faculty supervision. Topics and activities will hone product innovation skills, including project management, team building, concept generation and testing, market analysis, visualization, and prototyping.

INNO 591. Topics in Product Innovation. 1-3 Hours.

Semester course; 1-3 lecture hours (delivered online, face-to-face or hybrid). 1-3 credits. May be repeated for a maximum of nine credits. Enrollment is open to seniors and graduate-level students or with departmental approval. Study of current and emerging topics in the field of product innovation. Topics may vary by semester. See the Schedule of Classes for offerings each semester.

INNO 600. Integrative Design Studio. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the Master of Product Innovation program, the graduate Certificate in Health Care Innovation and the M.B.A. dual degree with the Master of Product Innovation, or with approval of the instructor. Integrates the theory and practice of product innovation across the arts, business and engineering disciplines. Students are exposed to and apply a broad set of skills and tools to aid in understanding, envisioning and communicating product innovation. Working in interdisciplinary teams, students will hone teamworking skills and collectively address contemporary issues associated with product innovation, such as sustainability. Course requirements may be fulfilled with select study abroad opportunities.

INNO 610. Innovation, Design Thinking and Change Management. 3 Hours.

Semester course; 3 lecture hours (delivered online, face-to-face or hybrid). 3 credits. Enrollment is restricted to graduate- or professional-level students or with departmental approval. Innovation, design thinking and change management are critical skills across disciplines and are part of a larger collection of 21st-century skills that benefit individuals and organizations. Students will learn to apply tools for innovation, find the right problems, identify solutions and develop a mindset ready to embrace and implement innovation and change. In addition to providing an introduction to these concepts, students will actively participate in real-world innovation projects and will earn certifications in design thinking and change management.

INNO 651. Master's Project in Product Innovation I. 6 Hours.

Semester course; 2 lecture and 4 laboratory hours (delivered online, face-to-face or hybrid). 6 credits. Prerequisites: INNO 501 and INNO 502, INNO 502 and INNO 503, or INNO 501 and INNO 503; and INNO 590 and INNO 600. Enrollment is restricted to students in the Master of Product Innovation program; students enrolled in the graduate Certificate in Health Care Innovation may be permitted to take this course with department approval. This capstone experience requires that an interdisciplinary team or individual engage in various facets of a real product development initiative. The project may be an approved company-sponsored or student-originated effort. Applying arts, business and engineering skill sets gained from previous course work, students will identify a potential opportunity and conceive viable product concepts to be pursued across the three project stages of concept generation, concept development and refinement, and concept finalization. The semester will culminate with each team or individual pitching a set of prototypes and business cases for preferable concepts, with at least one viable concept supported by a viable business case and expected class deliverable. Graded as S/U/F.

INNO 652. Master's Project in Product Innovation II. 6 Hours.

Semester course; 2 lecture and 4 laboratory hours (delivered online, face-to-face or hybrid). 6 credits. Prerequisite: INNO 651. This is the second course of the capstone experience that may culminate in one of three ways: 1) Viable projects from the prerequisite course will allow interdisciplinary teams or individuals to continue engaging in the facets of a company-sponsored or student-originated product development initiative, resulting in a proposal of at least one well-detailed, functional product prototype accompanied by a formal business plan, as well as writing requirements to document process, successes and pitfalls; 2) For projects unsuccessful in achieving viability or where industry experience is a serious interest, students may pursue a guided internship in product development, product management or a related field, culminating with deep written reflection on the experience as well as writing requirements to document process, successes and pitfalls; or 3) Students may propose to complete original research and compose a graduate thesis based on an approved topic of innovation. Thesis students may be asked to submit a writing sample prior to department approval of this option, and will be required to form a committee of three full-time faculty members or administrators, with one party external to the department. Graded as S/U/F.

INNO 691. Topics in Product Innovation. 1-3 Hours.

