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

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

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

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

I E 688 Human Factors Engineering 3(3,0) Introduction to human performance and limitations in the design of effective and efficient systems. Covers issues related to changes in technology, impact of design on society, ethical issues in design of systems, and the cost benefits from designing systems and environments that often challenge perceived notions of benefits. Preq: Junior standing; MTHSC 102 or 106.

I E 689 Industrial Ergonomics and Automation 3(2,3) Physical ergonomics and ergonomics in industrial settings including work physiology, the physical environment, automated systems, and hybrid work systems. Preq: I E 210 or Senior standing.

I E 691 Selected Topics in Industrial Engineering 1-3(0-3,0-9) Comprehensive study of any timely or special topic in industrial engineering not included in other courses. May be repeated for a maximum of six credits. Preq: Consent of instructor.

I E 800 Human Factors Engineering 3(3,0) Fundamentals of design for human use; human performance; applications of abilities, and limitations to the design of tools, machines, facilities, tasks, and environments for efficient, safe, and comfortable human use. Preq: Consent of instructor.

I E 801 Design and Analysis of Human-Machine Systems 3(3,0) Methodologies used in the design and evaluation of human-machine systems including function and task analysis; questionnaires and interviews; scenarios, mock-ups, and prototypes; participative design, empirical testing, and iterative design; models of human-system interaction; analysis and classification of human error; and design of job performance and training aids. Preq: Graduate standing and consent of instructor.

I E 802 Design of Human-Computer Systems 3(3,0) Issues in designing, implementing, maintaining, and refining the user interface of interactive computer systems including interface design theories, models, principles, and guidelines; interaction styles; input and output devices; system messages; screen design, manuals, on-line help, and tutorials; and iterative design, testing, and evaluation. Preq: I E 801 or consent of instructor.

I E 803 Engineering Optimization and Applications 3(3,0) Introduction to optimization through the study of problems related to the planning, design, and control of production/manufacturing systems; classical nonlinear optimization and algorithmic procedures, primal and dual problems with postoptimality analysis, Markov chains. Preq: Graduate standing and consent of instructor.

I E 804 Manufacturing Systems Planning and Design 3(3,0) Concepts and principles associated with the design of manufacturing systems with a focus on modeling and integration methodologies; group technology, process planning, manufacturing modeling, and design for manufacturing. Preq: Graduate standing and consent of instructor.

I E 805 Foundations in Quality Engineering 3(3,0) Fundamental tools of quality engineering and their application to real situations; advanced statistical process control, design of experiments, Taguchi techniques, and Shainin methodologies. Preq: Graduate standing and consent of instructor.

I E 807 Discrete Systems Simulation 3(3,0) Constructing computer models to represent existing real-world systems or hypothetical future systems; experimenting with these models to explain system behavior, improve system performance, or design new systems with desirable performances. Preq: MTHSC 302 and I E 809 or consent of instructor.

I E 809 Model Systems Under Risk 3(3,0) Application of probabilistic methods to engineering problem solving and decision making. Cases are presented illustrating use of Markov chains, queueing processes, and other stochastic models in practice. Preq: MTHSC 302 or consent of instructor.

I E 811 Human Factors in Quality Control 3(3,0) Aspects of use of the human as a detector of product quality, serving as the basis for a taxonomy of human tasks in inspection; incorporates models of visual search and human decision making within the quality control framework. Preq: Graduate standing and consent of instructor.

I E 812 Work Science and Design 3(3,0) Design methods for work and work systems; scientific and engineering basis of work and its analysis. Preq: Consent of instructor.

I E 813 Occupational Ergonomics 3(3,0) Theory and applications of ergonomics at work; human performance, fatigue, stress, work patterns, work environment.

I E 815 Research Methods in Ergonomics 3(2,2) Contexts and processes for research in ergonomics with emphasis on engineering problems; scientific and engineering methods; measurement; visual and physical tasks; simulation, laboratory and archival studies. Preq: MTHSC 884 or equivalent or consent of instructor.

I E 850 Introduction to Capital Projects Supply Chain 3(3,0) Introduces the phases of capital projects; design and control of the capital projects supply chain; challenges associated with each of the primary supply chain entities—owners, contractors, and suppliers.

I E 851 Data Collection, Analysis, and Interpretation 3(3,0) Collection and presentation of data for decision making in industry focusing on design and control of industrial processes. Includes application of inferential statistics to data from industrial engineering situations. Preq: I E 850 or consent of instructor.

I E 852 Modeling and Decision Making 3(3,0) Students formulate and resolve models of industrial engineering systems focusing on decision making. Preq: I E 851 or consent of instructor.

I E 853 Foundations of Quality 3(3,0) Discusses quality control and quality assurance techniques including control charts and smaller surveillance. Special attention is devoted to non-traditional applications such as those used in nonmanufacturing supply chain. Preq: I E 850 or consent of instructor.

I E 854 Fundamentals of Supply Chain and Logistics 3(3,0) Students apply model building and analytical techniques to design, optimize, and control the supply chain and other logistics systems. Preq: I E 851 or consent of instructor.

I E 855 Capital Projects Supply Chain 3(3,0) Application of quantitative and qualitative tools and techniques to the design, control, management, and optimization of the capital projects supply chain. Preq: MGT 856 or consent of instructor.

I E 857 Industrial Safety and Risk Management 3(3,0) Discusses safety and risk management issues in industrial engineering systems including hazard information systems, process safety, export control, and federal and international safety regulation requirements. Preq: I E 850 or consent of instructor.

I E 858 Case Studies in Capital Projects Supply Chain 3(3,0) Analysis of case studies in the capital projects supply chain. Preq: I E 852, 853, 854, 855, 857, or consent of instructor.

I E 859 Capstone Design Project 3(3,0) Capstone experience in the design, control, management, and optimization of capital projects supply chains. Preq: I E 858 or consent of instructor.

I E 860 Dynamic Programming 3(3,0) Theory and methodology of dynamic programming; Bellman’s principle of optimality; Mitten’s sufficiency conditions; recursive optimization of serial and nonserial multistage systems; optimization of discrete and continuous systems through decomposition; special aspects of problem formulation. Preq: I E 803.

I E 865 Facility Planning and Design 3(3,0) Planning and design of industrial facilities emphasizing automated production facilities; quantitative approaches to equipment design and evaluation of performance. Preq: I E 803.

I E 871 Industrial Testing and Quality 3(3,0) Design and use of component and product tests; automated inspection; test and inspection in integrated systems; cost-based models. Preq: I E 661.

I E 880 Advanced Methods of Operations Research 3(3,0) Methods and applications of advanced operations research techniques; discrete optimization, integer, and mixed integer programming, Boolean minimization, network optimization, permutation methods on implicit enumeration. Preq: I E 803 or consent of instructor.
INTEGRATED PEST MANAGEMENT

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

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

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

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

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

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

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

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

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

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

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

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

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

LANGUAGE

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

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

LAW

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

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

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

LAW 850 Law for Professional Accountants 3(3,0) Preparation for professional exams and responsibilities in managerial positions. Topics include professional and legal responsibilities of accountants, business organizations, commercial law, government regulation of business and property. Case studies, problems, and student papers are utilized. Preq: LAW 322 or equivalent.

M B A

See courses listed under Business Administration.

MANAGEMENT

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

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

MGT 805 Industrial Management Internship 0 Faculty-approved internship to give MS in Management students on-the-job learning in support of classroom education. Internships must be at least six, full-time, consecutive weeks with the same internship provider. May be repeated. Preq: Consent of graduate coordinator.

MGT 807 Comparative Management Theory 3(3,0) Evolution of management theory, up to and including contemporary theories; comprehensive review of the major schools of management thought, with emphasis on the area of organization theory and design.

MGT 808 Manufacturing Planning and Control Systems 3(3,0) Important components of a manufacturing planning and control system emphasizing the integration of planning and control functions in a dynamic manufacturing environment; extensive hands-on work with integrated manufacturing software. Offered spring semester only. Preq: MGT 803 or consent of instructor.

MGT (M B A) 809 Organizational Behavior and Human Resources Management 3(3,0) See M B A 809.

MGT 812 Supply Chain Management 3(3,0) In-depth study, through case studies and readings, of methodologies for designing and managing integrated, international supply chain networks. Topics include supply network design, distribution strategy, strategic alliances, inventory management, coordinated product and network design, and information systems for supply chain. Offered fall semester only. Preq: Consent of instructor.

MGT 815 Personnel Management 3(3,0) Personnel management activities including recruitment, selection, training and development, performance appraisal, discipline, grievance handling, wage and salary administration, and employee benefit programs.

MGT 818 E-Commerce Web Site Development 3(2,1) Enabling information technologies for electronic commerce, including databases and Web applications. These technologies are applied to a project. Preq: Computer programming experience.

MGT 819 Web-Based Information Systems for Supply Chain Management 3(2,1) Examines system architectures, technologies, approaches, and infrastructure requirements for supply-chain information systems. Students learn to design, develop, and implement systems that facilitate collaboration of an enterprise with its buyers and suppliers. Preq: MGT 812 and 818 or consent of instructor.

MGT 820 Service Operations Management 3(3,0) Concepts and techniques of service operating system design and management. Topics include characteristics of services, service system performance measurement, queuing and automation, planning and control in different service environments, and international service operations. Preq: MGT 803 or consent of instructor.

MGT 821 Lean Operations 3(3,0) Examines uses of the scientific method, the Toyota Production System and the application of the appropriate tools and techniques to design both service and production operations. Development of systems that promote lean operations is emphasized. Preq: M B A 806, M B A 856, or MGT 803 or consent of instructor.

MGT 822 International Operations Management 3(3,0) Operations management within an international business environment. Topics include the regulatory and cultural environment of international business, international business and operations strategies, global location, global sourcing and logistics decisions, international workforce management, technology transfer and configuration, and coordination of global operations activities. Preq: MGT 803 or consent of instructor.

