SIU CARBONDALE Southern Illinois University

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Mechanical Engineering

Admission

Students seeking admission to the graduate program in mechanical engineering must meet the admission standards set by the Graduate School and have a bachelor's degree in engineering or its equivalent. A student whose undergraduate training is deficient may be required to take coursework without graduate credit.

This program requires a nonrefundable $65 application fee that must be submitted with the application for Admissions to Graduate Study in Mechanical Engineering. Applicants must pay this fee by credit card. The application form can be obtained from the School of Mechanical, Aerospace, and Materials Engineering.

Requirements

Each student majoring in mechanical engineering will develop a program of study with a graduate adviser and establish a graduate committee of at least three members at the earliest possible date. A student may, with the approval of a graduate faculty committee and the School Director, also take courses in other branches of engineering, or in areas of science and business, such as physics, geology, chemistry, mathematics, life science, administrative sciences, or computer science. A thesis committee of at least three members will approve the thesis and the comprehensive oral exam.

For a student who wishes to complete the requirements of the M.S. in Mechanical Engineering degree with a thesis, a minimum of thirty hours of acceptable graduate credit is required. Of this total, eighteen credit hours must be earned in the School of Mechanical, Aerospace, and Materials Engineering. A minimum of 15 credit hours of coursework at the 500-level (excluding thesis) is required. Each candidate is also required to pass a comprehensive oral examination covering all of the student's graduate work, including thesis.

If a student prefers the non-thesis option, a minimum of thirty-six hours of acceptable graduate credit is required. The student is expected to take at least twenty-one credit hours within the School of Mechanical, Aerospace, and Materials Engineering including no more than three credit hours of the appropriate 592 course to be devoted to the preparation of a research paper. A minimum of 15 credit hours of coursework at the 500-level (excluding thesis) is required. In addition, each candidate is required to pass a written comprehensive examination. An oral presentation of the paper may be required.

Each non-thesis M.S. in Mechanical Engineering student will select a minimum of three engineering graduate faculty members to serve as a graduate committee, subject to the approval of the School Director. The committee must include at least one member from one of the other engineering programs and will:

1. approve the student's program of study,
2. approve the student's research paper topic,
3. approve the completed research paper, and
4. administer and approve the written comprehensive examination.

Teaching or research assistantships and fellowships are available for qualified applicants. Additional information about the program, courses, assistantships, and fellowships may be obtained from the College of Engineering, Computing, Technology, and Mathematics or the School of Mechanical, Aerospace, and Materials Engineering.

Master of Science (M.S.) in Mechanical Engineering

Graduate work leading to the Master of Science degree in Mechanical Engineering is offered by the School of Mechanical, Aerospace, and Materials Engineering. The program is designed to provide advanced study in air pollution control, mechanical system dynamics and vibration, acoustics and signal processing, mass and heat transfer, coal conversion, electrochemical processes, thermal science, thermal systems design, solar systems design, chemical and biochemical processes, biomechanics, mechanical systems, computer-aided design, composite materials and ceramics and tribology.

Accelerated Master's Program

Mechanical Engineering students with senior standing and a GPA of 3.5 will be permitted to take up to six hours of graduate credit in Fall and Spring semesters. Outstanding junior students will be allowed to take one course for graduate credit. By doing so, students then pursuing their M.S. in Mechanical Engineering degree after completing their bachelor of science degree will have these graduate credits transferred toward their M.S. in Mechanical Engineering degree so that they may be able to finish the degree requirements in a year or so. Students must complete a no fee Graduate School application and submit it to the School Director for approval. Students will be allowed to complete up to 12 hours of graduate credit before receiving their bachelor of science degree.

Mechanical Engineering Courses

ME400 - Engineering Thermodynamics II Combined first and second law analysis: Exergy analysis; Analysis of power and refrigeration cycles. Detailed treatment of gas and vapor cycles including gas and steam cycles; Thermodynamics of combustion and reaction of mixtures; Introduction to thermodynamic property relations, chemical and phase equilibrium. Prerequisite: ME 300. Credit Hours: 3

ME401 - Thermal Measurements Laboratory Study of basic measurements used in the thermal sciences. Calibration techniques for temperature and pressure sensors. Thermal measurements under transient and steady-state conditions. Applications include conduction, convection and radiation experiments. Uncertainty analysis. The handling and reduction of data. Prerequisite: ME 302. Credit Hours: 1

