SIU Southern Illinois University
CARBONDALE

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Mechanical Engineering

The mission of the School of Mechanical, Aerospace, and Materials Engineering is to provide high quality engineering education to students and equip them with lifelong learning skills, which allow them to adapt to a changing work environment throughout their careers. Also, the School of Mechanical, Aerospace, and Materials Engineering supports faculty growth and development through research and creative activities because quality teaching and service to humanity and society cannot be achieved without such activities. Finally, the School of Mechanical, Aerospace, and Materials Engineering supports the idea of service to school, college, university, professional societies and community as part of the mission. The undergraduate program in Mechanical Engineering is accredited by the Engineering Accreditation Commission of ABET, www.abet.org. The school also offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees.

Bachelor of Science (B.S.) in Mechanical Engineering

The fundamental goal of the undergraduate program in Mechanical Engineering is to offer a high-quality education for our students, designed to achieve the following Program Educational Objectives (PEOs), which describe what graduates are expected to attain within a few years of graduation.

Our Bachelor of Science (B.S.) degree in Mechanical Engineering prepares our students to excel in their careers. Within three to five years of graduating, our graduates will:

1. Attain increased responsibility beyond their entry-level position within Mechanical Engineering or related employment, while recognizing global and societal matters.
2. Become ambassadors for engineering and improve the quality of life in the communities they serve, through collaboration, innovation, and effective communication.
3. Successfully progress within graduate degree programs in Mechanical Engineering, progress toward their professional degrees or professional engineering licenses, and/or continue lifelong learning in a broad range of fields to advance their careers.
4. Successfully serve the profession by acting in a professional and ethical manner.

Also, the undergraduate program is designed to achieve the following Student Outcomes (SOs), which describe what students are expected to know and be able to do by the time of graduation:

1. The ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. The ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. The ability to communicate effectively with a range of audiences.
4. The ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. The ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. The ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
7. The ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Mechanical engineering is one of the broadest fields of engineering. Mechanical engineers learn measurement and instrumentation, computer-aided design, computer simulation, computer control, combustion and engine analysis. They learn to design thermal systems for mechanical and electrical equipment including heating, ventilating, air conditioning and refrigeration. Students learn how to design and produce new materials for advanced engineering applications. Courses are also offered in subjects related to the chemical processes and environmental control industries. The school offers a program leading to a Bachelor of Science degree in Mechanical Engineering. Students may choose to obtain Bachelor of Science in Mechanical Engineering with a specialization in Energy Engineering. In addition, a Minor in Energy Engineering is offered to non-Mechanical Engineering students provided they meet the requirements. Graduates are highly sought after in a variety of industries such as automotive, aerospace and manufacturing.

B.S. Mechanical Engineering Degree Requirements

Degree Requirements			Credit Hours	
University Core Curriculum Requirements (should include BIOL 202, ECON 240 and MATH 150)				39
Requirements for Major in Mechanical Engineering				(9)+87
	Basic Science		(6)+9	
		CHEM 200, CHEM 201, CHEM 210	(3)+4	
		PHYS 205A, PHYS 205B, PHYS 255A, PHYS 255B	(3)+5	
	Mathematics Analysis		(3)+14	
		MATH 150, MATH 250, MATH 251, MATH 305	(3)+11	
		ENGR 351	3	
	Required Engineering Courses		17	
		ENGR 222 or ENGR 296 or ME 222	2	
		ENGR 250, ENGR 261, ENGR 335, ENGR 350A, ENGR 370A	15	
	Required ME Courses		47	
		ME 102, ME 300, ME 302, ME 309, ME 312, ME 336, ME 401, ME 407, ME 411, ME 475, ME 495A, ME 495B	32	
		Mechanical Engineering Elective Courses. At least 12 credit hours must be from 400-level ME courses and 3 credit hours may be from IMAE 470A or a 400-level course used for a Math minor.	15	
Total				126

Aerospace Engineering Specialization

Students may choose to obtain Bachelor of Science in Mechanical Engineering with a specialization in Aerospace Engineering. Aerospace Engineering Specialization requires:

3 credit hours from the following list:

- ME 486, ME 422, ME 480, ME 478, ME 470, ME 449 -AND-

6 credit hours from the following list:

- ME 427, ME 437, ME 447

B.S. Mechanical Engineering - Aerospace Engineering Specialization Degree Requirements