Semester course; 1-3 lecture hours (delivered online, face-to-face or hybrid). 1-3 credits. May be repeated for a maximum of six credits. Enrollment is restricted to students in the Master of Product Innovation program and the graduate Certificate in Health Care Innovation, or with approval of the instructor. Study of current and emerging topics in the field of product innovation. Topics may vary by semester. See the Schedule of Classes for offerings each semester.

INNO 697. Guided Study in Product Innovation. 1-3 Hours.

Semester course; 1-3 independent study hours. 1-3 credits. May be repeated for a maximum of six credits. Students in the M.P.I. program who wish to do research on problems in the area of product innovation will submit a detailed outline of their problem. They will structure a research study, undertake this study and prepare a written report on the problem. Approval of proposed work is required by the program director.

Office of Research and Innovation

Clinical and Translational Research (CTTR)

CTTR 520. Fundamentals of Research Regulation. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Focuses on the regulations that govern translational and clinical research. There will also be a series of discussions on the influence of international policies and research guidelines on the conduct of research. Topics include, but are not limited to, the history and current role of the FDA and the OHRP within the research arena; informed consent regulations relevant to federally funded research i.e., the common rule; informed consent regulations relevant to investigations conducted in support of a new drug application or an expanded marketing indication; good clinical practice guidelines; international conference on harmonization (ICH) conduction of research guidelines; HIPPA rules and regulations relevant to the conduction of research on human subjects; fiscal accountability/responsibility; and clinical trial registration and results reporting guidelines.

CTTR 630. Design Implications in Clinical Trials. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course focuses on designing intervention studies to achieve research objectives by selecting appropriate study samples, end points and trial designs. Specific topics include efficacy versus effectiveness trials and critiquing clinical trial protocols, with emphasis on evaluating strengths and weaknesses of trial design.

CTTR 631. Adaptive Clinical Trials. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: CTTR 630 or BIOS 571. This course is intended for the research scientist who is interested in advancing innovative trial designs and wishing to incorporate adaptations, modifications and changes to the clinical trial process. The goal is to enhance comprehension and methodologic skills in designing adaptive clinical trials for clinical investigators. The course provides an overview of the theoretical framework and key concepts of adaptive design methods in clinical trials. The design and implementation process are discussed through real-world examples. The feasibility, validity, integrity and efficiency of the trial designs will be stressed through comparisons between traditional fixed and adaptive trials. Graded as pass/fail.

CTTR 640. Team Science: Theories and Practice. 2 Hours.

Semester course; 2 lecture hours (delivered online). 2 credits. In this seminar-style course, students will keep current by participating in presentations, discussion and writing on the topic of the science of team science. This course is designed to introduce students to research in the social sciences and to help build skills in critical-thinking, leading discussions, writing and providing succinct presentations. Teamwork is difficult and it is pervasive. Whether engaging in collaborative research or collaborating with others within a chosen profession, students will better understand how to be more effective at being team members as well as leading a team.

CTTR 690. Research Seminar in Clinical and Translational Sciences. 1 Hour.

Semester course; 1 lecture hour. 1 credit. The course will include student presentations and discussion of research topics and published papers of current interest within the broad field of the biomedical and biobehavioral sciences, focusing on interdisciplinary and systems-related research. Students will be required to make an oral presentation on their research the final semester they enroll in the course for credit. Students will keep current on new findings in the biomedical and biobehavioral sciences and, through presentations and the constructive critiques of course participants, will develop verbal research communication skills. Graded as S/U/F. M.S. students will be enrolled for three semesters; Ph.D. students for four semesters.

CTTR 691. Special Topics in Translational Research. 1-6 Hours.

Semester course; variable hours. 1-6 credits. Restricted to graduate students in clinical and translational sciences programs or by permission of instructor. Translational research improves the "bench-to bedside" trajectory of health research and is a rapidly evolving field. This course provides exposure opportunities to learn about the latest issues surrounding translational research in various disciplines. Graded S/U/F.

