

# MECHANICAL ENGINEERING (ME)

Subject-area course lists indicate courses currently active for offering at the University of Louisville. Not all courses are scheduled in any given academic term. For class offerings in a specific semester, refer to the Schedule of Classes ([https://csprd.louisville.edu/psp/ps\\_class/EMPLOYEE/PSFT\\_CS/c/COMMUNITY\\_ACCESS.CLASS\\_SEARCH./x/?state=62dab551a0d600a5e8237359c50704e59007&duo\\_code=sjUx20STj21bWVEuQ3Z1YRiHmfXpgoV](https://csprd.louisville.edu/psp/ps_class/EMPLOYEE/PSFT_CS/c/COMMUNITY_ACCESS.CLASS_SEARCH./x/?state=62dab551a0d600a5e8237359c50704e59007&duo_code=sjUx20STj21bWVEuQ3Z1YRiHmfXpgoV)).

500-level courses generally are included in both the undergraduate- and graduate-level course listings; however, specific course/section offerings may vary between semesters. Students are responsible for ensuring that they enroll in courses that are applicable to their particular academic programs.

## Course Fees

Some courses may carry fees beyond the standard tuition costs to cover additional support or materials. Program-, subject- and course-specific fee information can be found on the Office of the Bursar website (<https://louisville.edu/bursar/tuitionfee/university-fees/>).

### ME 510. Thermal Design of Internal Combustion Engines 3 Units

**Term Typically Offered:** Fall, Spring, Summer

**Prerequisite(s):** ME 310.

**Description:** Thermodynamics and fluid mechanics of internal combustion engine design. Combustion stoichiometry, thermochemistry, and properties of working fluids. Ideal and real engine cycles. Fluid flow processes, combustion processes, pollutant formation and control. Engine operating characteristics.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

### ME 512. Finite Element Methods for Mechanical Design I 3 Units

**Term Typically Offered:** Occasionally Offered

**Prerequisite(s):** ME 422.

**Description:** Matrix analysis of static and dynamic structural systems and steady-state heat transfer. Computer aided design of trusses, frames, plane stress structures, as well as one- and two-dimensional thermal systems including conduction and convection.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

### ME 513. Energy Conversion 3 Units

**Term Typically Offered:** Fall, Spring, Summer

**Prerequisite(s):** ME 310.

**Description:** A study of nuclear and fossil-fueled steam generators, plus internal combustion prime movers and alternate energy sources. A computerized design project will be required.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

### ME 521. Mechanical Vibrations 3 Units

**Term Typically Offered:** Fall, Spring, Summer

**Prerequisite(s):** ME 422.

**Description:** The theory of vibrating mechanical systems. Modeling of lumped parameter and distributed parameter systems. Free and forced vibration. Damping. Periodic and transient motion. Concept of normal modes. Multiple degree-of-freedom systems. Design applications.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

### ME 523. Intermediate Dynamics 3 Units

**Term Typically Offered:** Fall, Spring, Summer

**Prerequisite(s):** ME 206.

**Description:** Extension of the concepts in introductory dynamics (ME 206) to three dimensional motion. This includes the kinematics of multiple, rotating reference frames, and Newtonian vector mechanics for particles and rigid bodies (Euler's equations). Lagrangian analytical methods. Stability of motion.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

### ME 526. Vehicle Dynamics and Handling 3 Units

**Term Typically Offered:** Fall, Spring, Summer

**Prerequisite(s):** ME 380.

**Description:** Design of passenger and commercial vehicles for optimal dynamic performance with a focus on architecture layout, characterization of critical subsystems, and CAE-based kinematic and kinetic modeling.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

### ME 532. Experimental Stress Analysis 3 Units

**Term Typically Offered:** Fall, Spring, Summer

**Prerequisite(s):** ME 323, ME 414 and ME 415 or graduate standing in Mechanical Engineering.

**Fee:** An additional \$30.00 is charged for this course.

**Description:** Fundamentals of experimental stress analysis. Brittle coating methods, photoelastic coating and electrical strain gage techniques, strain measurements under static and dynamic loading.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

