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Mechanical Engineering and Energy Processes

The mission of the Department of Mechanical Engineering and Energy Processes 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 Department of Mechanical Engineering and Energy Processes 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 Department of Mechanical Engineering and Energy Processes supports the idea of service to department, 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 department also offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees.

The Capstone Option for Transfer Students

The Capstone Option is available to students who have earned an Associate in Engineering Sciences (AES) degree with a minimum cumulative 2.0/4.0 GPA on all accredited coursework prior to the completion of the AES, as calculated by SIU. The Capstone Option reduces the University Core Curriculum requirements from 39 to 30 hours, therefore reducing the time to degree completion. Students interested in the Capstone Option should contact the College of Engineering Advisement Office to develop a personal coursework pathway to degree completion.

Bachelor of Science Degree 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:
1. Practice mechanical engineering in a global and societal context
2. Have skills needed for effective written and oral communication, collaboration, and innovation
3. Pursue advanced education or lifelong learning that support careers in a broad range of fields
4. Act in a professional and ethical manner, in their careers and communities

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 apply knowledge of mathematics, science and engineering to problem solving
2. The ability to design and conduct experiments, as well as to analyze and interpret data
3. The ability to design a system, component, or process to meet desired needs within realistic constraints
4. The ability to function on multi-disciplinary teams
5. The ability to identify, formulate and solve engineering problems
6. An understanding of professional and ethical responsibility
7. The ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. A recognition of the need for and an ability to engage in life-long learning
10. Knowledge of contemporary issues
11. The ability to use the techniques, skills and modern engineering tools necessary for engineering practice

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 department 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.

**Bachelor of Science Degree in Mechanical Engineering Requirements**

<table>
<thead>
<tr>
<th>Degree Requirements</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Core Curriculum Requirements (should include BIOL 202, ECON 240 and MATH 150)</td>
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</tr>
<tr>
<td>Requirements for Major in Mechanical Engineering</td>
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<tr>
<td><strong>Basic Science</strong></td>
<td>(6)+9</td>
</tr>
<tr>
<td>CHEM 200, CHEM 201, CHEM 210</td>
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<tr>
<td>PHYS 205A, PHYS 205B, PHYS 255A, PHYS 255B</td>
<td>(3)+5</td>
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<tr>
<td><strong>Mathematics Analysis</strong></td>
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<tr>
<td>MATH 150, MATH 250, MATH 251, MATH 305</td>
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<tr>
<td>ENGR 351</td>
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<td><strong>Required Engineering Courses</strong></td>
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</tr>
<tr>
<td>ENGR 222 or ENGR 296 or ME 222</td>
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</tr>
<tr>
<td>ENGR 250, ENGR 261, ENGR 335, ENGR 350A, ENGR 370A</td>
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<tr>
<td><strong>Required ME Courses</strong></td>
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</tr>
<tr>
<td>ME 102, ME 300, ME 302, ME 309, ME 312, ME 336, ME 400, ME 401, ME 407, ME 411, ME 472, ME 475, ME 495A, ME 495B</td>
<td>38</td>
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<tr>
<td>Mechanical Engineering Elective Courses At least 6 hours must be from 400-level ME courses and 3 hours may be from IT 470A or a 400-level course used for a Math minor.</td>
<td>9</td>
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<tr>
<td>Degree Requirements</td>
<td>Credit Hours</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
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<tr>
<td>Total</td>
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**Bachelor of Science Degree in Mechanical Engineering with Specialization in Energy Engineering Requirements**

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<thead>
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<th>Degree Requirements</th>
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<tr>
<td>University Core Curriculum Requirements</td>
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<tr>
<td>Requirements for Major in Mechanical Engineering</td>
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</tr>
<tr>
<td>Basic Science</td>
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<tr>
<td>CHEM 200, CHEM 201, CHEM 210</td>
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<tr>
<td>PHYS 205A, PHYS 205B, PHYS 255A, PHYS 255B</td>
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<tr>
<td>Mathematics Analysis</td>
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<td>MATH 150, MATH 250, MATH 251, MATH 305</td>
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<td>ENGR 351</td>
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<td>Required Engineering Courses</td>
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<td>ENGR 222B or ENGR 296</td>
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<tr>
<td>Required ME Courses</td>
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<td>401, ME 407, ME 411, ME 472, ME 475, ME 495A, ME 495B</td>
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<td>Elective Energy Courses</td>
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**Minor in Energy Engineering for non-Mechanical Engineering Degrees Requirements**

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<td>Degree Requirements</td>
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<tr>
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<td>Elective Energy Courses</td>
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<td>Total</td>
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</table>

1 Prerequisite for ME 302 is ENGR 370. Equivalence for ME 300 and ENGR 370 will be considered.
2 Approved electives: ME 405, ME 406, ME 408, ME 410, ME 435, ME 440, ME 446, ME 493.