CTTR 692. Special Topics in Translational Research. 1-6 Hours.

Semester course; variable hours. 1-6 credits. Restricted to graduate students in clinical and translational sciences programs or by permission of instructor. Translational research improves the "bench-to bedside" trajectory of health research and is a rapidly evolving field. This course provides exposure opportunities to learn about the latest issues surrounding translational research in various disciplines.

CCTR 697. Directed Research in Clinical and Translational Sciences. 1-15 Hours.

Semester course; 1-15 research hours. 1-15 credits. May be repeated for credit. Research leading to the M.S. or Ph.D. degree and elective research projects for other students. Graded S/U/F.

CCTR 700. Master's Capstone Project. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course is the final "capstone" product for which a student should enroll after successfully completing 27 credits of didactic course work and directed research hours. Enrollment requires the approval of the program director and student's adviser. Students may select one of two options: 1) and NIH-style grant application demonstrating knowledge of the translational and clinical processes and the regulatory environment in which research is conducted or 2) a scientific research article to be submitted to a peer-reviewed journal. Students will demonstrate that they are able to integrate the core competencies of the master's program into problem resolution as evidenced by the development of a sound, well-written research project grant proposal or research article. Graded as S/U/F.

CCTR 702. Statistics for Genetic Studies I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to students in the psychiatric, behavioral and statistical genetics track of the clinical and translational sciences doctoral program or by permission of instructor. Teaches students statistical methods for multidisciplinary research, specifically presenting the mathematical components that underlie statistical analysis and including probability theory, statistical distributions, inference and linear models.

CCTR 703. Statistics for Genetic Studies II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Restricted to students in the psychiatric, behavioral and statistical genetics track of the clinical and translational sciences doctoral program or by permission of instructor. Builds upon the quantitative statistical methods from CCTR 702. Students will learn the mathematical components that underlie statistical analysis with a focus on maximum-likelihood methods and structural equation modeling. These components provide the necessary foundation for clinical and translational research and the advanced statistical genetic methods for understanding how genetic and environmental factors impact the development of psychiatric and substance abuse disorders.

CCTR 801. Clinical Practicum. 2 Hours.

Semester course; 2 practicum hours. 2 credits. Designed to equip students with knowledge of the translational and clinical research processes and the environments in which research is conducted. Through participation in these practica, the student will observe and develop an appreciation for the role of clinical or translational scientists in the design, conduction and analysis aspects of human research, including data collection, analysis or monitoring; case management of protocol participants; recruitment and enrollment of human subjects; protection of subjects and subjects' rights; development of informed consent documents; preparation of adverse event experience reports; construction or monitoring of case report forms; grant and budget development; report preparation; and education of other health care professionals, patients or families regarding clinical and translational studies, protocol development and program administration. Graded as S/U/F.

CCTR 802. Research Practicum I. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Designed to equip students with knowledge of the translational and clinical research processes and the environments in which research is conducted. Through participation in these practica, the student will observe and develop an appreciation for the role of clinical or translational scientists in the design, conduction and analysis aspects of human research, including data collection, analysis or monitoring; case management of protocol participants; recruitment and enrollment of human subjects; protection of subjects and subjects' rights; development of informed consent documents; preparation of adverse event experience reports; construction or monitoring of case report forms; grant and budget development; report preparation; and education of other health care professionals, patients or families regarding clinical and translational studies, protocol development and program administration. Graded as S/U/F.

CCTR 803. Research Practicum II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Designed to equip students with knowledge of the translational and clinical research processes and the environments in which research is conducted. Through participation in these practica, the student will observe and develop an appreciation for the role of clinical or translational scientists in the design, conduction and analysis aspects of human research, including data collection, analysis or monitoring; case management of protocol participants; recruitment and enrollment of human subjects; protection of subjects and subjects' rights; development of informed consent documents; preparation of adverse event experience reports; construction or monitoring of case report forms; grant and budget development; report preparation; and education of other health care professionals, patients or families regarding clinical and translational studies, protocol development and program administration. Graded as S/U/F.