### ME 534. Experimental Vibrations 3 Units

**Term Typically Offered:** Summer Odd Years

**Prerequisite(s):** ME 435.

**Description:** Experimental techniques for identifying the modal parameters of mechanical and structural systems. Review of multiple degree-of-freedom vibration modeling and analysis. Measurement of frequency response functions. Excitation techniques, instrumentation, Fourier analysis and signal processing. Acoustical modal analysis. Experiments on real mechanical and structural systems.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

<b>ME 535. Control System Design</b> <b>Term Typically Offered:</b> Fall, Spring, Summer <b>Prerequisite(s):</b> ME 435. <b>Description:</b> Basic concepts and principles of feedback control systems. Formulation of linear control problems by classical methods. Analysis and synthesis techniques as used in the design of automatic, dynamic control systems. Study of transient and steady state response, use of time and frequency domain concepts. System performance specifications. Design applications. For class offerings for a specific term, refer to the Schedule of Classes ( <a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a> )	<b>3 Units</b>	<b>ME 547. Design Methods</b> <b>Term Typically Offered:</b> Fall Only <b>Prerequisite(s):</b> ME 422. <b>Description:</b> This course uses broad based engineering knowledge to meld equation driven principles with customer and business driven needs/requirements. The product development process is used to design a mechanical or electro-mechanical product. Topics include: concurrent engineering, project management, voice of customer, quality function deployment, concept generation, concept selection, concept embodiment, robust design methods, design failure mode and effects analysis, design validation plan & report design for X, and value/cost analysis. For class offerings for a specific term, refer to the Schedule of Classes ( <a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a> )	<b>3 Units</b>
<b>ME 536. Applied Stress Analysis</b> <b>Description:</b> The course is designed to review basic concepts in structural mechanics, formulate analytical solutions to elastic problems, and understand finite element analysis procedures for mechanical engineering problems. For class offerings for a specific term, refer to the Schedule of Classes ( <a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a> )	<b>3 Units</b>	<b>ME 549. Geometric Dimensioning and Tolerancing</b> <b>Description:</b> Introduction to the terms, rules, symbols, and concepts of GD&T as prescribed in the ASME Y14.5-2009 Standard, plus application of the GD&T. The class includes a comparison of GD&T to coordinate tolerancing; Rules #1 and #2; form and orientation controls; tolerance of position; runout and profile controls. It also introduces measuring using a coordinate measuring machine and PolyWorks For class offerings for a specific term, refer to the Schedule of Classes ( <a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a> )	<b>3 Units</b>
<b>ME 540. Microfluidics</b> <b>Term Typically Offered:</b> Fall Only <b>Description:</b> Introduction to the basic theory and practical applications of microfluidics. Topics include fluid mechanics at small scales, fabrication of microfluidic devices, methods of inducing and controlling flow, and techniques to measure fluid properties. For class offerings for a specific term, refer to the Schedule of Classes ( <a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a> )	<b>3 Units</b>	<b>ME 551. Materials for Additive Manufacturing</b> <b>Description:</b> This course will explore polymeric and particulate materials in the context of processes and applications associated with additive manufacturing, popularly referred to as 3D printing. Metals, ceramics, polymers and composites can all be processed using additive manufacturing technologies. This course will guide students to undertake self-directed studies from popular, commercial and refereed research publications contributing to insights on materials-processing-design interactions in additive manufacturing. For class offerings for a specific term, refer to the Schedule of Classes ( <a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a> )	<b>3 Units</b>
<b>ME 542. Gas Turbines</b> <b>Term Typically Offered:</b> Fall, Spring, Summer <b>Prerequisite(s):</b> ME 310 and ME 401. <b>Description:</b> Theory and design of various types of gas turbine engines used for power and propulsion. Thermodynamic cycle analysis; design basics of turbomachinery, nozzles, diffusers and combustion chambers; engine performance analysis. For class offerings for a specific term, refer to the Schedule of Classes ( <a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a> )	<b>3 Units</b>	<b>ME 553. Design-To-Manufacture Digital Tools</b> <b>Description:</b> Successful product design involves correctly answering three inter-related questions: (1) What does the product look like? (2) What will the product be made out of? (3) How will the product be made? The three considerations based on material properties, component shapes, and processing methods offer many opportunities but impose several constraints that affect decision making in manufacturing. This online course will synthesize the learning from foundational engineering courses in materials, design and manufacturing and enable the student to undertake design challenges using the CES EduPack software to skillfully navigate the material-shape-process space. For class offerings for a specific term, refer to the Schedule of Classes ( <a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a> )	<b>3 Units</b>
<b>ME 544. Design of Fluid Power Systems</b> <b>Term Typically Offered:</b> Fall, Spring, Summer <b>Prerequisite(s):</b> ME 380 and ME 311. <b>Description:</b> Design methodology of hydraulic circuits and fluid power components. Study of rotary/linear actuators, hydrostatic transmissions, temperature control, contamination control, pneumatics, valves, and control components. Applied design projects and laboratory modules are required. For class offerings for a specific term, refer to the Schedule of Classes ( <a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a> )	<b>3 Units</b>		