ME405 - Transportation Power Systems Operation and performance characteristics of Otto, Diesel, Atkinson cycles. Methods of engine testing, types of fuels and their combustion, exhaust gas analysis. Types, selection, and analysis of jet engines. Analysis of fuel cell types, their performance and limitations. Operation of electric motors, capacitors, battery packs and their charging. Prerequisite: concurrent enrollment in or completion of ME 400, with a minimum grade of C or consent of instructor. Credit Hours: 3

ME406 - Thermal Systems Design Applications of the principles of engineering analysis to the design of thermal systems. Coordination of such systems as heat exchangers, air conditioners, cogeneration cooling towers, and furnaces. Emphasis is placed on application of basic principles of heat transfer and fluid mechanics. Prerequisite: ME 302. Credit Hours: 3

ME408 - Energy Conversion Systems Principles of advanced energy conversion systems; nuclear power plants, combined cycles, magnetohydromagnetics, cogeneration (electricity and process steam), and heat pumps. Constraints on design and use of energy conversion systems; energy resources, environmental effects, and economics. Prerequisite: ME 400. Credit Hours: 3

ME410 - Applied Chemical Thermodynamics and Kinetics Designed for students interested in chemical and environmental processes and materials science. Topics covered include application of the Second and Third Laws of Thermodynamics, solution theory, phase equilibria, sources and uses of thermodynamic data, classical reaction rate theory, kinetic mechanisms and the determination of rate-determining steps in chemical reactions. Prerequisite: CHEM 200, 201, ME 300 or consent of instructor. Credit Hours: 3

ME415 - Engineering Acoustics Principles of engineering acoustics and their applications to passive and active noise control techniques. Laboratory experience demonstrates techniques for control and reduction of noise. Prerequisite: ME 336. Credit Hours: 3

ME416 - Air Pollution Control An overview of problems in air pollution likely to influence the Mechanical Engineer. Engineering control theory, procedure and equipment related to control of particulate, gaseous, and toxic air emissions. Restricted to senior standing and College of Engineering, Computing, Technology, and Mathematics or consent of instructor. Credit Hours: 3

ME421 - Pneumatic Hydraulic Engineering Design principles of fluid power engineering. The behavior of fluids in a system. Analysis and design of hydraulic and pneumatics machinery and systems using fluid as a medium for transmission of power and control of motion. Analysis of steady state and dynamic behavior. Critical operations and analysis. Credit Hours: 3

ME422 - Applied Fluid Mechanics for Mechanical Engineers Applications of fluid mechanics in internal and external flows. The mathematical basis for inviscid and viscous flows calculations is developed with application to pipe and duct flows; external flow about bodies; drag determination; turbomachinery; and reaction propulsion systems. Semester design project of a fluid mechanical system. Prerequisite: ME 300 and MATH 305; ENGR 370A or 370B concurrently. Credit Hours: 3

ME423 - Compressible Flows Foundation of high speed fluid mechanics and thermodynamics. One-dimensional flow, isentropic flow, shock waves and nozzle and diffuser flows. Flow in ducts with friction and heat transfer. Prandtl-Meyer flow. Compressibility effects in reaction propulsion systems. Semester design project. Prerequisite: ME 300; ENGR 370A or 370B concurrently. Credit Hours: 3

ME427 - Aircraft Flight Dynamics Introduction to the performance, stability, and control of aircraft. Fundamentals of configuration aerodynamics. Methods for analyzing the dynamics of physical systems. Characterization of modes of motion and desirable flying qualities. Case studies in aircraft stability and control. Prerequisite: ENGR 261. Credit Hours: 3

ME435 - Design of Mass Transfer Processes Design principles of mass transfer processes. The rate mechanism of molecular, convective and interphase mass diffusion. The design of selected industrial mass transport process operations such as absorption, humidification, water-cooling, drying and distillation. Prerequisite: ME 302. Credit Hours: 3

ME437 - Orbital Mechanics Natural behavior of planets and moons in the solar system as well as spacecraft motion: orbit dynamics, two-body problem, perturbations, and stability; trajectory generation and control, on-orbit maneuvers, and transfers. Prerequisites: ENGR 261 and MATH 305. Credit Hours: 3

ME440 - Design of HVAC and Building Energy Systems Building energy design and simulation; HVAC systems, heating and cooling load analysis; Air conditioning processes; Principles of human thermal comfort. Prerequisite: ME 302. Restricted to graduate standing or consent of the instructor. Credit Hours: 3