Degree Requirements			Credit Hours	
University Core Curriculum Requirements				39
Requirements for Major in Mechanical Engineering				(9)+87
	Basic Science		(6)+9	
		CHEM 200, CHEM 201, CHEM 210 (3)+4		
		PHYS 205A, PHYS 205B, PHYS 255A, PHYS 255B (3)+5		
	Mathematics Analysis		(3)+14	
		MATH 150, MATH 250, MATH 251, MATH 305 (3)+11		
		ENGR 351 3		
	Required Engineering Courses		17	
		ENGR 222B or ENGR 296 2		
		ENGR 250, ENGR 261, ENGR 335, ENGR 350A, ENGR 370A 15		
	Required ME Courses		47	
		ME 102, ME 300, ME 302, ME 309, ME 312, ME 336, ME 401, ME 407, ME 411, ME 475, ME 495A, ME 495B 32		
		Aerospace Elective Courses 9		
		Mechanical Engineering Elective Courses. Must be from 400-level ME courses, or may be from IT 470A or a 400-level course used for a Math minor. 6		

Degree Requirements	Credit Hours
Total	126

B.S. Mechanical Engineering - Energy Engineering Specialization Degree Requirements

Degree Requirements		Credit Hours	
University Core Curriculum Requirements			39
Requirements for Major in Mechanical Engineering			(9) + 87
Basic Science		(6)+9	
CHEM 200, CHEM 201, CHEM 210	(3)+4		
PHYS 205A, PHYS 205B, PHYS 255A, PHYS 255B	(3)+5		
Mathematics Analysis		(3)+14	
MATH 150, MATH 250, MATH 251, MATH 305	(3)+11		
ENGR 351	3		
Required Engineering Courses		17	
ENGR 296 or ME 222	2		
ENGR 250, ENGR 261, ENGR 335, ENGR 350A, ENGR 370A	15		
Required ME Courses		47	
ME 102, ME 300, ME 302, ME 309, ME 312, ME 336, ME 401, ME 407, ME 411, ME 475, ME 495A, ME 495B	32		
Elective Energy Courses [1]	12		
Mechanical Engineering Courses. Must be from 400-level ME courses, or may be from IT 470A or a 400-level course used for a Math minor.	3		
Total			126

[1] Approved electives: ME 400, ME 405, ME 406, ME 408, ME 410, ME 435, ME 440, ME 446, ME 450, ME 459, ME 493

Energy Engineering (for non-Mechanical Engineering) Minor

Degree Requirements	Credit Hours
Required ME Courses	6
ME 300, ME 302 [1]	
Elective Energy Courses [2]	9
Total	15

[1] *Prerequisite for ME 302 is ENGR 370A. Equivalence for ME 300 and ENGR 370A will be considered.*

[2] *Approved electives: ME 400, ME 405, ME 406, ME 408, ME 410, ME 435, ME 440, ME 446, ME 450, ME 459, ME 493.*

Capstone Option for Transfer Students

The SIU Capstone Option is available to students who have earned an Associate in Engineering Sciences (A.E.S.) degree with a minimum cumulative 2.0/4.0 GPA on all accredited coursework prior to the completion of the A.E.S., as calculated by the transfer institution's grading policies. The Capstone Option reduces the University Core Curriculum requirements from 39 to 30 credit hours, therefore reducing the time to degree completion.

Students interested in the Capstone Option should contact the College of Engineering, Computing, Technology and Mathematics Advisement Office to develop a personal coursework pathway to degree completion.

Mechanical Engineering Courses

ME102 - Computer-Aided Engineering Drawing A broad base of current Computer-Aided Design and Engineering skills necessary for success, efficiency, and productivity in modern industry is covered in the curriculum. Course content includes manual sketching and computer-aided engineering drawing techniques along with orthographic projections, isometric projections, oblique projections, auxiliary views, and sectional views. Geometric properties and spatial relations of engineered components; design of engineering models and their appearance in the standard 2D form as well as in 3D solids; dimensioning and tolerancing as per ISO and ANSI standards; use of solid modeling software for creating relevant models at machine component and system levels; computer labs are equipped with a wide range of CAD packages currently used in the industry. A project must be completed using solid modeling software by the end of the semester. Lab fee: $25. Credit Hours: 2

