

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 (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>).

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 (<http://louisville.edu/bursar/tuitionfee>).

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 530. Mechanical Design of Consumer Appliances 3 Units

Term Typically Offered: Fall, Spring, Summer

Description: Application of classical, computational, and experimental methods and analyses to the design of mechanical systems characteristic of consumer appliances. Topics include component analysis and design, failure mechanisms, and organization with respect to life, reliability, performance, and cost.

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

ME 531. Consumer Appliance Energy Systems 3 Units

Term Typically Offered: Fall, Spring, Summer

Description: Analysis and design of energy systems in home appliances. Topics include thermal-fluid process fundamentals, energy transport, storage, use, and conversion, energy system components and materials, and the affect of extreme environments on components and finishes.

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.

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>)

<p>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)</p>	<p>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)</p>
<p>ME 535. Control System Design 3 Units Term Typically Offered: Fall, Spring, Summer Prerequisite(s): ME 435. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)</p>	<p>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)</p>
<p>ME 542. Gas Turbines 3 Units Term Typically Offered: Fall, Spring, Summer Prerequisite(s): ME 310 and ME 401. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)</p>	<p>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)</p>
<p>ME 544. Design of Fluid Power Systems 3 Units Term Typically Offered: Fall, Spring, Summer Prerequisite(s): ME 380 and ME 401. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)</p>	<p>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)</p>
<p>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)</p>	<p>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)</p>

ME 618. Heat Exchanger Design Prerequisite(s): ME 401 and ME 440. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units	ME 635. Advanced Control Systems Term Typically Offered: Fall Even Years Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units
ME 620. Advanced Mechanics of Solids Prerequisite(s): ME 432 or equivalent. Description: 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. Note: Cross-listed with CE 620. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units	ME 638. Computational Methods in Fluid Flow and Heat Transfer Prerequisite(s): Graduate School or Professional School Standing. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units
ME 621. Noise and Vibration Control Prerequisite(s): ME 422 and ME 414. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units	ME 639. Injury Biomechanics Prerequisite(s): ME 649 or BE 354 or equivalent or permission of the instructor. Description: 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. Note: Cross-listed with BE 639. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units
ME 625. Mechanical Design of Internal Combustion Engines Prerequisite(s): ME 310, ME 380, and ME 442, or equivalents. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units	ME 640. Optimum Design Methods Prerequisite(s): ME 422 or equivalent. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units
ME 626. Vehicle Body Structure Design Prerequisite(s): ME 380 and ME 442, or equivalent. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units	ME 641. Advanced Mechanics of Machinery Prerequisite(s): ME 442 and ME 521. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units
ME 630. Turbomachinery Prerequisite(s): ME 310 and ME 401. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units		

ME 644. Mechatronics	3 Units	ME 661. Advanced Thermodynamics	3 Units
Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)		Prerequisite(s): Graduate or Professional school standing. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	
ME 645. Mechanical Engineering Structured Research Project	3 Units	ME 662. Intermediate Heat Transfer	3 Units
Prerequisite(s): Graduate/professional school standing. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)		Prerequisite(s): ME 440. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	
ME 646. Design for Manufacturability and Reliability	3 Units	ME 667. Solar Energy Applications	3 Units
Prerequisite(s): ME 442 and IE 360. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)		Prerequisite(s): ME 401 and ME 440. Description: Theory of solar radiation transmission, absorption and reflectance. 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	
ME 647. Advanced Design Methods	3 Units	ME 668. Advanced Mechanical Vibrations	3 Units
Prerequisite(s): ME 442 and ME 497. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)		Prerequisite(s): ME 521. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	
ME 650. Biofluid Mechanics	3 Units	ME 669. Advanced Dynamics	3 Units
Prerequisite(s): ME 401. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)		Prerequisite(s): Graduate or Professional school standing. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	
ME 651. Kinematics and Kinetics of Human Movement	3 Units	ME 670. Experimental Fluid Mechanics	3 Units
Prerequisite(s): ME 206. Description: 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 (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)		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 652. Advanced Human Biodynamics	3 Units		
Prerequisite(s): ME 651. 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 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 in Mechanical Engineering** 1-6 Units
Description: Experimental and/or theoretical thesis research performed as part of Master of Science degree requirements.
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 in Mechanical Engineering** 1-8 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. Intended for candidates for the Master of Engineering degree choosing the thesis 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>)