CCTR 898. Dissertation Research in Clinical and Translational Sciences. 1-10 Hours.

Semester course; variable hours. 1-10 credits. Students will be required to complete a minimum of 15-30 credits under this course number directed toward completion of a dissertation. Prerequisite: admission to candidacy. Dissertation research with a strong interdisciplinary focus, as facilitated by the composition of the research advisory committee. Graded as S/U/F.

Research (OVPR)**OVPR 601. Scientific Integrity. 1 Hour.**

Semester course; 1 lecture hour. 1 credit. A survey of contemporary issues relating to responsible conduct in research. Topics include academic integrity, mentoring, authorship and peer review, use of humans and animals in biomedical research, ownership of data, intellectual property, conflict of interest, scientific record keeping, collaborative research, research misconduct, and genetic technology. Graded as pass/fail.

OVPR 602. Responsible Scientific Conduct. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Priority registration to postdoctoral trainees and graduate students; others by permission of instructor. A survey of contemporary issues relating to responsible conduct in research. Topics include research integrity, mentoring, authorship and peer review, use of humans and animals in biomedical research, ownership of data, intellectual property, conflict of interest, scientific record keeping, collaborative research, research misconduct, and genetic technology. Graded pass/fail.

OVPR 603. Responsible Conduct of Research. 1 Hour.

Short course; 1 lecture hour. 1 credit. Restricted to graduate or professional students, with preference given to Preparing Future Faculty students. Registration requires permission of PFF Program office. This course is designed to provide a learning experience that will enable students to develop and refine skills needed to solve problems involving relevant topic areas of responsible scientific conduct and to clearly articulate ethically and legally acceptable solutions to problems posed about scientific conduct. Content of the course includes relevant guidelines, policies and laws bearing on the conduct of scientific research including those dealing with scientific authorship, use of humans and animals in research, conflict of interest, data ownership, scientific record keeping, collaborative research, and ownership, protection and use of intellectual property in the arena of scientific research. Conventions and normative behavior related to responsibilities in the scientific mentor-trainee relationship will also be covered. Graded as pass/fail.

OVPR 611. Data Science I. 3 Hours.

Semester course; 3 lecture hours. 3 credits. This course will introduce students to tools and techniques from the discipline of data science that support efficient and reproducible scientific computing. Students will gain hands-on experience developing complete data analysis projects based on real-world datasets. Lessons will cover the primary tasks that comprise most analyses: data management/acquisition, cleaning, reshaping, manipulation, analysis and visualization, as well as strategies for arranging these constituent parts into cohesive workflows that are verifiable, easily repeatable and consistent with best practices for reproducible computational research. This course will focus on the statistical programming language R but no programming background is necessary. Crosslisted as: HGEN 611.

OVPR 612. Data Science II. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: HGEN 611/OVPR 611. This course builds upon the material introduced in the prerequisite course by providing instruction on advanced techniques for working with data and producing highly reproducible data products. The learning path focuses on the fundamentals of both machine learning and the creation of production-ready web applications as two highly marketable skills for future data scientists. Project-based assignments culminate in students creating their own applications that take advantage of tidy model principles to automate machine-learning workflows, visually communicate knowledge with interactive graphics and using Git and OSF for project management. The guiding principle of the course is that the these products of research should be open and accessible to all members of a project team for maximum impact. This course will continue the use of the statistical programming language R with a focus on advanced tidyverse functions for data wrangling and statistical model development. Crosslisted as: HGEN 612.

Graduate School

Graduate School (GRAD)

GRAD 601. The Academic Profession. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Restricted to graduate or professional students. Designed to introduce graduate students to the roles and responsibilities of faculty members in institutions of higher education. Through readings, discussion and conversations with faculty members from a variety of settings, students will learn about the changing social expectations for higher education, the diverse settings in which faculty work and strategies for developing and presenting marketable academic skills. Graded as pass/fail.