MGT 823 Management Systems Analysis 3(3,0) Design, construction, and analysis of stochastic simulation models for typical management decisions; design; input-output; variance reduction; applications; validation; implementation; optimum seeking techniques; designed experiments; effect of model results on managerial policy decisions.

MGT 829 Management of E-Commerce 3(3,0) Concepts of electronic commerce as facilitated by the Internet and related technologies. Topics include the catalysts for e-commerce (both B2B and B2C), technological challenges, legal and regulatory framework, behavior and educational challenges, and strategies for e-commerce. Preq: Consent of instructor.

MGT 830 E-Business Strategy 3(3,0) Theory and practice of business strategy in the e-business firm, emphasizing building competitive advantage and increasing shareholder value through digital technologies. The roles of technical and general managers in electronic business are investigated through business cases and class discussion. MS in Management and MBA students may not receive credit for this course. Preq: M B A 876, MGT 829.

MGT 833 E-Commerce Project 3(0,9) Application of e-commerce knowledge to a significant problem or opportunity. Preq: Submission of a written proposal and consent of instructor.

MGT (M B A) 845 Technology and Innovation Management 3(3,0) See M B A 845.

MGT 850 Business Decision Models 3(3,0) Fundamental management science modeling techniques emphasizing problem formulation, computer solution, and economic analysis in an operations context; queuing analysis, computer simulation, and mathematical programming approaches including linear, goal, and integer programming. Application areas encompass production, capacity, and project planning, scheduling, location, layout, and logistics. Preq: Consent of instructor.
Courses of Instruction

MGT 852 Management Science II 3(3,0) Continuation of MGT 850; dynamic, integer, and nonlinear programming emphasizing applications of different types of mathematical programming to business and industrial problems. Preq: MGT 850 or consent of instructor.

MGT 854 Design of Experiments in Business and Management 3(3,0) Design and analysis of experiments with a focus on business and industrial applications. Topics range from the analysis of single-factor experimental designs through factorial experiments, multiple comparisons, and confounding. Problems arising in the actual industrial environments are used to illustrate the application of the techniques and to introduce the student to major statistical software packages for the analysis of experimental data. Offered fall semester only.

MGT 856 Business Fundamentals for Supply Chain Management 3(3,0) Principles and techniques of leadership, human resources management, financial management, marketing, and economic analysis, particularly as they relate to the capital projects supply chain management.

MGT (M B A) 861 Information Systems 3(3,0) See M B A 861.

MGT 866 System Analysis and Design 3(2,1) Software engineering methods and techniques specific to analysis and design of information systems. Topics include concepts and methods for valuation of IT applications, data gathering, and process data, and object-oriented modeling analysis and design.

MGT 869 Project Management 3(3,0) In-depth study, through case studies, readings, and hands-on experience, of processes and techniques to initiate, plan, execute, control, and close-out information technology projects. Topics include project integration, scope, time, cost, quality, human resource, communications, risk, and procurement management. Preq: Consent of instructor.

MGT (M B A) 874 Managing Continuous Improvement 3(3,0) See M B A 874.

MGT 885 Industrial Scheduling 3(3,0) Theoretical results for single and parallel machine, flow shop, job shop, and network scheduling; treatment of mathematical programming applications, scheduling algorithm design and search procedures. Preq: One of the following: C E 835, CP SC 840, IE 803, MBA 859, MGT 850, MTHSCI 812 or 814; and consent of instructor.

MGT 888 International Perspectives in Industrial Management 3-6(3-6,0) International perspective to industrial management via organized plant visitations to businesses in a foreign country and lectures by, and discussions with, senior operations managers. Cultural visits and lectures are also organized to provide a holistic perspective to cover cultural and economic development of the host country. Preq: Consent of instructor.

MGT 891 Master's Thesis Research 1-12

MGT 892 Master's Project Course 3(0,9) Field project, the capstone activity in the program, requiring application of the program body of knowledge to a real-world operations management problem. Formal presentation and written report are required. May be repeated for a maximum of 12 credits. To be taken Pass/Fail only. Preq: Consent of instructor.

MGT 899 Selected Topics in Industrial Management 3(3,0) Current topics in industrial management theory and/or practice. Topics vary in keeping with developments in the management profession and interests of faculty. May be repeated for a maximum of nine credits.

MGT 903 Seminar in Manufacturing Planning and Control Systems 3(3,0) Current research issues and developments in manufacturing planning and control systems emphasizing research (philosophical, analytical, and empirical) dealing with alternative approaches for planning and control of manufacturing operations. Preq: MGT 808, consent of instructor.

MGT 904 Seminar in Current Management Topics 3(3,0) Topics from current management literature emphasizing research from scholarly journals. Topics vary in keeping with developments in the literature. May be repeated with different faculty for a maximum of six credits. Preq: MGT 803 or consent of instructor.

MGT 905 Research Methods 3(3,0) Research methods supporting scholarly research and publication in management. Topics include theory building, hypothesis specification and testing, experimental design, measurement, sampling, research ethics, and related issues. Restricted to doctoral students. Preq: MGT 854 or equivalent.

MGT 907 Seminar in the Design of Operations Systems 3(3,0) Current management issues and developments in the evaluation, selection, design, and installation of systems for manufacturing and service operations; empirical research dealing with the building blocks of operations such as process technology scanning, selection, and installation; operations systems location and layout; and management systems selection and installation. Preq: MGT 821, consent of instructor.

MGT 910 Seminar in Operations Management 1-3(1-3,0) New methodological developments, both analytical and philosophical, in operations management; development of theory of management science; converting management theory into practice while considering behavioral and economic aspects of the problem. Preq: Consent of instructor.

MGT 916 Directed Readings in Management 1-3(1-3,0) Directed reading and research in the student's area of interest. May be repeated for a maximum of three credits. Preq: Consent of instructor.

MGT 918 Seminar in Management Support Systems 3(3,0) Contemporary topics in decision-oriented information systems research; structure of the field, research methodologies, and research opportunities. Preq: MGT 818 or consent of instructor.

MGT 925 Seminar on Information Systems Foundations 3(3,0) Foundations of information systems research including classical framework literature. Research philosophies, key methodologies and relevant theoretical underpinnings are discussed and debated.

MKT 627 International Marketing 3(3,0) Study of marketing from the international point of view. Emphasis is on the necessary modification of marketing thinking and practice for foreign markets due to individual environmental differences. Preq: MKT 301.

MKT 628 Services Marketing 3(3,0) Exploration and study of the nature of service organizations and the principles that guide the marketing of their products. Emphasis is on a marketing mix that is fundamentally different than that found in traditional goods marketing. Preq: MKT 301 or consent of instructor.

MKT 629 Public and Nonprofit Marketing 3(3,0) Examines the role and application of marketing in public and nonprofit settings. Focuses on a conceptual understanding of the marketing discipline and marketing processes and shows how basic concepts and principles of marketing are applicable to public and nonprofit organizations. Preq: MKT 301 or consent of instructor.

MKT 630 Marketing Product Management 3(3,0) Management of the firm's product or service offerings. Topics include new product screening, evaluation, and development; product line and mix analysis; abandonment decisions; brand manager's role; new product development department and others. Emphasis is on decision making. Preq: MKT 310, MKT 301; or consent of instructor.

MKT 695 Selected Topics 3(3,0) In-depth examination of timely topics in marketing. May be repeated for credit, but only if different topics are covered. Preq: MKT 301 or consent of instructor.

MKT (M B A) 826 Business Marketing 3(3,0) See M B A 826.

MKT (M B A) 828 Services Marketing 3(3,0) See M B A 828.
MKT 860 Advanced Marketing Strategy 3(3,0)
Advanced marketing theory and critical thinking skills applied to support strategic decision making. Data analysis and advanced marketing models are employed with emphasis on building analytic and assessment skills. Offered spring semester only. Prq: M B A 555 or MKT 865 or consent of instructor.

MKT 861 Marketing Research 3(3,0)
Marketing theory and critical thinking to support decision making; data analysis and advanced marketing models are employed with emphasis on building assessment skills. Primary topics are gathering primary and secondary data, questionnaire design, sampling, experimental design, data collection, and data analysis. Prq: Enrollment in MS in Marketing or MKT 860 or consent of instructor.

MKT 862 Quantitative Methods in Marketing 3(3,0)
Advanced quantitative analytic methods and their use in translating facts into meaningful information. Provides practical understanding of several advance quantitative data analytic procedures including both predictive and interdependence techniques. Application to case analysis format to broaden analysis skills. Prq: MKT 861 or consent of instructor.

MKT 863 Buyer Behavior 3(3,0)
Buyer decision processes in the purchase and consumption of goods and services by both businesses and consumers. Topics include economic, sociocultural, and psychological aspects of buying behavior; decision-making processes and buyer choice; individual and group level influences on consumer behavior; and implications of consumer behavior for marketers. Prq: Enrollment in MS in Marketing or MKT 860 or consent of instructor.

MKT 865 Seminar in Marketing Management 3(3,0)
Current research and practice in components of marketing management. In-depth discussion of marketing mix variables, segmentation, targeting and positioning, and budget-related issues. Prq: Enrollment in MS in Marketing.

MKT 866 Selected Topics in Marketing 3(3,0)
Current topics in marketing theory and research. Topics vary with developments in the marketing profession. May be repeated for a maximum of six credits, but only if different topics are covered. Prq: MKT 860 or 865 or consent of instructor.

MKT 870 Master's Research Project 1-5
Student development and participation in research. Application to a current business problem or development of new research. Formal presentation and written report are required. May be repeated for a maximum of five credits. Prq: Enrollment in MS in Marketing and consent of graduate advisor.

MASTER OF BUSINESS ADMINISTRATION (MBA)
See courses listed under Business Administration.