**Mechanical Engineering and Energy Processes Courses**

**ME102 - Computer-Aided Engr Drawing** 102-2 Computer-Aided Engineering Drawing. Manual sketching and computer aided engineering drawing techniques including 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.

**ME222 - MATLAB for ME** 222-2 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.

**ME300 - Engineering Thermodynamics I** 300-3 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.

**ME302 - Engineering Heat Transfer** 302-3 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.

**ME303 - Energy Impacts** 303-3 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.

**ME309 - Mechanical Analysis & Design** 309-3 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. Prerequisite: ENGR 261; ENGR 222 or 296.

**ME312 - Materials Sci Fundamentals** 312-3 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 Supply fee: $8.


**ME392 - ME Co-Op Education** 392-1 to 6 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.

**ME393 - Internship in Mech Engr** 393-1 to 12 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.

**ME400 - Engr Thermodynamics II** 400-3 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.

**ME401 - Thermal Measurements Lab** 401-1 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.

**ME405 - Transportation Power Systems** 405-3 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.

**ME406 - Thermal Systems Design** 406-3 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.


**ME408 - Energy Conversion Systems** 408-3 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.

**ME410 - Appl Chem Thermo & Kinetics** 410-3 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.

**ME411 - Mnfg Methods: Engr Matls** 411-3 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.

**ME415 - Engineering Acoustics** 415-3 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.

**ME416 - Air Pollution Control** 416-3 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 or consent of instructor.


**ME422 - Appl Fluid Mechanics for ME** 422-3 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.


**ME440 - Design HVAC & Build Energy Sys** 440-3 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.

**ME446 - Energy Management** 446-3 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.


**ME451 - Advanced Dynamics** 451-3 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.

**ME463 - Introduction to Ceramics** 463-3 Introduction to Ceramics. Structure and physical properties, mechanical properties, processing and design of ceramics. Prerequisite: ME 312 or equivalent.

**ME465 - Intro to Nanotechnology** 465-3 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.

**ME468 - Friction Science & Apps** 468-3 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.

**ME470 - Mech System Vibrations** 470-3 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.

**ME472 - Materials Selection for Design** 472-3 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. Prerequisite: ENGR 222 and ME 312.

**ME475 - Machine Design I** 475-3 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.

**ME477 - Fund Comp Aid Des & Manf** 477-3 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.

**ME478 - FEA in CAD** 478-3 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.

**ME480 - Computational Fluid Dynamics** 480-3 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.

**ME481 - Design/Implement Vision System** 481-3 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.

**ME485 - Cell & Molecular Biomechanics** 485-3 Cellular and Molecular Biomechanics. (Same as BME 485) Mechanics at the micron and nanoscale level relevant to living cells. Molecular forces, bond dynamics, force induced protein conformational changes. Structural basis of living cells; contractile forces; mechanics of the biomembranes, the nucleus, the cytoskeletal filaments- actin, microtubule, intermediate filaments. Active and passive rheology techniques; microrheological properties of the cytoskeleton. Active cellular processes such as cell adhesion, cell spreading, control of cell shape, and cell migration. Discussion on the experimental techniques including single molecule approaches to understand these key cellular processes. Discussion on theoretical models that predict these cellular processes and their...
limitations. Introductory concepts of mechanobiology will be discussed. Prerequisites: ENGR 350A or 350B with a minimum grade of C or better; or graduate standing.

**ME486 - Nondestructive Eval Engr Matls** 486-3 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.

**ME492 - Special Problems in Engr** 492-1 to 5 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.

**ME493 - Materials in Energy** 493-3 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.

**ME495A - Mechanical Engr Design** 495A-3 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 400; one ME elective. Restricted to senior standing in ME.

**ME495B - Mechanical Engr Design** 495B-3 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).

**ME500 - Advanced Engr Thermodynamics** 500-3 Advanced Engineering Thermodynamics. Creating computer programs to solve complex problems in thermodynamics relating to vapor power cycles, gas power cycles, refrigeration cycles, and psychrometric evaluations. Advanced thermodynamic relations involving equations of state. Chemical and phase equilibrium. Prerequisite: ME 400 or graduate standing or consent of instructor.