- ME 555. Introduction to Micro and Nanotechnology** 3 Units  
**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** CHE 253 or equivalent; Senior or Graduate standing in an engineering program.  
**Description:** Design, fabrication and application of micro- and nano-electro-mechanical systems (MEMS/NEMS). Scaling laws governing micro- and nanoscale physics. Use of MEMS/NEMS devices in electronics, as sensors, and for medical applications.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 556. Micro/Nano Energy Systems** 3 Units  
**Prerequisite(s):** ME 310 or Graduate standing.  
**Description:** Introduction to different micro- and nanoscale energy conversion technologies - their basic principle, design considerations, fabrication, and operation. Topics include mechanical energy harvesting mechanisms such as piezoelectric and electrostatic, thermal energy harvesting systems such as thermoelectric and pyroelectric, and solid-state cooling technologies such as electrocaloric and magnetocaloric.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 559. Process Physics & Material Science in Advanced Manufacturing** 3 Units  
**Term Typically Offered:** Spring Only  
**Prerequisite(s):** ME 323 and ME 381.  
**Description:** Materials processing lies at the core of advanced manufacturing. It is through understanding and innovations in materials processing, true progress in manufacturing development can be reached. Topics include mechanical, thermal, electrochemical, acoustic, optical energy-based material processing physics, physical metallurgy, phase transformation, solidification, heat and mass transfer, dislocation mechanics in the context of manufacturing.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 562. Composite Materials** 3 Units  
**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** ME 422.  
**Description:** Overview of composite materials, stress/strain analysis of a polymer matrix fiber-reinforced composite ply, classical lamination theory, failure criteria, design approaches, manufacturing methods, and applications for structural polymeric composites.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 565. Advanced Engineering Mathematics I** 3 Units  
**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** ENGR 201 or ENGR 205 or equivalent.  
**Description:** Formulation and solution of mathematical models for mechanical engineering problems leading to ordinary and partial differential equations. Transform solution methods and linear algebra concepts, including real and complex-domain eigenvalue problem solutions.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 566. Advanced Engineering Mathematics II** 3 Units  
**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** ME 565 or equivalent.  
**Description:** Analysis of engineering systems and phenomena yielding complex domain models and solutions. Power series, Taylor series, and Laurent series. Complex analysis and potential theory. Numerical analysis for complex domain systems. Introduction to optimization and linear programming.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 570. Sustainable Energy Systems** 3 Units  
**Term Typically Offered:** Fall Only  
**Prerequisite(s):** ME 310 and ME 311.  
**Description:** Analysis and design of sustainable energy systems, and exploration of concepts such as carbon capture storage for making fossil energy systems more environmentally acceptable.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 572. Energy Storage Systems** 3 Units  
**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** ME 440 or graduate standing in Mechanical Engineering.  
**Description:** Study of the principles and analysis of energy systems. Introduction to energy storage systems and their applications; thermal and mechanical energy storage, storage of organic fuels, hydrogen, and electrochemical energy.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 573. Electric and Hybrid Vehicles** 3 Units  
**Prerequisite(s):** By course: ME 310.  
**Description:** By topic: Refrigeration and Heat Pump Systems, Reaction Mixture and Combustion, Chemical and Phase Equilibrium. By course: ME440. By topic: Heat Exchanger Design, Forced Convection. Introduction to the knowledge for the design, analysis, and development of electric, hybrid vehicles, and their components. Topics include the operation principle of electric cars, motors and power electronics in an electric car, battery, and relevant charging technologies.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 575. Special Topics in Mechanical Engineering** 1-4 Units  
**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** Faculty consent.  
**Description:** A special topics course in mechanical engineering topics not covered by regularly scheduled courses.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 580. Air Pollution Control** 3 Units  
**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** CHEM 202, ME 310 or equivalent.  
**Description:** Origin and fate of air pollutants, combustion and pollutant formation processes, control of emissions of gaseous and particulate pollutants and design of various pollution control devices.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