MATERIALS SCIENCE AND ENGINEERING

MS&E 800 Seminar in Materials Research 1(1,0)
Special topics and original research in materials science, materials engineering, and polymer and fiber chemistry. To be taken Pass/Fail only.

MS&E 820 Deformation Mechanisms in Solids 3(3,0)
Dislocation theory of solids; mechanisms of plastic deformation in single crystals and polycrystalline aggregates of metals and nonmetals; ductile and brittle fractures; fatigue, creep, and stress corrosion cracking of metals. Prq: Consent of instructor.

MS&E 821 Fracture and Fatigue 3(3,0)
Investigation into stress-strain-time relations in elasticity, plasticity, and rupture showing effects of high- and low-temperature structures. Prq: MS&E 820 or consent of instructor.

MS&E 825 Solid State Materials Science 3(3,0)
Bonding and structure of crystalline materials as related to mechanical, thermal, and chemical properties of solids.

MS&E 826 Phase Equilibria in Materials Systems 3(3,0)

MS&E 827 Kinetics of Phase Transformation 3(3,0)
Advanced treatment of the kinetics of phase transformation in materials systems including nucleation, growth, and spinodal decomposiition. Prq: MS&E 826 or equivalent, consent of instructor.

MS&E 828 Phase Transformations in Materials Science 3(3,0)

MS&E 891 Master's Thesis Research 1-12

MS&E 991 Doctoral Dissertation Research 1-12

MATHEMATICAL SCIENCES

MTHSC 600 Theory of Probability 3(3,0)
Principal topics include combinatorial theory, probability axioms, random variables, expected values, special discrete and continuous distributions, jointly distributed random variables, correlation, conditional expectation, law of large numbers, central limit theorem. Prq: MTHSC 206 or consent of instructor.

MTHSC 603 Introduction to Statistical Theory 3(3,0)
Principal topics include sampling distributions, point and interval estimation, maximum likelihood estimators, method of moments, least squares estimators, tests of hypotheses, likelihood ratio methods, regression and correlation analysis, introduction to analysis of variance. Prq: MTHSC 400 or equivalent.

MTHSC 605 Statistical Theory and Methods II 3(3,0)
Principal topics include simple linear regression, multiple regression and correlation analysis, one-way analysis of variance, multiple comparison, multifactor analysis of variance, experimental design. Computation and interpretation of results are facilitated through use of statistical computer packages. Prq: MTHSC 301.

MTHSC 606 Sampling Theory and Methods 3(3,0)
Probability-based treatment of sampling methodology. Theory and application of estimation techniques are treated using simple and stratified random sampling, cluster sampling, and systematic sampling. Prq: MTHSC 302 and 400, or consent of instructor.

MTHSC 607 Regression and Time Series Analysis 3(3,0)
Theory and application of the regression and time series. Approaches to empirical model building and data analysis are treated. Computation and interpretation of results are facilitated through the use of interactive statistical packages. Prq: MTHSC 302, 311, 400; or consent of instructor.

MTHSC 608 Topics in Geometry 3(3,0)
Introduction to topics in special geometries which include non-Euclidean space concepts such as projective geometry, finite geometries, and intuitive elementary topology. Brief introduction to vector geometry. Prq: MTHSC 206.

MTHSC 612 Introduction to Modern Algebra 3(3,0)
Introduction to the concepts of algebra. Topics include the number system and the elementary theory of groups, rings, and fields. Prq: MTHSC 311.

MTHSC 619 Discrete Mathematical Structures II 3(3,0)
Applies theoretical concepts of sets, functions, binary relations, graphs, Boolean algebras, propositional logic, semigroups, groups, homomorphisms, and permutation groups to computer characteristics and design, words over a finite alphabet and concatenation, binary group codes, and other communication or computer problems. Prq: MTHSC 311.

MTHSC 634 Advanced Engineering Mathematics 3(3,0)
Fourier series, Laplace and Fourier transform, and numerical methods for solving initial value and boundary-value problems in partial differential equations are developed. Applications to diffusion wave and Dirichlet problems are given. Matrix methods and special functions are utilized. Prq: MTHSC 208.

MTHSC 635 Complex Variables 3(3,0)
Elementary functions; differentiation and integration of analytic functions; Taylor and Laurent series; contour integration and residue theory; conformal mapping; Schwarz-Christoffel transformation. Prq: MTHSC 206.

MTHSC 640 Linear Programming 3(3,0)
Introduction to linear programming covering the simplex algorithm, duality, sensitivity analysis, network models, formulation of models, and the use of simplex codes to solve, interpret, and analyze problems. Prq: MTHSC 206, 311, or consent of instructor.

MTHSC 641 Introduction to Stochastic Models 3(3,0)
Introductory treatment of stochastic processes, finite-state Markov chains, queueing, dynamic programming, Markov decision processes, reliability, decision analysis, and simulation. Both theory and applications are stressed. Prq: MTHSC 400.

MTHSC 653 Advanced Calculus I 3(3,0)
Limits, continuity, and differentiation of functions of one and several variables, the Riemann integral, and vector analysis. Prq: MTHSC 206.
Courses of Instruction

MTHSC 654 Advanced Calculus II 3(3,0)
Continuation of MTHSC 653. Transformations, multiple integrals, line and surface integrals, infinite sequences and series, and improper integrals. Preq: MTHSC 453.

MTHSC 660 Introduction to Numerical Analysis I 3(3,0)
Introduction to the problems of numerical analysis emphasizing computational procedures and application. Topics include sources of error and conditioning, matrix methods, systems of linear equations, nonlinear equations, interpolation and approximation by splines, polynomials and trigonometric functions. Preq: MTHSC 206 or 207 and 360 or equivalent.

MTHSC 663 Mathematical Analysis I 3(3,0)
Basic properties of the real number system, sequences and limits; continuous functions, uniform continuity and convergence; integration, differentiation, functions of several real variables, implicit function theory. Preq: MTHSC 206.

MTHSC 670 Probability and Statistics for Middle Grades Teachers 3(3,0)
Topics include organizing, classifying, and summarizing data; univariate and bivariate graphical techniques; measures of center and dispersion; correlation and simple regression; elementary probability theory, counting, and simulations; binomial and normal distributions. A graphing calculator is used. Preq: Graduate standing in Middle Grades Education.

MTHSC 679 Geometry for the Middle Grades 3(3,0)
Hands-on approach to constructions with straight-edge and compass; polygons including tessellations and polyhedra; symmetry and transformational geometry; coordinate geometry measurement with dimensional analysis; perspective drawing and related topics; history of geometry; reasoning and informal proof with congruence; and computer software, calculator use, and Internet.

MTHSC 713 Algebra for Middle Grades Teachers 3(3,0)
Study of elementary algebra, solution of equations, and inequalities; properties and applications of linear, quadratic, polynomial, and exponential functions and models; graphical analysis and curve-fitting of real-world data; systems of equations and basic matrix operations. A graphing calculator is used. Preq: Graduate standing in Middle Grades Education.

MTHSC 714 Foundations of Mathematics for Middle Grades Teachers 3(3,0)
Topics include logic, set theory, numeration systems; arithmetic operations and their properties on the integer, rational, and real number systems; decimals, ratio, proportion, percent, exponents, and roots. Includes an introduction to algebra and counting, permutations, and combinations. Preq: Graduate standing in Middle Grades Education.

MTHSC 715 Quantitative Literacy I 3(3,0)
Data analysis and gathering data from surveys including box-and-whisker plots, bar charts, circle graphs, and stem-and-leaf plots. Construction of surveys to gather data to test a hypothesis. All material are presented by student activities using cooperative learning and manipulatives.

MTHSC 738 Modern Geometry for Secondary Teachers 3(3,0)
Concepts of Euclidean geometry reviewed and extended by means of coordinates, vectors, matrices; conic sections. Preq: Enrollment in Secondary Education graduate program.

MTHSC 740 Linear Programming for Secondary Teachers 3(3,0)
Introduction to the problems of linear programming emphasizing computational procedures and application. Topics include sources of error and conditioning; matrix methods, systems of linear equations and vector spaces; problem formulation is emphasized. Preq: Enrollment in Secondary Education graduate program.

MTHSC 749 Discrete Mathematics for Secondary Teachers 3(3,0)
Discrete mathematics emphasizing applications to computer science; propositions and logic; Boolean Algebra and switching circuits; recursion and induction; relations and partially ordered sets, graphs, and trees.

MTHSC 750 Modern Algebra for Secondary Teachers 3(3,0)
Introduction to the fundamental concepts and historical development of abstract algebra. Topics include integers, binary operations, functions, equivalence, relations, permutations, groups, polynomials, commutative rings, integral domains, and fields. Preq: MTHSC 311 or 753, Graduate standing in Secondary Education.

MTHSC 753 Matrix Algebra for Secondary Teachers 3(3,0)
Matrices and systems of equations; determinants; vector spaces and linear transformations; eigenvalues. Preq: Graduate standing in Secondary Education.

MTHSC 755 Combinatorial Analysis for Secondary Teachers 3(3,0)
Permutations; combinations; generating functions; recurrence relations; principle of inclusion-exclusion; partitions; Latin squares; block designs; finite geometries; graphs; codes; Polya's theorem; recreational mathematics. Preq: Graduate standing in Secondary Education.

MTHSC 756 Applied Modern and Linear Algebra for Secondary Teachers 3(3,0)
Various applied problems whose solutions rely on techniques and results of linear and modern algebra. Problems are selected from such areas as economics, finance management, genetics, population growth, transportation networks, cryptography, satellite communications, electronic switching circuits, chemistry, physics, sociology, and others. Preq: MTHSC 721 or equivalent or consent of instructor.

MTHSC 758 Number Theory for Secondary Teachers 3(3,0)
Topics include properties of integers, divisors, and prime numbers; fundamental properties of congruence; polynomials and primitive roots; quadratic residues. Preq: Graduate standing in Secondary Education.