**ME502 - Conduction Heat Transfer** 502-3 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.

**ME503 - Convective Heat Transfer** 503-3 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.


**ME505 - Vehicle Dynamics** 505-3 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.

**ME507 - Combustion Phenomena** 507-3 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.

**ME508 - Nanoscale Heat Transfer** 508-3 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.


**ME525 - Small Particle Phenomena** 525-3 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.


**ME535 - CAD of Mechanical Systems I** 535-3 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.

**ME537 - Nonlinear Vibrations** 537-3 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.


**ME539 - Catalysis** 539-3 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.

**ME540 - Intro to Continuum Mechanics** 540-3 Introduction to Continuum Mechanics. Tensor analysis applied to continuum mechanics: stress and strain and their invariance, equations of compatibility, constitutive equations - including linear stress-strain relations. Prerequisite: ENGR 350A, MATH 305. Restricted to graduate standing in engineering.
ME545 - Intelligent Control 545-3 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.

ME549 - Wave Propgtn, Impct & Explsns 549-3 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.

ME550 - Contact Mechanics 550-3 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.

ME551 - Advanced Vibration 551-3 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.

ME555 - Materials Processing 555-3 Materials Processing. Course to cover a multitude of topics in the processing of metals, ceramics and, to a lesser extent, polymers. Examples are: materials beneficiation, 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.

ME562 - Envr Degradation of Materials 562-3 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.

ME564 - Ceramic Materials Electronics 564-3 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.

ME565 - Finite Element Analysis 565-3 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.

ME566 - Advanced Mechanics-Materials 566-3 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.

ME567 - Tribology 567-3 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.

ME568 - Alt Energy & Fuel Resources 568-3 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.

**ME569 - Non-Destructive Evaluation** 569-3 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.

**ME577 - Bioprocess Engineering** 577-3 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.

**ME580 - Seminar** 580-1 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.

**ME582 - Experimental Research Tools** 582-1 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.

**ME583 - Technical Research Reporting** 583-1 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.

**ME592 - Special Investigations in ENGR** 592-1 to 4 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.

**ME593 - Spec Topics in Mech Engr** 593-3 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.

**ME595 - Research Paper** 595-3 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.

**ME599 - Thesis** 599-1 to 6 Thesis. Six hours maximum course credit.

**ME601 - Continuing Enrollment** 601-1 per semester 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.

**Mechanical Engineering and Energy Processes Faculty**

Abrate, Serge, Professor, Ph.D., Purdue University, 1983.
Agrawal, Om P., Professor, Ph.D., University of Illinois at Chicago, 1984.
Chai, Tan, Assistant Professor, Ph.D., Ohio State University, 2013.
Chen, Juh W., Professor, Emeritus, Ph.D., University of Illinois, 1959.
Chowdhury, Farhan, Assistant Professor, Ph.D., University of Illinois at Urbana-Champaign, 2011.
Chu, Tsuchin, Professor, Ph.D., University of South Carolina, 1982.
Cooley, Christopher G., Assistant Professor, The Ohio State University, 2012.
Don, Jarlen, Professor, Ph.D., Ohio State University, 1982.
Esmaeeli, Asghar, Professor, Ph.D., The University of Michigan, 1995.
Farhang, Kambiz, Professor, Ph.D., Purdue University, 1989.
Filip, Peter, Professor, Ph.D., Technical University, Ostrava, 1989.
Kent, Albert C., Professor, Emeritus, Ph.D., Kansas State University, 1968.
Kim, Dal Hyung, Assistant Professor, Ph.D., Drexel University, 2013.
Koc, Rasit, Professor and Chair, Ph.D., University of Missouri-Rolla, 1989.
Mathias, James A., Associate Professor, Ph.D., Ohio State University, 2001.
Mondal, Kanchan, Professor, Ph.D., Southern Illinois University, 2001.
Nsofor, Emmanuel C., Professor, Ph.D., Mississippi State University, 1993.
O’Brien, William S., Associate Professor, Emeritus, Ph.D., West Virginia University, 1972.
Orthwein, William, Professor, Emeritus, Ph.D., University of Michigan, 1959.
Rajan, Suri, Professor, Emeritus, Ph.D., University of Illinois, 1970.
Suni, Ivar Ian, Professor, Ph.D., Harvard, 1992.
Tempelmeyer, Kenneth E., Professor, Emeritus, Ph.D., University of Tennessee, 1969.
Wiltowski, Tomasz, Professor, Ph.D., Institute of Catalysis and Surface Chemistry, 1982.
Wittmer, Dale E., Professor, Emeritus, Ph.D., University of Illinois, 1980.
Wright, Maurice, Professor, Emeritus, Ph.D., University of Wales, 1962.

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