- ME 585. Design and Energy Analysis of Consumer Appliances** 4.5 Units  
**Description:** Application of classical, computational, and experimental methods and analysis to the design of mechanical and energy systems. Topics include material impacts on design, structural component design, and design and analysis of thermal fluid, and acoustic systems. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 588. Independent Study in Mechanical Engineering** 1-4 Units  
**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** Faculty consent.  
**Description:** A theoretical or experimental investigation of a problem area related to mechanical engineering. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 595. Measurement, Reliability, and Thermal Design of Electromechanical Systems** 4.5 Units  
**Prerequisite(s):** ME 585.  
**Description:** Application of classical, computational, and experimental methods and analyses to the design of electromechanical systems. Topics include reliability and failure analysis, measurement and control of electromechanical systems, and analysis and design optimization of thermal systems. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 602. Graduate Internship in Mechanical Engineering** 2 Units  
**Grading Basis:** Pass/Fail  
**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** Admission to Graduate Study, Permission of Department Chair, and Permission of Director of Career Services.  
**Description:** Supervised professional experience in industry at the graduate level. This course provides the structure and focus for the graduate intern field assignment to ensure that the assignment is appropriate and consistent with the intern's graduate course of study and professional development. Not to be counted towards meeting the requirements for a degree. May be repeated for credit.  
**Course Attribute(s):** CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 606. Continuum Mechanics** 3 Units  
**Prerequisite(s):** Graduate standing, ME 311 and ME 323.  
**Description:** Emphasizes the basic principles of continuum mechanics and the central role these principles play in the formulation of the fundamental equations of fluids and solid mechanics. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 610. Data Acquisition and Signal Analysis** 3 Units  
**Prerequisite(s):** Graduate/Graduate Professional standing in Mechanical Engineering or instructor permission.  
**Description:** Implementation of PC-based data acquisition systems for dynamic signal analysis. The LabView graphical programming language will be used to design virtual instruments for data collection and signal analysis. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 611. Introduction to Experimental Statistical Design** 3 Units  
**Term Typically Offered:** Summer Only  
**Prerequisite(s):** ME 414.  
**Description:** Experimental Statistical Design based on experimental principles including randomization, replication, blocking, and parametric versus non-parametric assumptions. Associated topics include factorial designs, statistical assumptions, regression and software package use. The course is open to students in Mechanical Engineering graduate programs; but is not open to students with credit for IE 464 or 664.  
**Note:** Students may only receive credit for one of the following: IE 464, IE 664, ME 611, and EM 661.  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 612. Finite Element Methods for Mechanical Design II** 3 Units  
**Prerequisite(s):** ME 512.  
**Description:** Use of general purpose software for practical structural, thermal, and fluid design applications, including nonlinear and transient effects. Advanced modeling techniques, and analysis guideline with emphasis on interpretation of results. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 614. Heating, Ventilating, and Air Conditioning** 3 Units  
**Prerequisite(s):** ME 440.  
**Description:** Psychometric principles. Detailed calculation of heat losses and heat gain for both heating and cooling of buildings. Basic concepts of refrigeration. Design of actual systems and selection of equipment. Automatic controls. Codes and standards. A design project will be required. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 615. Pattern Recognition and Learning Algorithms** 3 Units  
**Description:** In this class students will learn how to use concepts of Machine Learning to identify patterns in related engineering applications. Concepts related to Regression, Classification, Clustering, and Time-Series Forecast will be discussed, alongside topics related to different learning approaches as Supervised Learning, Unsupervised Learning, and Reinforcement Learning. Case studies related to different engineering applications will be presented throughout the course. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)