ME102H - Computer-Aided Engineering Drawing A broad base of current Computer Aided Design and Engineering skills necessary for success, efficiency, and productivity in modern industry is covered in the curriculum. Course content includes manual sketching and computer-aided engineering drawing techniques along with orthographic projections, isometric projections, oblique projections, auxiliary views, and sectional views. Geometric properties and spatial relations of engineered components; design of engineering models and their appearance in the standard 2D form as well as in 3D solids; dimensioning and tolerancing as per ISO and ANSI standards; use of solid modeling software for creating relevant models at machine component and system levels; computer labs are equipped with a wide range of CAD packages currently used in the industry. A project must be completed using solid modeling software by the end of the semester. Credit Hours: 2

ME222 - MATLAB Programming for Mechanical Engineers This course provides fundamental computing principles and MATLAB programming concepts for Mechanical Engineers. Topics covered in

MATLAB fundamentals, engineering computing, data import/export, 2D/3D plotting, condition statements/loops, MATLAB scripts/debugging, data fitting, solving differential equations, graphical user interface development environment, and examples of mechanical engineering problems. This course includes a term project in which students learn how to solve various mechanical engineering problems. Prerequisite: MATH 111 or equivalent with a minimum grade of C. Credit Hours: 2

ME300 - Engineering Thermodynamics I Study of the basic principles of thermodynamics. Engineering analysis of physical systems based on the first and second laws. Properties of pure substance (ideal gas behavior, non-ideal gas behavior, and equations of states.) Introduction to cycle analysis. Prerequisite: MATH 250, PHYS 205A. Credit Hours: 3

ME302 - Engineering Heat Transfer Fundamentals of heat transfer by conduction, convection and radiation. Applications of theory to engineering systems. Prerequisite: ME 300 and MATH 305; ENGR 370A or 370B concurrently. Credit Hours: 3

ME303 - Energy: Uses and Cultural Impacts Lectures, discussions, and class projects directed at understanding the role of energy, power, and related concepts in cultures in the past, the present, and the future. A review of current energy resources and use patterns and their impact on various cultures, as well as projections for new energy conservation techniques and the development of alternative energy technology and their cultural effects. An overview of worldwide energy needs, seeking to identify future limits on energy use attributable to environmental, economic, political, cultural, and other technological and evolutionary constraints. Prerequisite: Satisfactory completion of three hours of University Core Curriculum science requirements. Credit Hours: 3

ME309 - Mechanical Analysis and Design The course covers kinematics and kinetics of interconnected bodies. Principles of kinematics and force analyses are applied to planar machinery. Vector loop approach is used to model mechanisms and numerical methods are employed in which a set of nonlinear equations are solved iteratively to find their displacement, velocity and acceleration. Limited coverage of design of mechanisms is presented. Prerequisites: ENGR 261; ME 222 or ENGR 222 or ENGR 296. Credit Hours: 3

ME312 - Materials Science Fundamentals Sub-Microscopic Structure of solids, including electronic states, atomic and molecular, arrangement, structural imperfections and atomic diffusion, and their relationship to macro-mechanical properties. Prerequisites: PHYS 205A, MATH 250, CHEM 200, 201. Lab fee: $25. Credit Hours: 3

ME336 - System Dynamics and Control Modeling and simulation of mechanical, electrical, fluid and thermal systems, time domain response analysis, properties of feedback control systems, analysis and design using root-locus and frequency response methods, PID controllers. Computer-aided modeling, analysis, and design. Prerequisites: MATH 305 and ENGR 261. Credit Hours: 3

ME392 - Mechanical Engineering Cooperative Education Supervised work experience in industry, government or professional organization. Students work with on-site supervisor and faculty advisor. Reports are required from the student and the employer. Hours do not count toward degree requirements. Mandatory Pass/Fail. Restricted to sophomore standing. Credit Hours: 1-6

ME393 - Internship in Mechanical Engineering Credit for documented work experience as an intern in an engineering occupation or an engineering-related occupation. Work assignments must have been professional service in the mechanical engineering field. Hours do not count toward degree requirements. Mandatory Pass/Fail. Prerequisite: satisfactory completion of twelve hours of Engineering and/or Mechanical Engineering courses. Credit Hours: 1-12

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. Lab fee: $25. 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