GRAD 602. Teaching and Learning in Higher Education. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Restricted to graduate or professional students. This course focuses on the art and science of teaching and learning in higher education. Graded as pass/fail.

GRAD 604. Teaching, Learning, Technology and the Future of Higher Education. 2 Hours.

Semester course; 2 lecture hours. 2 credits. This course is designed to provide students with an introduction to contemporary technologies and the implications for instructional practices that can serve as both a foundation and a process for continued growth and development in understanding teaching and learning. Throughout the course students will explore and critically examine how the World Wide Web and emerging digital technologies are changing the landscape of learning in higher education. Class sessions will consider key instructional contexts/issues and explore the ways in which digital technology might enhance learning. Specific attention will be given to the ways in which students explore, select, use and assess the use of technology in teaching.

GRAD 605. Professional Specialty Seminar. 1-3 Hours.

Short course; 1-3 seminar hours. 1-3 credits. Prerequisites: GRAD 601 and GRAD 602. Restricted to graduate or professional students. Registration by permission of PFF Program office. Seminars will provide students with the opportunity to focus on the full range of faculty responsibilities specific to their chosen disciplines/professions in such a way that builds on the more general knowledge and skills covered in prerequisite courses. Students will be enrolled in a professional cluster section related to their academic disciplines (such as fine arts, social sciences, physical and life sciences, health sciences, etc.). Graded as pass/fail.

GRAD 606. Internship/Externship in Professional Teaching. 1-3 Hours.

Intern course; 1-3 practicum hours. 1-3 credits. Prerequisites: GRAD 601, 602, 604 or 605; and OVPR 603. Restricted to graduate or professional students. Registration by permission of the PFF Program office after proposal submission and approval. The internship in professional teaching is the capstone experience of the Preparing Future Faculty Program in which students will gain experience and practice in clinical/field or studio instruction under the tutelage of a senior faculty mentor at an institution that most likely mirrors the institution of interest to the student. A proposal agreement must be signed by the faculty mentor who will direct the project and assign the final grade and must be submitted to the PFF Program office for approval before the student enrolls or begins the internship/externship. The proposal must define the project and the intended outcomes, must specify the learning goals and the agreed-upon methods for evaluation, and must identify the institution where the project will take place. At the end of the project, the student must submit to the faculty mentor a report describing the experience and the extent to which the stated goals were accomplished. The faculty mentor will submit the student report, along with an evaluation of the project and the grade to be awarded, to the director of the PFF Program. Each internship/externship course requires approximately 150 contact hours in the form of preparing for and carrying out the project. The student's role is to be one of "junior faculty member" and the faculty member's as guide and mentor. Students must complete all three hours of GRAD 606 for the PFF Certificate of Achievement and must have made final edits and uploads of all relevant materials to their PFF electronic portfolios. Refer to PFF Program website for proposal instructions and electronic portfolio requirements: <http://www.graduate.vcu.edu/programs/pff/courses.html>. Graded as pass/fail.

GRAD 610. Career and Professional Development Planning for Graduate Students. 1 Hour.

Semester course; 2 lecture hours per week for seven weeks. 1 credit. Prerequisite: graduate standing. This course is designed to assist participants as they navigate the challenges faced when making career choices in a complex global economy. Includes opportunities for self- and career-skills assessment.

GRAD 611. Professional and Personal Development. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Open to graduate students and postdoctoral fellows with permission of instructor. The course will involve self-assessment and development of the student's personal mission statement and individual development plan in consultation with faculty and alumni mentors from the student's discipline.

GRAD 612. Oral Presentation Skill-building for Career Professionals. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Graduate standing required. This course focuses exclusively on developing and delivering presentations. Students are expected to create professional presentations representative of their focused research area to be delivered to a "lay" audience. Class exercises focus on audience analysis and strategic choices, theme development, argument construction, and impromptu public speaking as a means to develop confidence in speaking to an audience. Graded as S/U/F.