MTHSC 775 AP Statistics Institute 3(3,0)
Topics include probability, conditional probability, descriptive statistics, random variables, probability functions, binomial distribution, normal distribution, sampling, estimation, decision making. Preq: Graduate standing in Secondary Education.

MTHSC 777 AP Calculus Institute 3(3,0)
Elementary functions, differential calculus and integral calculus; enrichment material and a theoretical perspective of calculus. Restricted to teachers who hold a current teaching certificate in secondary mathematics. Completion of this course satisfies the special certification requirements for AB-calculus teachers in South Carolina.

MTHSC 780 Probability Theory for Secondary Teachers 3(3,0)
Calculus-based introduction to basic ideas in probability theory. Topics include basic counting techniques, fundamental axioms of probability, conditional probability, discrete and continuous distributions, and sampling distributions. Emphasizes real-world applications and the use of simulations to illustrate concepts. Preq: MTHSC 108, Graduate standing in Secondary Education.

MTHSC 785 Data Analysis for Secondary Teachers 3(3,0)
Topics include data types, basic sampling and experimental designs, one- and two-sample confidence intervals and hypothesis tests, analysis of variance, model building with simple and multiple linear regression, and contingency tables. Includes a brief review of probability. Student groups propose and implement a real-world research project. Preq: MTHSC 301, 400, 600, or 780; Graduate standing in Secondary Education.

MTHSC 791 Selected Topics in Mathematics Education 1-3(1-3,0)
Mathematical problems in elementary or secondary school curricula. May be repeated for credit, but only if different topics are covered. Preq: Graduate standing in Elementary or Secondary Education.

MTHSC 800 Probability 3(3,0)
Study of basic probability theory with emphasis on results and techniques useful in operations research and statistics. Topics include axiomatic probability, advanced combinatorial probability, conditional informative expectation, functions of random variables, moment generating functions, distribution theory, and limit theorems. Offered fall semester only. Preq: MTHSC 206.

MTHSC 801 General Linear Hypothesis I 3(3,0)
Topics include least-square estimates; Gauss-Markov theorem; confidence ellipsoids, and confidence intervals for estimable functions; tests of hypotheses; one-, two-, and higher-way layouts; analysis of variance for other models. Offered fall semester only. Preq: MTHSC 311, 403.

MTHSC 802 General Linear Hypothesis II 3(3,0)
Continuation of MTHSC 801. Offered spring semester only.

MTHSC 803 Stochastic Processes 3(3,0)
Theory and analysis of time series, recurrent events, Markov chains, random walks, renewal theory, application to communication theory and operations research. Preq: MTHSC 400 or 800.

MTHSC 804 Statistical Inference 3(3,0)
Sampling distributions; maximum likelihood estimation and likelihood ratio tests; asymptotic confidence intervals for Binomial, Poisson, and Exponential parameters; two-sample methods; nonparametric tests; ANOVA; regression; model building. Offered fall semester only. Preq: MTHSC 400 or equivalent or consent of instructor.

MTHSC 805 Data Analysis 3(3,0)
Methodology in analysis of statistical data emphasizing applications to real problems using computer-oriented techniques: computer plots, transformations, criteria for selecting variables, error analysis, multiple and stepwise regression, analysis of residuals, model building in time series and ANOVA problems, jackknife and random subsampling, multidimensional scaling, clustering. Preq: MTHSC 301, 400.
MTHSC 806 Nonparametric Statistics 3(3,0)
Order statistics; tolerance limits; rank-order statistics; Kolmogorov-Smirnov one-sample statistics; Chi-square goodness-of-fit test; two-sample problem; linear rank statistics; asymptotic relative efficiency. Offered spring semester only. Prereq: MTHSC 600 or 800.

MTHSC 807 Applied Multivariate Analysis 3(3,0)
Applied multivariate analysis: computer plots of multivariate observations; multidimensional scaling; multivariate tests of means, covariances, and equality of distributions; univariate and multivariate regressions and their comparisons; MANOVA; principal components analysis; factor analysis; analytic rotations; canonical correlations. Offered fall semester only. Prereq: MTHSC 403 and 805 or consent of instructor.

MTHSC 808 Reliability and Life Testing 3(3,0)
Probability models and statistical methods relevant to parametric and nonparametric analysis of reliability and life testing data. Offered spring semester only. Prereq: MTHSC 400 or equivalent.

MTHSC 809 Time Series Analysis, Forecasting, and Control 3(3,0)
Modeling and forecasting random processes; autocorrelation functions and spectral densities; model identification, estimation and diagnostic checking; transfer function models; feedforward and feedback control schemes. Offered spring semester only. Prereq: MTHSC 605; 600 or 800; or equivalent.

MTHSC 810 Mathematical Programming 3(3,0)
Formulation and solution of linear programming models; mathematical development of the simplex method; revised simplex method; duality; sensitivity analysis; parametric programming; implementation and software packages. Prereq: MTHSC 311.

MTHSC 811 Nonlinear Programming 3(3,0)
Theoretical development of nonlinear optimization with applications, classical optimization, convex and concave functions, separable programming, quadratic programming, and gradient methods. Offered spring semester only. Prereq: MTHSC 440, 454.

MTHSC 812 Discrete Optimization 3(3,0)
Principles used in integer programming and discrete optimization; branch and bound, implicit enumeration, cutting planes, group knapsack, Lagrangian relaxation, surrogate constraints, heuristics (performance analysis), separation/branching strategies, and polynomial time algorithms for specific problems on special structures. Offered fall semester only. Prereq: MTHSC 810 or equivalent.

MTHSC 813 Advanced Linear Programming 3(3,0)
Development of linear programming theory using inequality systems, convex cones, polyhedra and duality; solution algorithms, and computational considerations for large scale and special structured problems using techniques of upper bounded variables, decomposition, partitioning and column generation; game theory; nonlinear representations and other methods such as ellipsoid and Karmarkar. Offered spring semester only. Prereq: MTHSC 440, 810 or equivalent.

MTHSC 814 Network Flow Programming 3(3,0)
Max-flow/min-cut theorem, combinatorial applications, minimum cost flow problems (transportation, shortest path, transshipment), solution algorithms (including the out-of-kilter), and implementation and computational considerations. Offered fall semester only. Prereq: MTHSC 440, 810 or equivalent.

MTHSC 816 Network Algorithms and Data Structures 3(3,0)
Design, analysis, and implementation of algorithms and data structures associated with the solution of problems formulated as networks and graphs; applications to graph theory, combinatorial optimization, and network programming. Offered spring semester only. Coreq: MTHSC 640, 810, 854, 863 or consent of instructor.

MTHSC 817 Stochastic Models in Operations Research I 3(3,0)
Stochastic control; structure of sequential decision processes; stochastic inventory models; recursive computation of optimal policies; discrete parameter finite Markov decision processes; various optimality criteria; computation by policy improvement and other methods; existence of optimal stationary policies; stopping rule problems; examples from financial management, maintenance and reliability, search, queueing, and shortest path. Offered spring semester only. Prereq: MTHSC 503.

MTHSC 818 Stochastic Models in Operations Research II 3(3,0)
Introduction to queuing theory: Markovian queues, general queues, systems with arrivals and departures, vacation problems, queues with an embedded Markov structure, the queue GI/GI/1, queues with a large number of servers, decision making in queues; introduction to reliability theory; failure distributions; stochastic models for complex systems; maintenance and replacement policies; reliability properties of multicomponent structures. Offered fall semester only. Prereq: MTHSC 817.

MTHSC 819 Multicriteria Optimization 3(3,0)
Theory and methodology of optimization problems with vector-valued objective functions; preference orders and domination structures; generating efficient solutions; solving multicriteria decision-making problems; noninteractive and interactive methods with applications. Offered fall semester only. Prereq: MTHSC 810 or equivalent.

MTHSC 820 Complementarity Models 3(3,0)
Theory, algorithms, and applications of linear and nonlinear complementarity; classes of matrices and functions and corresponding algorithms; applications to economics, game theory, and networks; generalization of fixed-point problems and nonlinear systems of equations. Offered spring semester only. Prereq: MTHSC 810.

MTHSC 821 Linear Analysis 3(3,0)
Normed spaces; Hilbert spaces, Banach spaces, linear functionals, linear operators, orthogonal systems. Offered spring semester and summer session only. Prereq: MTHSC 454 or 453 and 853.

MTHSC 822 Measure and Integration 3(3,0)
Rings and algebras of sets, inner and outer measures; measurability and additivity, examples on the line and in space, Lebesgue integration, types of convergence, Lebesgue spaces; integration and differentiation, product measure, Fubini theorem. Offered fall semester only. Prereq: MTHSC 454.

MTHSC 823 Complex Analysis 3(3,0)
Topological concepts; complex integration; local and global properties of analytic functions; power series; representation theorems; calculus of residues. Designed for nonengineering majors.

MTHSC 825 Introduction to Dynamical Systems Theory 3(3,0)
Techniques of analysis of dynamical systems; sensitivity analysis, linear systems, stability, and control; theory of differential and difference equations. Offered fall semester only. Prereq: MTHSC 454 and 311 or 453 and 853.

MTHSC 826 Partial Differential Equations 3(3,0)
First-order equations: elliptic, hyperbolic, and parabolic. Second-order equations: existence and uniqueness results, maximum principles, finite difference, and Hilbert Space methods. Offered fall semester only. Prereq: MTHSC 821 or consent of instructor.

MTHSC 827 Dynamical System Neural Networks 3(3,0)
Modeling problems in the context of dynamical systems theory; useful methods from Lyapunov stability, local linearization, qualitative analysis using graph theory and numerical approximations; several dynamical systems neural networks including binary code recognizers and binary matrix choosers. Prereq: MTHSC 206, 311.

MTHSC 831 Fourier Series 3(3,0)
Fourier series with applications to solution of boundary value problems in partial differential equations of physics and engineering. Introduction to Bessel functions and Legendre polynomials.