ME446 - Energy Management Fundamentals and various levels of analysis for energy management of commercial buildings and industrial processes and buildings. Use of energy management systems and economic evaluations are required in course projects. Prerequisite: ME 302. Credit Hours: 3

ME447 - Spacecraft Dynamics and Control Space missions and how pointing requirements affect attitude control systems. Rotational kinematics and attitude determination methods. Modeling and analysis of the attitude dynamics of space vehicles. Rigid body dynamics, effects of energy dissipation. Gravity gradient, spin, and dual spin stabilization. Rotational maneuvers. Impacts of attitude stabilization techniques on mission performance. Prerequisites: ENGR 261 and ME 336. Credit Hours: 3

ME449 - Mechanics of Advanced Materials Mechanical behavior of composite materials, cellular materials, functionally graded materials. Constitutive equations for the linear and nonlinear ranges, failure theories, fracture mechanics. Application to the design of composite and sandwich structures, pressure vessels, shafts, armor under static loading, impact and blast loading. Prerequisite: ENGR 261; ENGR 350A or 350B concurrently. Credit Hours: 3

ME450 - Introduction to Battery Engineering Fundamentals of battery operation. Overview of battery chemistries. Battery applications. Design considerations. Emerging Technologies. Restricted to senior or graduate standing. Credit Hours: 3

ME451 - Advanced Dynamics Three-dimensional kinematics and dynamics of particles and rigid bodies; Coordinates and reference frames; Rotations of rigid bodies; Euler angles; Newtonian mechanics; Work and energy; Generalized coordinates and degrees of freedom; Analytical mechanics with a focus on Lagrange's equations; Hamilton's principle for continuous elastic systems. Prerequisites: MATH 305 and ME 309 with a grade of C or better or graduate standing. Credit Hours: 3

ME459 - Carbon Management - Engineering Capture and Conversion Carbon management is expected to affect every sector and industry. Knowledge of the state of art technologies for carbon capture, utilization and storage and assessment methodologies for estimating the impact of the implementation of technologies on greenhouse gas emissions are building blocks to understanding, developing and implementing carbon management strategies. The course will encompass: a) process descriptions including current efficacies, quantitative process analysis and materials properties involved in carbon dioxide separation and capture including direct air capture; b) fundamental processes involved in carbon dioxide conversions using thermo-electro-biochemical and biological routes; qualitative and quantitative discussions on rate processes involved and net carbon reductions by the processes, and c) greenhouse gas emissions assessments using systems approaches and integrative approaches such as life cycle analysis and other numerical techniques. Prerequisite: ME 400 with a grade of B or better or consent of instructor. Credit Hours: 3

ME463 - Introduction to Ceramics Structure and physical properties, mechanical properties, processing and design of ceramics. Prerequisite: ME 312 or equivalent. Credit Hours: 3

ME465 - Introduction to Nanotechnology Survey of the rapidly developing fields of nanometer science and engineering. Impact on society; principles of self-assembly; production and properties of nano-materials; cell mechanism as a model for assemblers; nano-tools; and nano-systems are explored. Prerequisite: CHEM 210. Credit Hours: 3

ME468 - Friction Science and Applications Study of systems and materials used for friction applications with a focus on aerospace and ground transportation vehicles. Course covers theories and experimental methods regarding friction and wear, contact mechanics, friction materials, vibration and noise, thermal transport and thermo-elastic phenomena. The course approach uses a materials emphasis. Prerequisite: ME 312. Restricted to senior standing or consent of instructor. Credit Hours: 3

ME470 - Mechanical System Vibrations Linear vibration of mechanical systems; System modeling; Free and forced response of single degree of freedom systems; Lagrange's equations; Multi-degree of freedom systems; Modal analysis for response calculations; Vibration of continuous systems. Prerequisite: ENGR 261, ENGR 351, MATH 305. Credit Hours: 3

ME472 - Materials Selection for Design Interaction of material design process with material selection criteria. Comparison of materials properties, processes and fabrication. Project work includes design models, materials selection rationale, oral presentation of projects, construction of mock-up models, and theoretical design problems in the area of the student's specialization, including materials selection considerations for biomaterials/biomedical applications. Prerequisites: ME 312, ENGR 261; ME 222 or ENGR 222 or ENGR 296. Credit Hours: 3