<p><b>ME 618. Heat Exchanger Design</b> <b>Prerequisite(s):</b> ME 440. <b>Description:</b> Thermal and hydraulic design of heat exchangers. Selection and optimum design of heat exchangers. Cost and construction of heat exchangers. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>	<p><b>ME 635. Advanced Control Systems</b> <b>Term Typically Offered:</b> Fall Even Years <b>Description:</b> Design of modern control systems including state-space realizations and observer design. Introduction to non-linear control systems including phase plane analysis, nonlinear stability analysis, describing functions, feedback linearization and anti-windup compensation. Advanced control methods covered include sliding mode control and adaptive control. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>
<p><b>ME 620. Advanced Mechanics of Solids</b> <b>Prerequisite(s):</b> ME 432 or equivalent. <b>Description:</b> Analysis of stress and strain. Topics include failure theories, unsymmetric bending, curved beams, shear center, torsion, beams on elastic foundations, beams with combined axial and lateral loads, thick-wall cylinders, rotating disc, introduction to elastic stability. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>	<p><b>ME 638. Computational Methods in Fluid Flow and Heat Transfer</b> <b>Prerequisite(s):</b> Graduate School or Professional School Standing. <b>Description:</b> Solutions of the momentum and thermal boundary-layer equations; methods of solving boundary-value problems using digital computers. Finite-difference methods, finite-element methods, and other methods for solving equations of fluid flow and heat transfer. Turbulence models. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>
<p><b>ME 621. Noise and Vibration Control</b> <b>Prerequisite(s):</b> ME 422 and ME 414. <b>Description:</b> Practical aspects of noise and vibration control are studied. Methods for measuring and analyzing noise and vibration. Methods for selecting design criteria. Methods for quieting a product. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>	<p><b>ME 639. Injury Biomechanics</b> <b>Prerequisite(s):</b> ME 649 or BE 354 or equivalent, or permission of the instructor. <b>Description:</b> Application of mechanics to the study of human injury. Response of the human body to injurious conditions. Injury tolerance of the human body. Applications to child abuse, transportation safety and medico-legal environment. <b>Note:</b> Cross-listed with BE 639.  For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>
<p><b>ME 625. Mechanical Design of Internal Combustion Engines</b> <b>Prerequisite(s):</b> ME 310, ME 380, and ME 442, or equivalents. <b>Description:</b> Principles and procedures for the mechanical design of internal combustion engine components and systems for strength, endurance, and optimal performance. Design projects and computer applications are emphasized. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>	<p><b>ME 640. Optimum Design Methods</b> <b>Prerequisite(s):</b> ME 422 or equivalent. <b>Description:</b> Methods and applications of engineering design optimization. Strategies for problem formulation. Transformation methods, search techniques, linearization methods and quadratic approximation methods. Solution evaluation. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>
<p><b>ME 626. Vehicle Body Structure Design</b> <b>Prerequisite(s):</b> ME 380 and ME 442, or equivalent. <b>Description:</b> Principles of structural analysis and design for commercial and passenger vehicle bodies. Body architecture. Fabrication/assembly options. NVH assessment and optimization. Material selection for safety, reliability, cost reduction and weight reduction. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>	<p><b>ME 641. Advanced Mechanics of Machinery</b> <b>Prerequisite(s):</b> ME 442 and ME 521. <b>Description:</b> Machine analysis and design for high speed, high performance applications. Rigid-body kinematics and dynamics of mechanisms, balancing of machinery. Cam-follower mechanisms. Mathematical modeling of mechanisms composed of elastically deformable elements such as gears, bearings, linkages and actuators. Transient and steady-state dynamic response. Failure modes and prevention. A design project is required. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>
<p><b>ME 630. Turbomachinery</b> <b>Prerequisite(s):</b> ME 310 and ME 401. <b>Description:</b> The thermodynamics and fluid mechanics of turbomachinery. Dimensional analysis and performance mapping. Preliminary design procedures. Blading and flow path design. Experimental and theoretical methods for determination of flow losses. Flow field calculations and performance prediction. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>3 Units</b></p>		