MTHSC 837 Calculus of Variations and Optimal Control 3(3,0)
Fundamental theory of the calculus of variations; variable end points; the parametric problem; the isoperimetric problem; constraint inequalities; introduction to the theory of optimal control; connections with the calculus of variations; geometric concepts. Prereq: MTHSC 453 or 463.

MTHSC 841 Applied Mathematics I 3(3,0)
Derivation of equations from conservation laws, dimensional analysis, scaling and simplification; methods such as steepest descent, stationary phase, perturbation series, boundary layer theory, WKB theory, multiple-scale analysis, and ray theory applied to problems in diffusion processes, wave propagation, fluid dynamics, and mechanics. Offered fall semester only. Prereq: MTHSC 208 and 453 or 463.

MTHSC 850 Computational Algebraic Geometry 3(3,0)
Covers algebraic geometry and commutative algebra via Grobner bases. Includes ideals and varieties (affine and projective), Grobner bases, elimination theory, dimensions, solving polynomial systems via eigenvalues and eigenvectors. Selected applications may include coding theory, computer vision, geometric theorem proving, integer programming, or statistics. Prereq: MTHSC 311, 412.

MTHSC 851 Abstract Algebra I 3(3,0)
Basic algebraic structures: groups, rings, and fields; permutation groups, Sylow theorems, finite abelian groups, polynomial domains, factorization theory, and elementary field theory. Offered spring semester only.
Courses of Instruction

MTHSC 852 Abstract Algebra II 3(3,0) Continuation of MTHSC 851 including selected topics from ring theory and field theory. Offered fall semester only.

MTHSC 853 Matrix Analysis 3(3,0) Topics in matrix analysis that support an applied curriculum: similarity and eigenvalues; Hermitian and normal matrices; canonical forms; norms; eigenvalue localizations; singular value decompositions; definite matrices. Preq: MTHSC 311, 453 or 463.

MTHSC 854 Theory of Graphs 3(3,0) Connectivity; path problems; trees; matching theorems; directed graphs; fundamental numbers of the theory of graphs; groups and graphs. Offered spring semester only. Preq: Consent of instructor.

MTHSC 855 Combinatorial Analysis 3(3,0) Combinations; permutations; permutations with restricted position; Polya's theorem; principle of inclusion and exclusion; partitions; recurrence relations; generating functions; Mobius inversion; enumeration techniques; Ramsey numbers; finite projective and affine geometries; Latin rectangles; orthogonal arrays; block designs; error detecting and error correcting codes. Offered fall semester only. Preq: MTHSC 311.

MTHSC 856 Theory of Error-Correcting Codes 3(3,0) Topics include code constructions such as Hamming, cyclic, BCH, Reed-Solomon, Goppa, algebraic geometry, finite geometry, low-dimension parity check, convolutional and polynomial codes; code parameters and bounds; and decoding algorithms. Preq: MTHSC 853 or consent of instructor.

MTHSC 857 Cryptography 3(3,0) Classical and modern cryptography and their uses in modern communication systems are covered. Topics include entropy, Shannon's perfect secrecy theorem, Advanced Encryption Standard (AES), integer factorization, RSA cryptosystem, discrete logarithm problem, Diffie-Hellman key exchange, digital signatures, elliptic curve cryptosystems, hash functions, and identification schemes. Preq: MTHSC 311, 400 or 600, 412 or 851.

MTHSC 858 Number Theory 3(3,0) Covers topics and techniques from modern number theory including unique factorization, elementary estimates on the distribution of prime numbers, congruences, Chinese remainder theorem, primitive roots, n-th powers modulo an integer, quadratic residues, quadratic reciprocity, quadratic characters, Gaussian sums, and finite fields. Preq: MTHSC 853 or consent of instructor.

MTHSC 860 Introduction to Scientific Computing 3(3,0) Floating point models, conditioning and numerical stability, numerical linear algebra, integration, systems of ordinary differential equations and zero finding; emphasis is on the use of existing scientific software. Preq: CP SC 110, MTHSC 208, 311.

MTHSC 861 Advanced Numerical Analysis I 3(3,0) Consideration of topics in numerical linear algebra: eigenvalue problems, the singular value decomposition, iterative algorithms for solving linear systems, sensitivity of linear systems, and optimization algorithms. Offered: MTHSC 311 and 460; or 860.

MTHSC 863 Digital Models I 3(3,0) Experimental mathematics; pseudostochastic processes; analytical and algebraic formulations of time-independent simulation; continuous-time simulation and discrete-time simulation; digital optimization; Fibonacci search; random search; gradient methods; current research in digital analysis. Offered fall semester only. Preq: MTHSC 311, 453, digital computer experience.

MTHSC 865 Data Structures 3(3,0) Representation and transformation of information; formal description of processes and data structures; tree and list structures; pushdown stacks; string and formula manipulation; hashing techniques; interrelation between data structure and program structure; storage allocation methods. Offered fall semester only. Preq: Computational maturity, consent of instructor.

MTHSC 866 Finite Element Method 3(3,0) Discusses the basic theory of the finite element method (FEM) for the numerical approximation of partial differential equations. Topics include Sobolev spaces, interpolation theory, finite element spaces, error estimation, and implementation of FEM in one and higher dimensions. Preq: MTHSC 860 or consent of instructor.

MTHSC 881 Mathematical Statistics 3(3,0) Fundamental concepts of sufficiency, hypothesis testing and estimation; robust estimation; resampling (jackknife, bootstrap, etc.) methods; asymptotic theory; two-stage and sequential sampling problems; ranking and selection procedures. Offered spring semester only. Preq: MTHSC 403 or equivalent.

MTHSC 884 Statistics for Experimenters 3(3,0) Statistical methods for students who are conducting experiments; introduction to descriptive statistics, estimation, and hypothesis testing as they relate to design of experiments; higher-order layouts, factorial and fractional factorial designs, and response surface models. Offered fall semester only. Preq: MTHSC 206 or equivalent.

MTHSC 885 Advanced Data Analysis 3(3,0) Continuation of MTHSC 805 covering alternatives to ordinary least squares, influence and diagnostic considerations, robustness, special statistical computation methods. Offered spring semester only. Preq: MTHSC 603, 800, 805.

MTHSC 891 Master's Thesis Research 1-12

MTHSC 892 Master's Project Course 1(0,1) For students in the nonthesis option of the MS degree program in Mathematical Sciences. Successful completion includes a presentation of the master's project to the student's advisory committee and acceptance of the paper by the committee.

MTHSC 900 Seminar in Preparing for College Teaching in the Mathematical Sciences 3(3,0) Elements involved in being a college professor with emphasis on broadening the student's mathematical experiences within a framework of improving classroom performance. Preq: Completion of the departmental PhD qualifying examinations.

MTHSC 901 Probability Theory I 3(3,0) Axiomatic theory of probability; distribution functions; expectation; Cartesian product of infinitely many probability spaces, and the Kolmogorov consistency theorem; models of convergence; weak and strong laws of large numbers. Preq: MTHSC 400 and 822, or MTHSC 800 and 822 or consent of instructor.

MTHSC 902 Probability Theory II 3(3,0) Continuation of MTHSC 901; characteristic functions, infinitely divisible distributions, central limit theorems, laws of large numbers, conditioning, and limit properties of sums of dependent random variables, conditioning, martingales. Preq: MTHSC 901.

MTHSC 927 Functional Analysis 3(3,0) Linear operators on specific spaces, spectral theory, semigroups of operators and the Hille-Yosida theorem, applications of linear spaces and operators, convexity. Preq: MTHSC 821.

MTHSC 954 Advanced Graph Theory 3(3,0) Continuation of MTHSC 854 including the four-color theorem, domination numbers, Ramsey theory, graph isomorphism, embeddings, algebraic graph theory, and tournaments. Research papers are also examined. Offered fall semester only. Preq: MTHSC 854 or consent of instructor.

MTHSC 970 Directed Studies in Mathematical Sciences 1-3(1-3,0) Directed individual studies on topics in the mathematical sciences supervised by faculty. May be repeated for a maximum of 18 credits. Preq: Consent of instructor.

MTHSC 974 Selected Topics in Mathematical Sciences 3(3,0) Advanced topics in the mathematical sciences from current areas of interest presented in lecture format. May be repeated for a maximum 24 credits, but only if different topics are covered. Preq: Consent of instructor.

MTHSC 981 Selected Topics in Mathematical Statistics and Probability 1-3(1-3,0) Advanced topics in mathematical, statistics and probability of current interest. May be repeated for credit, but only if different topics are covered.

MTHSC 982 Selected Topics in Analysis 1-3(1,3,0) Advanced analysis topics from current problems of interest. May be repeated for credit, but only if different topics are covered.

MTHSC 983 Selected Topics in Computational Mathematics 1-3(1-3,0) Advanced topics in computational mathematics and numerical analysis from current problems of interest. May be repeated for credit, but only if different topics are covered.

MTHSC 985 Selected Topics in Algebra and Combinatorics 1-3(1-3,0) Advanced topics in algebra and combinatorics from current problems of interest. May be repeated for credit, but only if different topics are covered.

MTHSC 986 Selected Topics in Geometry 1-3(1-3,0) Advanced topics in geometry from current problems of interest. May be repeated for credit, but only if different topics are covered.

MTHSC 988 Selected Topics in Operations Research 1-3(1-3,0) Advanced topics in operations research from current problems of interest. May be repeated for credit, but only if different topics are covered.
MTHSC 989 Selected Topics in Mathematical Education 3(3,0) Advanced topics in the mathematical sciences from the area of mathematics education. May be repeated for credit, but only if different topics are covered. Preq: Consent of instructor.

MTHSC 991 Doctoral Dissertation Research 1-12

MECHANICAL ENGINEERING

M E 607 Applied Heat Transfer 3(3,0) Application-oriented extension of M E 304 considering topics in transient conduction, flow of fluids, energy exchange by radiation, and mass transfer. Applications in heat-exchanger design with emphasis on economics and variation of operating conditions from the design point. Preq: M E 304, consent of instructor.