ME475 - Machine Design I Design of machines using bearings, belts, clutches, chains and brakes. Develops application of the theory of fatigue, power transmission and lubrication to the analysis and design of machine elements. Prerequisite: ENGR 351; ENGR 350A or 350B concurrently. Credit Hours: 3

ME477 - Fundamentals of Computer-Aided Design and Manufacturing Introduction to the concepts of computer-aided design and manufacturing (CAD/CAM). Subjects include computer graphics, geometric modeling, engineering analysis with FEM, design optimization, computer numerical controls, project planning, and computer integrated manufacturing. (CIM). Students are required to use computer packages for projects. Prerequisite: ME 475 or consent of instructor. Credit Hours: 3

ME478 - Finite Element Analysis in CAD Course to cover a multitude of topics in CAD/CAE with emphasis on finite element modeling and analysis. Overview of CAD/CAM/CAE; FEA software; FEA

problems including trusses, beams, frames, thermal analysis, and fluid mechanics; design optimization; rapid prototyping. Students are required to use FEA software for homework assignments and a design project. Prerequisite: ME 302. Co-requisite: ME 475. Credit Hours: 3

ME480 - Computational Fluid Dynamics Application of computational fluid dynamics techniques to the solution of problems in engineering heat transfer and fluid flow. Discretization techniques; stability analysis. Introduction to grid generation. Prerequisite: ENGR 351, ENGR 370A (or 370B concurrently); ME 302 or consent of instructor. Credit Hours: 3

ME481 - Design and Implementation of Vision System (Same as BME 481) This course provides an introduction to a vision system and instrumentation with engineering applications including optical microscopy. A vision system is an essential tool in most of the application, and optical microscopy is a powerful scientific tool to study microscale worlds. Topics covered in basic geometrical optics, Optoelectronic devices, basic electronics for illumination system, optical microscopy, actuators in the microscope, fundamentals of fluorescence microscopy, and advanced imaging techniques. Prerequisites: ENGR 296 or ME 222 or consent of instructor. Credit Hours: 3

ME485 - Cellular and Molecular Biomechanics (Same as BME 485) Mechanics of living cells at the micron/nanoscale level. Molecular forces, bond dynamics, force-induced protein conformational changes. Structural basis of living cells, contractile forces, mechanics of biomembranes, nucleus, cytoskeletal filaments- actin, microtubule, intermediate filaments. Active and passive rheology, microrheological properties of cytoskeleton. Active cellular processes such as cell adhesion, cell spreading, control of cell shape, and cell migration. Discussion on experimental techniques including single-molecule approaches to understanding key cellular processes. Discussion of theoretical models that predict cellular processes and limitations. Introduction to mechanobiology. Restricted to senior or graduate standing. Credit Hours: 3

ME486 - Nondestructive Evaluation of Engineering Materials (Same as CE 486) Overview of common nondestructive evaluation (NDE) techniques, such as visual inspection, eddy current, X-ray, and ultrasonics, to measure physical characteristics of and to detect defects in engineering materials. Laboratory experiments include contact ultrasonic, magnetic particle, liquid penetrant, and infrared thermography methods of testing. Prerequisite: ME 312 with a grade of C or better. Credit Hours: 3

ME493 - Materials in Energy Applications Materials are central to every energy technology. The course will provide information on high performance materials for alternative energy technologies and developing a fundamental understanding of their structure-property-performance relationships. It will include materials for fuel cells, lithium ion batteries, supercapacitors, photovoltaics, solar energy conversion, thermoelectrics, and hydrogen production and storage, catalysts for fuel conversion. Prerequisite: ME 312. Credit Hours: 3

ME500 - Advanced Engineering Thermodynamics This course creates computer programs to solve complex problems in thermodynamics relating to vapor power cycles, gas power cycles, refrigeration cycles, and psychrometric evaluations. The course also covers advanced thermodynamic relations involving equations of state and chemical equilibrium. Prerequisite: ME 400 or equivalent or consent of instructor. Credit Hours: 3

ME501 - Transport Phenomena Mechanism of heat, mass and momentum transport on both molecular and continuum basis. Estimation of transport properties. Generalized transport equations in one- or three-dimensional systems. Analogy of mass, heat and momentum transfer. Macroscopic balances, simultaneous mass and heat transfer. Prerequisite: ME 302. Credit Hours: 3