<p><b>ME 644. Mechatronics</b> <span style="float: right;"><b>3 Units</b></span>  <b>Fee:</b> An additional \$40.00 is charged for this course.  <b>Description:</b> Introduction to multi-domain systems. Mechanical, electrical, electronic, electromechanical system dynamics. Emphasis on modeling and simulation of hybrid systems using modern computer-aided tools. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>ME 652. Advanced Human Biodynamics</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> ME 651.  <b>Description:</b> Development of techniques for synthesis and analysis of kinematic and kinetic models of human motion, in conjunction with acquisition of biomechanical data associated with functional human movement. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>
<p><b>ME 645. Mechanical Engineering Structured Research Project</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> Graduate/professional school standing.  <b>Description:</b> Structured research in a mechanical engineering discipline. A proposal, activity reports and final report are required. Research results are presented for faculty and peer review, and must also be documented in a scholarly paper targeted toward a journal or technical conference. Intended for candidates for the Master of Engineering degree choosing the non-thesis curriculum alternative. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>ME 661. Advanced Thermodynamics</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> Graduate or Professional school standing.  <b>Description:</b> Review of thermodynamic fundamentals, with application to selected topics. Irreversible, non-equilibrium thermodynamics. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>
<p><b>ME 646. Design for Manufacturability and Reliability</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> ME 442 and IE 360.  <b>Description:</b> Introduction to manufacturing concerns such as efficient assembly, producibility, and quality that should be considered early in the design process. Topics include the product development cycle, manufacturing process selection, tolerancing, design for assembly, quality control techniques, Taguchi's robust design methodology, quality function deployment, value engineering and reliability-based design. Life cycle optimization. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>ME 662. Intermediate Heat Transfer</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> ME 440.  <b>Description:</b> Classical heat conduction solutions and numerical techniques. Intermediate convection and radiative heat transfer topics. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>
<p><b>ME 647. Advanced Design Methods</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> ME 442 and ME 497.  <b>Description:</b> Practical techniques for product definition, concept generation and selection, value analysis, parameter design, design for manufacture, life cycle design and product structuring. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>ME 667. Solar Energy Applications</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> ME 440 Theory of solar radiation transmission, absorption and reflectance.  <b>Description:</b> Heat transfer in solar energy devices. Design methods for heating of buildings by solar energy. Active and passive solar applications. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>
<p><b>ME 650. Biofluid Mechanics</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> ME 401.  <b>Description:</b> Application of the Navier-Stokes equation to flow in the human body and to other biological systems. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>ME 668. Advanced Mechanical Vibrations</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> ME 521.  <b>Description:</b> Analytical and computational methods for mechanical vibration problems. Formulation and solution techniques. Modeling and applications. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>
<p><b>ME 651. Kinematics and Kinetics of Human Movement</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> ME 206.  <b>Description:</b> Development of analytical tools for evaluating three-dimensional kinematics and kinetics of human motion. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>ME 669. Advanced Dynamics</b> <span style="float: right;"><b>3 Units</b></span>  <b>Prerequisite(s):</b> Graduate or Professional school standing.  <b>Description:</b> Kinematics and dynamics of rigid-body motion. An introduction to variational mechanics, including generalized coordinates and Lagrange's equations of motion. Stability of motion, including the Routh-Hurwitz criterion and the Liapounov direct method. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>