M E 616 Control of Mechanical Systems 3(3,0) Physical modeling and feedback principles are presented for control of mechanical systems. Transient response, root locus, and frequency response principles are applied to the control of basic mechanical systems such as electric motors, fluid tanks, or thermal processes. PID control laws are emphasized. Preq: M E 305.

M E 617 Mechatronics System Design 3(2,3) Mechatronics integrates control, sensors, actuators, and computers to create a variety of electromechanical products. Includes concepts of design, appropriate dynamic system modeling, analysis, sensors, actuating devices, and real-time microprocessor interfacing and control. Laboratory experiments, simulation, and design projects are used to exemplify course concepts. Preq: M E 305 or consent of instructor.

M E 620 Energy Sources and Their Utilization 3(3,0) Covers availability and use of energy sources such as fossil fuels, solar (direct and indirect), and nuclear. Addresses energy density and constraints to use (technical and economic) for each source. Preq: M E 303, 304.

M E 621 Introduction to Compressible Flow 3(3,0) Introductory concepts to compressible flow; methods of treating one-dimensional gas dynamics including flow in nozzles and diffusers, normal shocks, moving and oblique shocks, Prandtl-Meyer Flow, Fanno Flow, Rayleigh Flow, and reaction propulsion systems. Preq: M E 303, 308.

M E 622 Design of Gas Turbines 3(3,0) Guiding principles in gas turbine cycles are reviewed. Turbine and compressor design procedures and performance prediction for both axial and radial flow machines are presented. Methods of design of rotary heat-exchangers and retrofitting gas turbine for regenerative operation are presented. Design projects are used to illustrate the procedures. Preq: M E 308.

M E 623 Introduction to Aerodynamics 3(3,0) Basic theories of aerodynamics for accurately predicting the aerodynamic forces and moments which act on a vehicle in flight. Preq: M E 308.

M E 629 Thermal Environmental Control 3(3,0) Mechanical vapor compression refrigeration cycles, refrigerants, thermoelectrical cooling systems, cryogenics, thermodynamic properties of air, psychrometric charts, heating and cooling coils, solar radiation, heating and cooling loads, insulation systems. Preq: M E 303, 308.

M E 630 Mechanics of Composite Materials 3(3,0) Fundamental relationships for predicting the mechanical and thermal response of multilayered materials and structures are developed. Micromechanical and macromechanical relationships are developed for laminated materials with emphasis on continuous filament composites. The unique nature of composites and the advantages of designing with composites are discussed. Preq: M E 302.

M E 632 Advanced Strength of Materials 3(3,0) Topics in strength of materials not covered in M E 302. Three-dimensional stress and strain transformations, theories of failure, shear center, unsymmetrical bending, curved beams, and energy methods. Other topics such as stress concentrations and fatigue concepts are treated as time permits. Preq: M E 302.

M E 650 Mechanical Vibrations 3(3,0) Mathematical analysis of physical problems in the vibration of mechanical systems. Topics include linear-free vibrations, forced vibrations, and damping in single degree of freedom systems, transient vibrations, critical speeds and whirling of rotating shafts, dynamic balancing, and multidegree of freedom systems with lumped parameters. Preq: E M 202, M E 302, MTHSC 208.

M E 653 Dynamic Performance of Vehicles 3(3,0) Introduces techniques for analyzing the dynamic behavior of vehicles such as aircraft, surface ships, automobiles and trucks, railway vehicles, and magnetically levitated vehicles. Preq: M E 205, 305, or consent of instructor.

M E 654 Design of Machine Elements 3(3,0) Design of common machine elements including clutches, brakes, bearings, springs, and gears. Optimization techniques and numerical methods are employed as appropriate. Preq: M E 306 or consent of instructor.

M E 655 Design for Computer-Automated Manufacturing 3(3,0) Concepts of product and process design for automated manufacturing. Topics include product design for automated manufacturing, inspection and assembly using automation, industrial robots, knowledge-based systems, and concepts of flexible product manufacture. Preq: M E 301, 306, 404 (or concurrent enrollment) or consent of instructor.

M E (ECE) 656 Fundamentals of Robotics 3(3,0) Introduction to the fundamental mechanics and control of robots including their application to advanced automation. Topics include robot geometry, kinematics, dynamics, and control. Planar machine structures are emphasized, including methods using computer analysis. Application considerations include design and operation of robot systems for manufacturing and telerobotics. Preq: M E 305, 416 (or concurrent enrollment), or consent of instructor.

M E 671 Computer-Aided Engineering Analysis and Design 3(2,3) Students are exposed to geometric and solid modeling, finite elements, optimization, and rapid-prototyping. Students design an artifact, represent it on the computer, analyze it using FEA, then optimize before prototyping it. Emphasizes the use of computer-based tools for engineering design. Preq: ENGR 141, M E 202, or consent of instructor.

M E 693 Selected Topics in Mechanical Engineering I-6(1-6,0) Study of topics not found in other courses. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: Consent of instructor.

M E 801 Foundations of Fluid Mechanics 3(3,0) Derivations of basic equations for multidimensional flow fields; analytical techniques for solving problems in laminar viscous flow and laminar inviscid flow; theories of similarity. Preq: Consent of instructor.

M E 810 Macroscopic Thermodynamics 3(3,0) First, second, and third laws of thermodynamics with engineering applications; thermodynamic property relations; chemical equilibrium. Preq: M E 312 or equivalent.

M E 811 Gas Dynamics 3(3,0) Concepts from thermodynamics, one-dimensional gas dynamics, one-dimensional wave motion, normal, and oblique shocks; flow in ducts and wind tunnels; two-dimensional equation of motion; small perturbation theory. Preq: Undergraduate course in fluid mechanics.

M E 812 Experimental Methods in Thermal Science 3(2,2) Theories of measurements, instrumentation, and techniques for measuring temperature, pressure, and velocity on a practical graduate engineering level; mathematical presentation of data, uncertainty analysis, data acquisition techniques, and theory and state-of-the-art measuring systems.

M E 814 Concepts of Turbulent Flow 3(3,0) Concepts of fluid turbulence; turbulent transport mechanisms, dynamics of turbulence, and experimental techniques pertinent to existing theories; classification of shear flows and their prediction methods. Preq: M E 801.

M (PHYS) 815 Statistical Thermodynamics I 3(3,0) See PHYS 815.

M E 818 Introduction to Finite Element Analysis 3(3,0) Introduction to the finite element method; applications to heat transfer, fluid flow and solids; introduction to transient analysis; analysis strategies using finite elements; introduction to solid modeling, finite element modeling and analysis using commercial codes. Preq: Numerical methods course or consent of instructor.