GRAD 614. Introduction to Grant Writing. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment requires graduate standing. This course introduces the graduate student to the grant-writing process. Topics include basic components of a grant application, writing the proposal, identifying funding sources, understanding proposal guidelines and the grant proposal review process. Graded S/U/F.

GRAD 615. Biomedical Science Careers Seminar Series. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Open to graduate students and postdoctoral fellows with permission of instructor. Trainees investigate the broad spectrum of potential careers available to biomedical scientists by participating in weekly discussions, each with a scientist who has been successful in a different career path. Graded P/F.

GRAD 616. Becoming an Entrepreneur. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment requires graduate standing. This course introduces the student to the core concepts and resources of entrepreneurship. Topics include recognizing the need for innovation, how to develop a business plan, building an effective team, intellectual property, patent and trademark strategy, marketing strategy and cultivating funding sources. Graded S/U/F.

GRAD 617. Biomedical Sciences Projects in the Community. 2 Hours.

Semester course; 1 lecture hour and 1 service-learning/laboratory hour. 2 credits. Prerequisite: Enrollment requires graduate standing. The community service based experiential learning project is selected to provide an integrative learning experience that addresses the practice of citizenship and promotes an awareness of and participation in public affairs. Service projects will be selected to benefit a community organization, agency, public service provider, the VCU BEST program or another unit within the university. The goal of these projects is to provide students with an opportunity to gain firsthand exposure to specific target populations/organizations, observing the needs and current efforts, if any, to address those needs. Community partners will include nonprofit agencies, schools, worksites, hospitals and state and local health departments. Approved experiential learning placements and assignments will vary depending on the specific project topic and learning objectives. Reflection, project/activity presentation and website narratives will be required for the experiential learning project.

GRAD 691. Topics in Graduate Education. 1-15 Hours.

Variable lecture hours. Variable credit. Restricted to graduate or professional students. A seminar course for the examination of specialized issues, topics, readings, problems or areas of interest for all graduate students, such as the responsible conduct of research, globalization, mentoring, service-learning and areas of interest for graduate students interested in careers within and outside of academe. This course is open to all graduate, postgraduate and professional students unless specifically restricted. Graded as P/F.

GRAD 693. Graduate Internship. 1-9 Hours.

Semester course; variable hours (60 hours per credit). 1-9 credits. Students will spend 60 to 540 hours in a planned, supervised experience with an agency or business. A summary of work duties and how internship relates to degree program along with confirmation of hours worked must be submitted. Must consult with and have approval from current degree program director for course to count in degree program. Graded as S/U/F.

GRAD 697. Directed Research. 3,6 Hours.

Semester course; 3, 6 research hours. 3, 6 credits. Prerequisite: completion of all course work in M.I.S. program's individualized course of study concentration and approval of final research project proposal and degree candidacy. Restricted to graduate or professional students. Registration by permission of M.I.S. graduate program director. A final directed research study for the M.I.S. capstone project culminating in a synthesis of the academic focus areas of the student's M.I.S. curriculum plan. Students must receive a grade of A or B. A maximum of 6 credits applicable to the M.I.S. degree.

Academic Affairs

Community Studies (CMST)

CMST 691. Special Topics in Community Studies. 1-3 Hours.

Semester course; 1-3 variable hours. 1-3 credits. May be repeated for a maximum of 6 credits. Prerequisite: permission of instructor. Provides an in-depth study of a selected topic related to community studies. See the Schedule of Classes for specific topics to be offered each semester. If several topics of different content are offered, students may elect to take more than one.

CMST 692. Independent Study in Community Studies. 1-3 Hours.

Semester course; 1-3 variable hours. 1-3 credits. Prerequisite: permission of instructor. Intensive study or research under supervision of a faculty member in an area not covered in-depth or contained in other VCU graduate-level courses.