ME502 - Conduction Heat Transfer Engineering considerations involving the construction of mathematical and numerical models of conduction heat transfer and the interpretation of results of analyses. Prerequisite: ME 302. Credit Hours: 3

ME503 - Convective Heat Transfer Laminar and turbulent forced convection heat transfer over surfaces and inside tubes, including non-circular cross sections. Developing flows. Laminar free convection. Emphasis throughout is on the analytical approach. Prerequisite: ME 302. Credit Hours: 3

ME504 - Diffraction Methods in Engineering X-ray and neutron physics. Geometry of crystals. Scattering of X-rays and neutrons by atoms, crystals, and noncrystalline matter. Kinematical theory of diffraction. Powder method, Laue method. Formation and analysis of diffraction patterns. Analysis

of crystal defects. Mechanical property measurement. Residual Strain measurement. Stress-Strain analysis. Thermal property measurement. Prerequisite: ME 312 with a grade of C+ or better or instructor permission. Credit Hours: 3

ME505 - Vehicle Dynamics To provide an introductory coverage of dynamics of vehicle systems. The topics include mainly automotive systems but others such as aircraft and train systems may be discussed. Students will become familiar with issues related to tire behavior, vehicle suspension design, steering, vehicle and load transfer. Prerequisite: ENGR 261. Credit Hours: 3

ME507 - Combustion Phenomena Basic combustion phenomena-chemical rate processes-flame temperature, burning velocity, ignition energy, quenching distance and inflammability limits-laminar and turbulent flame propagation-aerodynamics of flame-gaseous detonations-two phase combustion phenomena-fluidized bed combustion. Prerequisite: ME 300. Credit Hours: 3

ME508 - Nano/Microscale Energy and Heat Transfer Review of limitations of macroscopic energy transport models; Energy transport and conversion mechanisms at the micro/nano/molecular scale; Energy transfer in nanostructured energy devices; Related topics on the transport of electrons, phonons and molecules; Molecular Dynamics simulation. Restricted to graduate standing or consent of the instructor. Credit Hours: 3

ME509 - Thermal Radiation Heat Transfer Review of radiation fundamentals. Prediction of radiative properties using classical electromagnetic theory. Properties of real materials. Governing equations between blackbody and graybody surfaces. Exchange of radiation between nondiffuse, nongray surfaces. Radiation in the presence of other energy transfer modes. Approximate and computer solution techniques. Prerequisite: ME 302. Credit Hours: 3

ME525 - Small Particle Phenomena Small particle formation, behavior, properties, emission, collection, analysis and sampling. Includes atomization, combustion, transport of suspension and sols, filtration, light scattering and movement patterns of mono and polydisperse particles and use of a device to measure size, size distribution and one other physical property of an aerosol. Restricted to graduate standing. Credit Hours: 3

ME531 - Reaction Engineering and Rate Processes Chemical kinetics of homogeneous and heterogeneous reactions, kinetic theories, mechanism and mathematical modeling. Reactor design. Design of multiple reactions; temperature and pressure effects. Nonisothermal and nonadiabatic processes. Non-ideal reactors. Prerequisite: ME 435. Credit Hours: 3

ME535 - Computer Aided Analysis of Mechanical Systems I Computer aided kinematic and dynamic analysis of planar mechanism: topics will include formulation of kinematic and dynamic equations of motion for planar systems. Automatic generations of kinematic constraint such as resolute joint, translation joint, etc. Numerical techniques for solution of nonlinear, differential, and algebraic equations, application of these techniques to planar mechanism and robotic systems. Prerequisite: ME 309. Credit Hours: 3

ME537 - Nonlinear Vibrations Dynamic response and stability of nonlinear systems. Examples and sources of nonlinearity. Various techniques for studying dynamic behavior or nonlinear systems. Prerequisite: ME 470 or consent of instructor. Credit Hours: 3

ME538 - Applied Optimal Design and Control of Dynamic Systems Unconstrained and Constrained Mechanical-System Optimization Problems; Variational Calculus; Continuous Optimal Control; The Maximum Principle and Hamilton-Jacobi Theory; Dynamic-Systems Optimum-Control Examples; Design Sensitivity Analysis; Numerical Methods for Dynamic-System Design and Control Problems; Application of the above techniques to Large Scale Dynamic Systems. Prerequisite: ME 470 or equivalent. Credit Hours: 3