M E 819 Computational Methods in Thermal Sciences 3(3,0) Numerical techniques as applied to the solution of fluid flow and heat transfer problems; use of finite difference methods.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>General Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>M E 820</td>
<td>Modern Control Engineering</td>
<td>3(3,0)</td>
<td>Mathematical modeling of engineering systems using differential and difference state equations; state variable time solutions using analytic and computer-aided analysis techniques; state control principles of controllability, observability, stability and performance specification; trade-offs between state variable and transfer function techniques. Preq: Undergraduate controls course or consent of instructor.</td>
</tr>
<tr>
<td>M E 821</td>
<td>Advanced Control Engineering</td>
<td>3(3,0)</td>
<td>Concepts in multivariable, nonlinear, stochastic, and optimal control engineering; design and analysis considerations related to physical machines and processes; mathematical methods as needed. Preq: Undergraduate controls course or consent of instructor.</td>
</tr>
<tr>
<td>M E 829</td>
<td>Energy Methods and Variational Principles</td>
<td>3(3,0)</td>
<td>Application of variational principles in solid mechanics problems; virtual work; Castigliano’s theorems on deflection and rotation; stationary potential energy; energy stability criterion; Hamilton’s principle. Preq: M E 837 or consent of instructor.</td>
</tr>
<tr>
<td>M E 830</td>
<td>Conduction and Radiation Heat Transfer</td>
<td>3(3,0)</td>
<td>Fundamental concepts related to conduction and radiation heat transfer; analytical methods for steady and transient conduction heat transfer in one and two physical dimensions; radiation exchange between surfaces with and without radiatively participating media; combined conduction and radiation heat transfer. Preq: M E 304 or equivalent.</td>
</tr>
<tr>
<td>M E 831</td>
<td>Convective Heat Transfer</td>
<td>3(3,0)</td>
<td>Derivation of continuity, momentum, and energy equations for boundary layer flow; solutions for confined and external flow regimes in laminar and turbulent flow. Preq: M E 304 or equivalent, MTHSC 208.</td>
</tr>
<tr>
<td>M E 832</td>
<td>Radiative Heat Transfer</td>
<td>3(3,0)</td>
<td>Radiation properties; enclosure theory; radiation exchange between solid bodies; radiation exchange in the presence of absorbing, transmitting, and emitting media; combined radiation, conduction, and convection exchange. Preq: M E 304 or equivalent, consent of instructor.</td>
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<tr>
<td>M E 833</td>
<td>Heat Transfer with Change of Phase</td>
<td>3(3,0)</td>
<td>Nucleate boiling in a pool; film boiling in a pool; forced nucleate boiling; forced film boiling; effect of impurities on boiling phenomena; dropwise condensation; filmwise condensation; effect of noncondensable gases on condensation; boiling and condensing processes in systems. Preq: M E 304 or equivalent, consent of instructor.</td>
</tr>
<tr>
<td>M E 834</td>
<td>Principles of Structural Stability</td>
<td>3(3,0)</td>
<td>Practical criteria for analysis of conservative and nonconservative systems’ stability; methods of adjacent equilibrium, initial imperfections, total potential energy, and vibration as applied to practical problems. Preq: M E 837.</td>
</tr>
<tr>
<td>M E 836</td>
<td>Fracture Mechanics</td>
<td>3(3,0)</td>
<td>Fundamental elasticity-based course in the development of the basic concepts of engineering fracture mechanics; the Griffith criterion, Barrenblatt and Dugdale models, linear elastic fracture mechanics (L.E.F.M.), plane strain fracture toughness, the crack-tip stress and strain field, and plasticity and the J-integral. Preq: M E 837.</td>
</tr>
<tr>
<td>M E 837</td>
<td>Theory of Elasticity I</td>
<td>3(3,0)</td>
<td>Theory of stress and deformation for continuous media; linear stress-strain relations for elastic material; two-dimensional problems including Airy stress function, polynomial solutions, plane stress and plane strain in rectangular and polar coordinates, torsion and bending of prismatic bars and thermal stresses. Preq: M E 302, MTHSC 208.</td>
</tr>
<tr>
<td>M E 838</td>
<td>Theory of Elasticity II</td>
<td>3(3,0)</td>
<td>Continuation of M E 837 including topics from either three-dimensional problems associated with an infinite elastic medium, elastic half-space, contact stresses, symmetrically loaded sphere and circular cylinder, or complex variable methods in plane elasticity, stress concentrations problems, singular stresses and fracture, and composite materials. Preq: M E 837, PHYS 812.</td>
</tr>
<tr>
<td>M E 843</td>
<td>Nonlinear Dynamics of Mechanical Systems</td>
<td>3(3,0)</td>
<td>Behavior of nonlinear mechanical systems analyzed with numerical, graphical, and analytical methods; understanding nonlinear effects and methods of analysis. Preq: Graduate standing or consent of instructor.</td>
</tr>
<tr>
<td>M E 845</td>
<td>Vibration of Continuous Media</td>
<td>3(3,0)</td>
<td>Fundamental principles of generation, propagation, absorption, reflection, and scattering of vibrational wave in solids and fluids; free and forced oscillation of flexible strings, bars, membranes, and plates; theory of wave motion in liquids and gases. Preq: Consent of instructor.</td>
</tr>
<tr>
<td>M E 846</td>
<td>Intermediate Dynamics</td>
<td>3(3,0)</td>
<td>Kinematics and dynamics of particles and rigid bodies, Lagrange and Hamilton’s formulation of mechanics; two-body central force problem; rendezvous of two bodies in a central force field; rotation of rigid bodies about a fixed point in space; vector analysis and matrix methods as aids in mathematical analysis. Preq: E M 202 or consent of instructor.</td>
</tr>
<tr>
<td>M E 852</td>
<td>Advanced Finite Element Analysis</td>
<td>3(3,0)</td>
<td>Application of variational and weighted residuals methods; nonlinear analysis, steady-state, and time-dependent problems; application of commercial finite element codes; advanced computational procedures. Preq: C E 808 or equivalent or consent of instructor.</td>
</tr>
<tr>
<td>M E (E C E) 859</td>
<td>Intelligent Robotic Systems</td>
<td>3(0)</td>
<td>See E C E 859.</td>
</tr>
<tr>
<td>M E 861</td>
<td>Materials Selection in Engineering Design</td>
<td>3(3,0)</td>
<td>Advanced study of various physical, chemical, and mechanical materials properties which govern the selection of materials in engineering design. Case studies of materials selection in design with metals, ceramics, polymers, and composites are presented.</td>
</tr>
<tr>
<td>M E 870</td>
<td>Advanced Design Methodologies</td>
<td>3(3,0)</td>
<td>Nurturing of creativity; decision-making processes for design; in-depth study of the mechanical design process and tools; quality function deployment, concurrent design, systemic design, robust design, design for assembly, and axiomatic design.</td>
</tr>
<tr>
<td>M E 871</td>
<td>Engineering Optimization</td>
<td>3(3,0)</td>
<td>Optimization in the context of engineering design; nonlinear and linear, static and dynamic, constrained and unconstrained formulation and solution of practical problems; structural optimization; multiobjective optimization; genetic algorithms; simulated annealing.</td>
</tr>
<tr>
<td>M E 891</td>
<td>Master’s Thesis Research</td>
<td>1-12</td>
<td></td>
</tr>
<tr>
<td>M E 893</td>
<td>Selected Topics in Mechanical Engineering</td>
<td>1-6(1-6,0)</td>
<td>Topics not covered in other courses. May be repeated for credit.</td>
</tr>
<tr>
<td>M E 930</td>
<td>Advanced Topics in Heat Transfer</td>
<td>1-6(1-6,0)</td>
<td>Topics not covered in other courses. May be repeated for a maximum of six credits.</td>
</tr>
<tr>
<td>M E 931</td>
<td>Advanced Topics in Fluid Mechanics</td>
<td>3(3,0)</td>
<td>Topics not covered in other courses. May be repeated for a maximum of six credits.</td>
</tr>
<tr>
<td>M E 932</td>
<td>Advanced Topics in Thermodynamics</td>
<td>3(3,0)</td>
<td>Topics not covered in other courses. May be repeated for a maximum of six credits.</td>
</tr>
<tr>
<td>M E 991</td>
<td>Doctoral Dissertation Research</td>
<td>1-12</td>
<td></td>
</tr>
</tbody>
</table>

**M E 991 Doctoral Dissertation Research 1-12**
MICRO 611 Pathogenic Bacteriology 4(3,3) Study of pathogenic bacteria and their virulence mechanisms. Emphasizes host-microbe interactions, responses to infection and treatment, and research strategies for various topics of bacterial pathogenesis. Prereq: MICRO 305, 414.

MICRO 612 Bacterial Physiology 4(3,3) Considers the cytology, physiology, metabolism, and genetics of bacteria including growth and death, reproduction and mutation, nutrition and metabolic pathways, regulatory mechanisms, and effects of environment. Prereq: CH 224, MICRO 305, one-semester of biochemistry, or consent of instructor.

MICRO 613 Industrial Microbiology 3(2,3) Microbial aspects of large-scale processes for the production of foods, antibiotics, enzymes, fine chemicals, and beverages. Topics include strain selection, culture maintenance, biosynthetic pathways, continuous cultivation, and production of single cell protein. Prereq: MICRO 305.

MICRO (AVS, BIOSC) 614 Basic Immunology 4(3,3) Consideration of the nature, production, and function of basic immune responses in animals. Procedures and mechanisms of antigen-antibody and other immune reactions. Prereq: MICRO 305, organic chemistry.

MICRO 615 Microbial Genetics 4(3,3) Cytological basis of bacterial, fungal, and viral genetics; molecular aspects; mutations; mechanisms of genetic transfers; episomes and plasmids; and population changes. Prereq: BIOCH 301, MICRO 305, 412.

MICRO 616 Introductory Virology 3(3,0) General introduction to the field of virology including animal, bacterial, and plant viruses. Topics include nomenclature and classification, biochemical and biophysical characteristics, mechanisms of replication, chemotherapy, and techniques for isolation, assay, and purification. Prereq: BIOCH 301, MICRO 305, or consent of instructor.

MICRO 617 Molecular Mechanisms of Carcinogenesis and Aging 3(3,0) Changes which occur at the cellular and subcellular levels during transformation and aging. Accumulated damage and "intrinsic clock" theories of aging; genetic and epigenetic theories of carcinogenesis; epidemiology of cancer; viral, radiation-induced, and chemical carcinogenesis; the immune system and cancer. Prereq: BIOCH 301, MICRO 305, or consent of instructor.

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

MICRO 619 Selected Topics in Molecular Medicine 3(3,0) Introduction to various areas of molecular medicine. Examines the latest research and developments in molecular medicine. Designed for students interested in medicine and biomedical research. May be repeated for a maximum of six credits. Prereq: BIOCH 301, MICRO 305, or consent of instructor.

MICRO 802 Bacteriological Techniques 4(2,6) Analytical and experimental procedures used in bacteriology including techniques for studying bacterial cytology, physiology, and metabolism; experience in more advanced methods of investigation. Offered fall semester only.

MICRO 803 Special Problems in Microbiology 1-3 Research not related to a thesis.

MICRO 804 Selected Topics in Microbiology 1-3(1-3,0) Evaluation of current research literature in various areas of microbiology. Critical evaluation of specific publications in terms of their scientific merit. Required of all Microbiology graduate students. May be repeated for credit.

MICRO 805 Techniques of Clinical Microbiology and Immunobiology 3(2,3) Methods for isolating, identifying, and cultivating different mammalian cell types; techniques used to analyze cell function and viability and for protein and DNA analysis emphasizing application to the diagnosis of disease, determination of prognosis, optimization of treatment, and determination of etiology. Prereq: MICRO (AVS, BIOSC) 614, 615, BIOCH 623 or equivalent, or consent of instructor.

MICRO 806 Pathogenesis and Infectious Disease 3(3,0) Medically important host-parasite relationships at the cellular and subcellular levels with emphasis on bacterial and viral infections in man. Prereq: MICRO 611 or consent of instructor.

MICRO 807 Current Topics in Microbiology 1(1,0) Students learn and practice skills of literature interpretation, presentation, and discussion of articles in relevant and recent scientific journals. May be repeated for a maximum of eight credits.

MICRO (HLTH) 809 Epidemiological Research 3(3,0) Basic concepts of epidemiology with emphasis on applied aspects rather than theoretical. Examples are drawn from clinical practice. Use of relevant PC-based computer packages is required. Prereq: MTHSC 405 or EX ST 801 or consent of instructor.

MICRO 811 Bacterial Cytology and Physiology 4(4,0) Structure, chemistry, and physiology of the various bacterial cell components. Physiology of bacterial growth and reproduction in batch, continuous, and synchronous cultures. Economy of the bacterial cell including endogenous metabolism and maintenance requirements; physiology of bacterial death; regulation of enzyme and nucleic acids synthesis. Offered spring semester of odd-numbered years only. Prereq: BIOCH 423, MTHSC 206, or consent of instructor.