Center for Interprofessional Education and Collaborative Care

Interprofessional Education and Collaborative Care (IPEC)

IPEC 501. Foundations of Interprofessional Practice. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Open to students enrolled in a professional health science degree program. An introductory study of the concept of interprofessional collaborative practice, this course includes units on health care systems, teams and teamwork, and professional roles and responsibilities. Students actively work within interprofessional student teams to apply course content during specific learning activities that build a foundation of the knowledge, skills and attitudes necessary for effective interprofessional practice in contemporary health care.

IPEC 502. Interprofessional Quality Improvement and Patient Safety. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Enrollment is restricted to students in the College of Health Professions and the schools of Medicine, Nursing and Pharmacy. A study of interprofessional quality improvement and patient safety, this course includes units on quality in the workplace, error in the health care system and improving health care. Students actively work within interprofessional student teams to apply course content to specific learning activities for interprofessional quality improvement and patient safety practice. Graded as pass/fail.

IPEC 525. Mindfulness Practices for Health Care Professionals: Clinical Applications. 1 Hour.

Semester course; 16 hours (lecture/seminar). 1 credit. Open to health care professional students in good standing (e.g. students in the schools of Dentistry, Nursing, Medicine, Pharmacy, Allied Health Professions or Social Work or in the programs of dental hygiene or clinical psychology). This course will allow a qualified health care professional student the opportunity to participate in a variety of mindfulness practices and learn their applications to clinical practice.

IPEC 528. Global Health and Health Equity. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course will cover health disparities, health equity, international health, and being a community member as well as a provider and advocate for the community. The course will focus on practicing health care in a low-resource setting, health disparities that exist in these settings, and the concepts and goals of what it means to be a health care provider in low-resource settings both domestically and abroad. Participation in a health services brigade is not required. Graded as Pass/Fail.

IPEC 561. IPE Virtual Geriatric Case. 2 Hours.

Semester course; 2 lecture hours (delivered online). 2 credits. Health professional learners from multiple disciplines will collaborate to identify health care needs and plan care for an older adult. Contemporary theoretical concepts and evidence-based recommendations will be integrated within a complex, unfolding case that crosses all settings of care: ambulatory, inpatient, post-acute, community-based and palliative/end-of-life. Patient- and family-centered care concepts will also be emphasized throughout each module. Learners who participate in this preceptor-supervised virtual case will make decisions based on their discipline-specific geriatric/gerontological competencies, practice identifying and retrieving evidence to fill gaps in knowledge, reinforce understandings about the scope of practice for other health professions, and expand working capacity for interprofessionalism and team-based care. Graded as pass/fail.

IPEC 562. IPE Quality Improvement Project Practicum. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: IPEC 502 or HADM 609 or approval by course director. Enrollment restricted to students in the schools of Allied Health Professions, Medicine, Nursing and Pharmacy. This capstone course will provide interprofessional teams of students the opportunity to apply quality improvement processes and patient safety theories, models, methods, and tools in a health care setting to execute a quality improvement project in an organizational setting. Graded as Pass/Fail.

IPEC 563. Interprofessional Complex Care Coordination. 2-3 Hours.

Semester course; 2-3 lecture hours. 2-3 credits. May be repeated for a maximum of six credits. This course focuses on the health care utilization of complex patients and identifies root causes of patients who require frequent health care services. Students actively explore topics such as how social determinants impact health, motivating change in others, how best to link complex patients to community services, the complexity of medication adherence and the importance of interprofessional teams to future professional success. Students build confidence in interprofessional health care delivery by working within interprofessional student teams to apply concepts of care coordination to complex patients. Graded as pass/fail.

IPEC 591. Interprofessional Special Topics. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated for credit. Explores specific topics in interprofessional education and collaborative care theory and practice. Sections may include lecture and/or clinical hours. See Schedule of Classes for topics offered each semester. Graded as pass/fail.