ME539 - Catalysis in Energy Processes This course spans the full range from fundamentals of kinetics and heterogeneous catalysis via modern experimental and theoretical results of model studies to their equivalent large-scale energy processes. Several processes are discussed including hydrogen production, fuel cells, liquid fuel synthesis. Prerequisite: ME 410 or consent of instructor. Credit Hours: 3

ME540 - Tissue Engineering (Same as BME 540) Fundamentals of tissue engineering will be discussed. Developing biomaterials for artificial scaffolds and cell populations within the scaffolds will be discussed. Stem cells for cell-based therapy will be highlighted. Design of various organ-on-chips will be covered. Other topics include recent advances in 3D bioprinting for organ engineering/regenerative medicine. Advances in in-vitro tumor models will be discussed. Ethical considerations will be emphasized. Credit Hours: 3

ME545 - Intelligent Control Techniques to design and develop intelligent controllers for complex engineering systems. Specific techniques covered are fuzzy logic, expert systems, genetic algorithms, simulated annealing and any combinations of these. Prerequisite: ME 336 or consent of instructor. Credit Hours: 3

ME549 - Wave Propagation, Impact and Explosions This course will deal with the dynamic response of materials and structures to dynamic events with particular emphasis on crashes, impacts and explosions. Prerequisite: ENGR 261 or consent of instructor. Credit Hours: 3

ME550 - Contact Mechanics Course covers fundamentals of mechanics of elastic and inelastic solids in contact. Although the primary focus is on elastic contact, topics involving plastic flow, thermo-elastic effects and contact of rough surfaces are included in the content. Restricted to graduate standing. Credit Hours: 3

ME551 - Advanced Vibration Analytical techniques for the vibration of discrete, continuous, and hybrid discrete-continuous systems; Vibration of conservative and nonconservative systems with focus on their representation in terms of linear operators; Properties of vibrating systems; Discretization methods for the analysis of continuous and nonlinear systems; Vibration and stability of gyroscopic systems. Prerequisite: ME 470 with a grade of C or better or graduate standing. Credit Hours: 3

ME555 - Materials Processing Course to cover a multitude of topics in the processing of metals, ceramics and, to a lesser extent, polymers. Examples are: materials benificiation, extraction, solidification, sintering and thin film deposition; topics for which the scientific basis for the processes is well established. Prerequisite: ME 312 and 410 or consent of instructor. Credit Hours: 3

ME562 - Environmental Degradation of Materials Course designed for majors in engineering and the physical sciences. Topics covered include general corrosion, oxidation, hydrogen embrittlement, stress corrosion cracking and fine particle erosion. Approach will draw on principles of chemistry and materials science. Prerequisite: CHEM 200 and CHEM 210, ME 312, or consent of instructor. Credit Hours: 3

ME564 - Ceramic Materials for Electronics Ceramic materials contribute essential passive functions as components for a wide range of electronic applications related to sensors and energy converters. Ceramic material's electronic properties, electronic and ionic conduction in ceramic oxides; processing, properties and applications of ceramic materials for electronics, solid-oxide fuel cells, properties, fabrication and performance will be covered in this course. Prerequisite: ME 312, 463 or consent of instructor. Credit Hours: 3

ME565 - Finite Element Analysis (Same as CE 551) Finite element analysis as a stress analysis or structural analysis tool. Derivation of element stiffness matrices by various means. Application to trusses, plane stress/strain and 3-D problems. Dynamic and material nonlinearity problems. Restricted to graduate standing in engineering or consent of instructor. Credit Hours: 3

ME566 - Advanced Mechanics of Materials (Same as CE 557) Advanced topics in mechanics of materials including: elasticity equations; torsion of non-circular sections; generalized bending including curved beams and elastic foundations; shear centers; failure criteria including yielding, fracture and fatigue; axisymmetric problems including both thick and thin walled bodies; contact stresses; and stress concentrations. Restricted to graduate standing in engineering or consent of instructor. Credit Hours: 3

ME567 - Tribology Analysis and design of tribological components particularly bearings. A number of modern developments in the field and advanced topics will be presented. Restricted to graduate standing or consent of instructor. Credit Hours: 3

ME568 - Alternative Energy and Fuel Resources The course covers the alternatives for energy resources and the impact of the human growth on the energy usage and its environmental

consequences. The course describes the fossil fuel era, renewable energy resources, and hydrogen fuel era. The fundamentals of each of these fuel types, their conversion to usable energy and the potential of each of these fuels for the future is discussed. Prerequisite: ME 300 and 400, or instructor's consent. Credit Hours: 3