MICRO 812 Bacterial Metabolism 3(3,0) Various biochemical pathways occurring in bacterial cells; fermentations of carbohydrates and related compounds and of nitrogenous organic compounds; anaerobic and aerobic respiration including electron transport systems and oxidative phosphorylation; bacterial photosynthesis; nitrogen fixation; biosyntheses of amino acids, purines, pyrimidines, lipids, proteins, nucleic acids, and polysaccharides. Offered spring semester of even-numbered years only. Prereq: BIOCH 423, MTHSC 206, or consent of instructor.

MICRO 815 Advanced Microbial Genetics 3(3,0) Current developments in microbial genetics; integration of genetics and biochemistry; analysis of genetic fine structure in microorganisms; nature of bacterial variation and expression of mutations; population dynamics; physicochemical mechanisms of heredity; regulation of gene action in microorganisms; physiology and genetics of virulent and lysogenic bacteriophages. Offered fall semester only. Prereq: MICRO 415.

MICRO 891 Master's Thesis Research 1-12

Courses of Instruction

MUSIC

MUSIC 600 Elementary Music in the Classroom 3(3,0) Familiarizes teachers in the elementary classroom with traditional Kodaly, Orff, and Kindermusik approaches in correlating music with language arts, mathematics, and social studies.

MUSIC 680 Audio Engineering II 3(2,2) Advanced course in music technology focused on music production integrating digital audio and virtual instruments Prereq: MUSIC 380 or consent of instructor.

MUSIC 699 Independent Studies 1-3(1-3,0) Tutorial work for students with special interests in music study outside the scope of existing courses. May be repeated for a maximum of six credits. Prereq: Consent of department chair.

NURSING

NURS 801 Advanced Family and Community Nursing 3(3,0) Developmental, psychodynamic, social-political, and cultural theories and concepts are synthesized and applied to the analysis of health and illness in communities and in families across the life cycle. Roles and functions of advanced practice nurses in promoting community health and family health are examined.

NURS 804 Knowledge Development in Advanced Nursing 2(2,0) Nursing theories and theories relevant to nursing practice and research; processes of theoretical thinking and critical thinking applied to health problems and needs of individuals and their families in the community; theoretical and conceptual models of contemporary practice and research.

NURS 805 Pharmacotherapeutics for Advanced Nursing 3(3,0) Prescription administration and patient/family education in use of pharmacological agents emphasizing drugs prescribed for common or chronic illnesses; drug selection; adverse drug reactions; age-related differences in utilization; regulations affecting nurses’ prescriptive authority. Prereq: NURS 809 or consent of instructor.

NURS 806 Advanced Assessment for Nursing 2(1,3) Comprehensive assessment and diagnosis of health problems and status for individuals of all ages including assessment of families; physical and laboratory/radiologic diagnostic assessments; directed laboratory experiences in advanced assessment of clients of several ages. Prereq: Undergraduate assessment and NURS 809 or consent of instructor.

NURS 807 Clinical Nursing Research 2(2,0) Quantitative and qualitative research methodologies useful and appropriate to clinical nursing practice and for the development of nursing knowledge; ethics with human subjects; does not include thesis advisement. Student must select chairperson prior to enrollment. Prereq: NURS 804, 808.

NURS 808 Nursing Research Analysis 2(2,0) Quantitative research methods in nursing science including basic elements of statistical design with a focus on the use of nursing informatics and computer applications. Prereq: Undergraduate statistics course.
Courses of Instruction

NURS 809 Pathophysiology for Advanced Nursing 3(3,0) Human response to health alterations as they impact nursing knowledge and practice; recognizing the manifestations of health alterations and developing nursing interventions accordingly.

NURS 814 Instructional Technologies for Nursing Educators 3(3,0) Provides novice and experienced nurse educators an opportunity to integrate emerging instructional technologies. Covers theories and trends that support the use of technologies for the enhancement of teaching and learning. Emphasizes the integration of educational technologies and the evaluation of current technologies to enhance instruction.

NURS 819 Developing Family Nursing 4(2,6) Theories and concepts related to nursing management in the care of developing families; critical thinking applied to health problems and needs of developing families before, during, and immediately following pregnancy; application of related nursing issues and current research; clinical practice with developing families in a variety of settings. Preq: NURS 801, 804, 805, 806, 809.

NURS 820 Child and Adolescent Nursing 4(2,6) Advanced nursing roles and functions applied to health promotion, health maintenance, health restoration, habilitation, and rehabilitation of infants, children, and adolescents with existing or potential health problems. Critical thinking is used to assess, diagnose, intervene, and promote continuity of care with clients of these ages irrespective of setting. Preq: NURS 801, 804, 805, 806, 809.

NURS 821 Adult Nursing 4(2,6) Roles and functions embodied in advanced practice applied to the health promotion and clinical management of common or chronic health problems of adults within the context of family; clinical practice with adult clients in a variety of settings. Preq: NURS 801, 804, 805, 806, 809.

NURS 822 Gerontology Nursing 4(2,6) Roles and functions of advanced practice applied to the preventive, restorative, and rehabilitative care of the older adult with existing or potential health problems; clinical practice in a variety of settings. Preq: NURS 801, 804, 805, 806, 809.

NURS 823 Nurse Practitioner Clinical Practice 6(0,18) Guided practice applying advanced nursing knowledge in family nursing and advanced practice roles (clinical nurse specialist, case manager, and/or practitioner); joint preceptor and faculty guidance and supervision in the care of selected populations in a variety of health care settings. Preq: FNP track: NURS 819, 820, 821, 822; GNP track: NURS 822, 882, 884; A/GNP track: NURS 821, 822, 882, 884.

NURS 825 Leadership in Health-Care Systems 3(3,0) Examines health-care systems and delivery across the continuum. Emphasizes complexity, influence of internal and external environments, assessment of strengths and opportunities, strategic planning, leadership theories, and leading change. Explores implications for middle and executive level health-care leaders. Preq: NURS 804 or consent of instructor.

NURS 826 Quality and Outcomes Management in Health Care 4(3,3) Examines the science of systems improvement including the models, methods, and tools of process analysis and improvement applied to health care. Emphasis is on designing outcome and evidence-based safe and efficient processes and workflows to achieve customer satisfaction and targeted outcomes. Practicum with quality experts permits guided application of classroom content. Preq: NURS 825 or consent of instructor.

NURS 827 Foundations of Nursing Education 3(3,0) Exploration of the foundations of nursing education. Emphasizes curriculum development in nursing for the collegiate or continuing education areas. Current issues and research that influence nursing education. Preq: Graduate standing in Nursing.

NURS 828 The Nurse Educator 3(2,3) Roles and functions of nurse educators applied to education of nurses and nursing students in collegiate and continuing education nursing education programs; current issues and research in classroom, laboratory, and continuing education programs. A teaching practicum is required. Preq: NURS 827 or consent of instructor.

NURS 829 Theories and Models of Clinical Specialization 3(3,0) Caregiver, researcher, manager, teacher, and consultant roles of the clinical nurse specialist in a variety of settings; theories, models, and health care issues underlying the role of clinical nurse specialist. Preq: NURS 804, CNS graduate option, or consent of instructor.

NURS 830 Clinical Specialty Practicum in Nursing 6(0,18) Advanced practice in a selected clinical specialty area in nursing that emphasizes application of the clinical specialist role. Preq: NURS 829 and one of the following: NURS 819, 820, 821, 822, 882, 884, or consent of instructor.

NURS 831 Clinical Research Problems 1-3(1-2) Research activities related to thesis; minimum of six hours required. To be repeated for a maximum of three credits. To be taken Pass/Fail basis. Preq: NURS 804.


NURS 847 Internship 3(1,6) Guided practice to apply advanced nursing knowledge in nursing administration in the advanced practice role; joint preceptor and faculty guidance and supervision in the administrative management and care with selected populations in a variety of health care settings. Preq: NURS 825, 826, 846, or consent of instructor.

NURS 848 Health Care Policy and Economics 3(3,0) Reciprocal relationship between client, community, health care system, sociocultural, and economic variables and policy making; analysis and synthesis of these relationships and their impact on the role and responsibility of the advanced practice nurse and nurse administrator. Preq: Graduate standing or consent of instructor.

NURS 850 Information and Control Systems for Nursing Leadership 3(3,0) Computer-based systems of information management and control for nursing environments. Explores data needed for cost-efficient use of nursing resources and effective systems of monitoring, quality assurance, and control; information systems as tools useful to humanistic nursing practice, human resource management, and solution of professional and scientific problems. Preq: Graduate standing or consent of instructor.

NURS 879 Special Topics in Nursing 1-3(1-3,0-9) In-depth seminar on selected topics such as therapeutic communication, legal and ethical issues in nursing, and health care and political process in health. Preq: Consent of instructor.

NURS 882 Primary Care for Elders 4(2,6) Application of the roles and functions of advanced practice in the management of frailty in old age; prevention of early disability and dependence; maintenance of function, independence, and self care; cultural, social, and ethical issues. Preq: NURS 801, 804, 805, 806, 809.

NURS 884 Mental Health and Illness of Adults 4(2,6) Psychosocial, developmental, spiritual, and cultural theories are synthesized and applied to the analysis of mental health and illness in adulthood. Considers roles and functions of advanced practice nurses in promoting the mental health of adults and their families. Clinical practice in the community is incorporated. Preq: NURS 801, 804, 805, 806, 809.

NURS 889 Special Problems in Nursing 1-6(1-6,0) Problems selected to meet special and individualized interests of students. Up to six hours of NURS 889 may be taken as elective credit. Preq: Consent of instructor.

NURS 891 Master's Thesis Research 1-12 Research activities related to thesis; minimum of six hours required. Preq: NURS 804.

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

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