ME407 - Measurements and Instrumentation Measurements of displacement, velocity, frequency, pressure, force, vibration, and flow rate. Data acquisition and analysis. System parameter identification. Team execution of experiments; technical report writing; data presentation using figures and tables. Prerequisite: ME 336. Lab fee: $25. Credit Hours: 2

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 300. 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

ME411 - Manufacturing Methods for Engineering Materials Overview of manufacturing processes with emphasis on the fabrication of materials from the processing and equipment viewpoint. This course presents a broad study of the many manufacturing processes utilized in the production of a wide variety of products and components. Insight into the multitude of processing factors which influence the practical design of manufactured parts to achieve the advantages of maximum economy, accuracy and automation in everyday production. Prerequisite: ME 312 and ENGR 350A. 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

ME431 - Advanced Manufacturing and Sustainability The manufacturing sector accounts for a significant portion of global energy consumption and greenhouse gas emissions, and there is growing interest in the potential for advanced manufacturing technologies such as additive manufacturing and smart manufacturing to reduce the sector's environmental impacts. For sustainable manufacturing, decision makers should focus on a triple bottom line that addresses the three pillars of sustainability: economic considerations, social responsibility, and environmental impact. The Advanced Manufacturing and Sustainability course provides an overview of sustainability, sustainable manufacturing, and advanced manufacturing processes such as additive manufacturing and smart manufacturing. Manufacturing cost analysis, energy consumption and environmental impact, life cycle assessment (LCA), product and process design for sustainability, and sustainable manufacturing systems are also covered in detail. Prerequisite: ENGR 350A. 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

ME464 - Electronic Properties and Applications of Materials Electronic properties of materials, and the applications of materials as electronic components. The effects of chemistry, crystal structure, stoichiometry, processing, and microstructure on the electronic properties are discussed, along with the functions, performance requirements, and testing methods of materials for conductors, semiconductors, insulators, dielectrics, ferroelectric, piezoelectric, electro-optical, superconductors, and magnetic materials. Prerequisite: ME 312 or consent of the instructor. 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. Lab fee: $25. 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. Lab fee: $25. 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

ME492 - Special Problems in Engineering Engineering topics and problems selected by either the instructor or the student with the approval of the instructor. Five hours maximum course credit. Not for graduate credit. Restricted to senior standing. Special approval needed from the instructor. Credit Hours: 1-5

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

ME495A - Mechanical Engineering Design Project development skills, feasibility and cost-benefit analysis, ethical issues, professionalism, preliminary design, identification of tasks, assignment of tasks to project team members, coordination of interdisciplinary team effort, development of final proposal, oral presentation of final proposal. Not for graduate credit. Prerequisite or concurrent enrollment in: ENGR 351; ME 475; one ME elective. Restricted to senior standing in ME. Lab fee: $70. Credit Hours: 3

ME495B - Mechanical Engineering Design Development of the final design, hardware implementation of the final design (if the project warrants), documentation of all stages of design, project coordination, documentation of the testing and evaluating of the design, cost estimating, scheduling, and written, oral, and poster presentation of the final design. Not for graduate credit. Prerequisite: ME 495A (last semester). Lab fee: $70. Credit Hours: 3

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.

Dong, Bin, Assistant Professor, Ph.D., Virginia Polytechnic Institute and State University, 2019; 2023. Vibration of mechanical systems, vibration analysis based on symmetry principles.

Eslamiat, Hossein, Assistant Professor, Ph.D., Syracuse University, 2020; 2020. Nonlinear dynamics and control, geometric control design, variational methods for observer design.

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

Filip, Peter, Professor, Ph.D., Technical University, Ostrava, 1989; 1999. Materials science and engineering nanotechnology, friction science and applications, biomaterials, shape memory, alloys and advanced composite materials.

Jung, Sangjin, Assistant Professor, Ph.D., Hayang University, 2012; 2021. Additive manufacturing, product design.

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., Southern Illinois University Carbondale, 2001; 2006. Electrochemistry, energy from coal, catalysis, reactor systems and design.

Nilufar, Sabrina, Assistant Professor, Ph.D., University of Illinois at Urbana-Champaign, 2015; 2019. 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).

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 at Chicago, 1984; 1985.

Chen, Juh W., Professor, Emeritus, Ph.D., University of Illinois, 1959; 1965.

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

Farhang, Kambiz, Professor, Emeritus, Ph.D., Purdue University, 1989; 1990.

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.

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 University, 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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