ME569 - Non-Destructive Evaluation Course to cover a multitude of topics in non-destructive evaluation (NDE) techniques with emphasis on recent advancements in the field. Introduction to the field of NDE. Overview of common NDE techniques, such as visual inspection, eddy current, X-ray and ultrasonics. Recent development and research areas in NDE. Credit Hours: 3

ME577 - Bioprocess Engineering (Same as BME 577) This course introduces the Mechanical and/or the Biomedical Engineer to the applications of bioprocesses to biotechnology, bacterial cell cultivation, animal cell cultivation, plant cell cultivation and medical applications bioprocessing. Attention will be given to a short survey of the working cells and rectors for cell growth, but will be an overview in nature. Restricted to graduate student standing. Credit Hours: 3

ME580 - Seminar Presentations of topics in the broad areas of mechanical engineering such as thermal, mechanics, materials and acoustics. Restricted to enrollment in program leading to Master of Science of Mechanical Engineering. Credit Hours: 1

ME581 - Microrobotics This course provides an introduction to Microrobotics which is a newly emerging robotics field. Since the micro/nano-scale technologies have been improved dramatically, the microrobot has been highlighted for applications in healthcare, biotechnology, etc. Topics covered: the forces and its effects on microrobots at the micron scale, the fabrication methods, control/sensing methods for microrobots, microrobots actuation methods, and locomotions in low Re number regime. In addition, the course will summarize and describe the near-future challenges in Microroborics. Restricted to graduate standing. Credit Hours: 3

ME582 - Experimental Research Tools Topics important to engineering graduate students engaging in research. These topics include: laboratory safety, statistical data analysis, experimental design, library research and chemical hygiene. Restricted to graduate enrollment in Engineering. Credit Hours: 1

ME583 - Technical Research Reporting Analysis of technical and scientific writing: journal article, thesis, research paper. Guidelines and principles for writing engineering research literature and proposals. Term project involving thesis or research paper proposal to meet department requirements. Prerequisite: ME 582. Special approval needed from the instructor. Credit Hours: 1

ME586 - Additive Manufacturing Overview of common additive manufacturing (AM) systems, such as stereolithography (STL), fuse deposition modeling (FDM), powder bed fusion, laminated object manufacturing (LOM), etc. Application of AM in aerospace, automobile, medical, and bioengineering. Material selection and processes for AM. Credit Hours: 3

ME592 - Special Investigations in Engineering Advanced topics in thermal and environmental engineering. Topics are selected by mutual agreement of the student and instructor. Four hours maximum course credit. Special approval needed from the instructor and department chair. Credit Hours: 1-4

ME593 - Special Topics in Mechanical Engineering Studies of special topics in various areas in mechanical engineering. Such topics as coal refining, energy conversion, thermal systems, mechanics, robotics, CAD/CAM, TOM and engineering materials. Special approval needed from the instructor. Credit Hours: 3

ME595 - Research Paper Research paper on a topic approved by a faculty advisor and committee in Mechanical Engineering. This course is restricted to graduate students in the non-thesis option. Restricted to graduate standing in Mechanical Engineering. Special approval needed from the instructor or department. Credit Hours: 3

ME599 - Thesis Six hours maximum course credit. Credit Hours: 1-6

ME601 - Continuing Enrollment For those graduate students who have not finished their degree programs and who are in the process of working on their dissertation, thesis, or research paper. The student must have completed a minimum of 24 hours of dissertation research, or the minimum thesis, or

research hours before being eligible to register for this course. Concurrent enrollment in any other course is not permitted. Graded S/U or DEF only. Credit Hours: 1

Mechanical Engineering Faculty

Chowdhury, Farhan, Associate Professor, Ph.D., University of Illinois at Urbana-Champaign, 2011; 2015. Biomedical Engineering, stem cell biology, regenerative medicine, biomedical and molecular mechanism of tumorigenic cancer cells.

Chu, Tsuchin P., Professor and Interim Director, Ph.D., University of South Carolina, 1982; 1990. Non-destructive evaluation, biomedical engineering, FEA, carbon composites, CAD/CAM, machine vision, optical methods in experimental mechanics, image processing and analysis.