- ME 670. Experimental Fluid Mechanics** 3 Units  
**Term Typically Offered:** Occasionally Offered  
**Description:** This course provides a graduate-level introduction to the basic theory and practical application of several important experimental techniques used in fluid dynamics. Topics include techniques for the measurement of material properties, pressure, density, force, fluid velocity, temperature and heat flux. The course will also review applications of measurement techniques for non-Newtonian fluids, hydraulics, microfluids, and other special-case topics. Fundamentals of data processing and data acquisition will be discussed. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 671. Advanced Fluid Mechanics** 3 Units  
**Prerequisite(s):** ME 401.  
**Description:** A study of the Navier-Stokes equation, with application to laminar and turbulent-flow fields for various geometries. Computer applications. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 675. Advanced Topics in Mechanical Engineering** 1-6 Units  
**Prerequisite(s):** Faculty consent.  
**Description:** An advanced course in mechanical engineering topics not covered by regularly scheduled courses. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 683. Additive Manufacturing with Polymers** 3 Units  
**Term Typically Offered:** Spring Only  
**Description:** This course will explore polymer materials used in Additive Manufacturing (AM) in the context of design of new materials, material selection, polymer processing for AM, material selection for AM, and various applications that can be manufactured with polymer AM. This course offers new design tools such as CES and MSC Digimat that are often used by design engineers in AM for material and process selection and process simulation to reduce trial-and-error practices. This course will guide students to undertake self-directed learning from peer reviewed research papers, and popular publications to enable focused learning in a continuously emerging field of AM. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 685. Computational Modeling of Materials** 3 Units  
**Term Typically Offered:** Spring Only  
**Prerequisite(s):** ME 310.  
**Description:** Crystal structures and chemical bonding in solids; Basics of statistical thermodynamics; introduction to different materials modeling techniques at nano-to meso-scopic scales (Molecular Dynamics, Monte-Carlo, and Kinetic Monte-Carlo); atomic-scale modeling of surface diffusion processes, structural, thermal, mechanical, and defect properties; "Hands-on" sessions on designing and executing atomistic simulations using available open-source packages, visualize and analyze output; introduction to emerging techniques like machine learning and materials informatics to design-materials. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 688. Independent Study in Mechanical Engineering** 1-6 Units  
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 690. Master of Science Thesis or Paper in Mechanical Engineering** 1-6 Units  
**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** Graduate standing.  
**Description:** Experimental and/or theoretical research performed under the direction of a faculty member. A written thesis must be presented to a faculty committee and defended, or a paper approved by a faculty committee must be submitted to a peer reviewed journal or conference. Intended for candidates for the Master of Science degree choosing the thesis or paper curriculum alternative. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 694. Mechanical Engineering Seminar** 0 Units  
**Grading Basis:** Pass/Fail  
**Prerequisite(s):** Graduate or Professional school standing.  
**Description:** Presentations on research projects and current literature. Course begins in the fall semester and concludes in the spring semester. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 695. Platform Engineering Project** 3 Units  
**Prerequisite(s):** ME 530, ME 531, and ECE 532.  
**Description:** Major product development project involving a multidisciplinary team working on design and/or research problems associated with consumer appliance technologies. Concurrent topics on project realization and management. A proposal, activity reports and final report are required. Project results are presented for faculty and peer review. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 697. Master of Engineering Thesis or Paper in Mechanical Engineering** 1-6 Units  
**Prerequisite(s):** Graduate or Professional school standing.  
**Description:** Original design or research activity in a mechanical engineering discipline, under the direction of a faculty member. A written thesis must be presented to a faculty committee and defended, or a paper approved by a faculty committee must be submitted to a peer reviewed journal or conference. Intended for candidates for the Master of Engineering degree choosing the thesis or paper curriculum alternative. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- ME 700. Dissertation Research in Mechanical Engineering** 1-18 Units  
**Prerequisite(s):** Completion of doctoral program core and permission of dissertation director.  
**Description:** Original research activity in an appropriate mechanical engineering discipline, under the direction of a Mechanical Engineering graduate faculty member. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)