Eslamiat, Hossein, Assistant Professor, Mechanical Engineering, Ph.D., Syracuse University, 2020; 2020. Nonlinear Dynamics, Control and Estimation for Underactuated Systems.

Esmaeeli, Asghar, Professor, Ph.D., The University of Michigan, 1995; 2005 Large scale computations of multiphase flows, phase change phenomena, and electrohydrodynamics.

Farhang, Kambiz, Professor, Ph.D., Purdue University, 1989; 1990. CAD/CAM, controls, vibrations, kinematics, dynamics, control and stability of flexible and rigid-body mechanical, electromechanical, mechanical-drive systems; manufacturing processes and process control.

Filip, Peter, Professor, Ph.D., Technical University Ostrava, D.Sc., Academy of Sciences, Prague, Czech Republic, 1989. 1989; 1999. Materials science and engineering nanotechnology, friction science and applications, biomaterials, shape memory, alloys and advanced composite materials.

Koc, Rasit, Professor, Ph.D., Missouri University Science and Technology, 1989; 1994. Advanced Materials and composites processing and characterization.

Mathias, James A., Associate Professor, Ph.D., Ohio State University, 2001; 2003. Nanotechnology, microchannels, heat transfer, thermodynamics, energy utilization.

Mondal, Kanchan, Professor, Ph.D., SIUC, 2001; 2006. Electrochemistry, energy from coal, catalysis, reactor systems and design.

Nilufar, Sabrina, Assistant Professor, Ph.D., University of Illinois, Champaign, 2014. Advanced materials, covetics and reinforced composite materials processing and characterization. Phase transformation, corrosion resistance, and thermal and electrical properties for aerospace, military armors, cardiovascular stents application, and biomedical implants for orthopedic application.

Nsofor, Emmanuel C., Professor, Ph.D., Mississippi State University, 1993; 1999. Heat transfer, advanced energy systems, renewable energy sources, computational fluid dynamics (CFD).

Suni, Ian I., Professor and Director of the Materials Technology Center, Ph.D., Harvard University, 1992; 2013. Application of electrochemistry and electrochemical engineering to technology advancement in thin film growth and dissolution, including both photovoltaic thin films and ULSI materials; electrochemical biosensors, including the use of electrochemical impedance spectroscopy (EIS) for detecting antibody-antigen recognition; and nanotechnology, including the use of nanoporous template materials for alternative energy development and biosensing.

Swift, Geoffrey, Assistant Professor, Ph.D., California Institute of Technology, 2004; 2020. Advanced batteries and battery materials; mechanics of materials; ceramic materials.

Emeriti Faculty

Abrate, Serge, Professor, Emeritus, Ph.D., Purdue University, 1983; 1995.

Agrawal, Om, Professor, Emeritus, Ph.D., University of Illinois-Chicago, 1984; 1985.

Don, Jarlen, Professor, Emeritus, Ph.D., Ohio State University, 1982; 1985.

Hippo, Edwin J., Professor, Emeritus, Ph.D., Pennsylvania State University, 1977; 1984.

Jefferson, Thomas B., Professor, Emeritus, Ph.D., Purdue University, 1955; 1969.

Kent, Albert C., Professor, Emeritus, Ph.D., Kansas State University, 1968; 1966.

O'Brien, William S., Associate Professor, Emeritus, Ph.D., West Virginia University, 1972; 1973.

Orthwein, William C., Professor, Emeritus, Ph.D., University of Michigan, 1958; 1965.

Swisher, George M., Professor, Emeritus, Ph.D., Ohio State University, 1969; 1999.

Swisher, James H., Professor, Emeritus, Ph.D., Carnegie Mellon, 1963; 1983.

Tempelmeyer, Kenneth E., Professor, Emeritus, Ph.D., University of Tennessee, 1969; 1979.

Wittmer, Dale E., Professor, Emeritus, Ph.D., University of Illinois, 1980; 1986.

Wright, Maurice, Professor, Emeritus, Ph.D., University of Wales, United Kingdom, 1962; 1984.

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Catalog Year Statement:
Students starting their collegiate training during the period of time covered by this catalog (see bottom of this page) are subject to the curricular requirements as specified herein. The requirements herein will extend for a seven calendar-year period from the date of entry for baccalaureate programs and three years for associate programs. Should the University change the course requirements contained herein subsequently, students are assured that necessary adjustments will be made so that no additional time is required of them.