

Mechanical Engineering (ME)

Courses

ME A280 Solid Modeling for Engineers 3 Credits

Introduces the use of solid modeling in engineering. Covers the process of creating solid parts, assemblies and fabrication-ready drawings in addition to kinematics linkages. Rapid prototyping technologies such as three-dimensional printing will be used as laboratory exercises.

Registration Restrictions: Admission to the Bachelor of Science in Mechanical Engineering.

Prerequisites: ES A106 with a minimum grade of C or (ENGR A105A with a minimum grade of C and ENGR A105B with a minimum grade of C).

ME A306 Dynamics of Systems 3 Credits

Modeling of mechanical, electrical, fluid and thermal elements and systems. Study of free and forced response by the Laplace transform, transfer function and state space models. Time domain and frequency domain responses. Coupled systems, system analogy, sensing and actuation principles.

Crosslisted With: EE A306

Prerequisites: (EE A203 with a minimum grade of C or concurrent enrollment or ES A309 with a minimum grade of C or concurrent enrollment) and ES A210 with a minimum grade of C and MATH A302 with a minimum grade of C.

ME A308 Instrumentation and Measurement 3 Credits

Principles of measurement, instrumentation, Laplace transform, Fourier series, transfer function, steady-state response, calibration, and errors. Signal filtering and amplification, data acquisition, recording, and processing. Methods and devices for measuring strain, force, torque, displacement, velocity, acceleration, pressure, fluid flow properties, and temperature.

Crosslisted With: EE A308.

Prerequisites: MATH A302 with a minimum grade of C and (EE A306 with a minimum grade of C or ME A306 with a minimum grade of C or EE A353 with a minimum grade of C).

ME A313 Mechanical Engineering Thermodynamics 3 Credits

Continuation of ES A346 (or ES F346), with topics that include power and refrigeration cycles (Rankine, Brayton, Otto, and Diesel), compressible flow (isentropic, shock waves, and flow in ducts with friction), combustion, and gas vapor mixtures.

Prerequisites: ES A346 with a minimum grade of C.

ME A334 Materials Science 3 Credits

Study and investigate the processing, structures, properties and performance of materials including metals, ceramics, polymers, and composites. Materials design and selection for engineering applications.

Prerequisites: CHEM A106 with a minimum grade of C and ME A334L with a minimum grade of C or concurrent enrollment and PHYS A212 with a minimum grade of C.

ME A334L Materials Science Laboratory 1 Credit

Provides laboratory instruction and experience in the structures, processing, properties, and performance of materials.

Prerequisites: ME A334 with a minimum grade of C or concurrent enrollment and WRTG A212 with a minimum grade of C.

ME A403 Machine Design 3 Credits

Design and analysis of machines by analytical, experimental and computer methods. Identification of requirements and conceptual design of mechanical systems, detailed design of components considering strength, life, reliability and cost.

Prerequisites: ES A261 with a minimum grade of C and ES A331 with a minimum grade of C and MATH A302 with a minimum grade of C and ME A280 with a minimum grade of C.

ME A408 Mechanical Vibrations 3 Credits

Modeling of vibratory mechanical systems with single and multiple degrees of freedom. Study of free and forced vibrations with or without damping by lumped-parameter methods and finite element analysis. Vibrations of rotor systems and vibration monitoring.

Special Note: Not available for credit to students who have completed ME A608.

May Be Stacked With: ME A608

Prerequisites: (EE A306 with a minimum grade of C or ME A306 with a minimum grade of C) and ES A331 with a minimum grade of C.

ME A414 Thermal System Design 3 Credits

Introduces the design of power and space conditioning systems, energy conversion, heating, ventilating, air conditioning, refrigeration (HVAC&R), and steady-state simulation of thermal systems.

Prerequisites: ES A341 with a minimum grade of C and ES A346 with a minimum grade of C.

ME A414L Thermal System Design Lab 1 Credit

Provides supplemental explanation and practical exercises applying thermal system design and heating, ventilation and air conditioning (HVAC) concepts including refrigeration systems, psychrometric applications, air handling unit designs, pipe and pump designs, and fan and air distribution designs.

Prerequisites: ES A341 with a minimum grade of C and ES A346 with a minimum grade of C and ME A414 with a minimum grade of C or concurrent enrollment.

ME A415 Composite Materials 3 Credits

This course presents the mechanics and manufacturing of composite materials and their applications. The analysis, design, processing/fabrication, repair, and evaluation of composite materials and structures are considered.

Special Note: Not available for credit to students who have completed ME A615.

May Be Stacked With: ME A615

Prerequisites: ES A331 with a minimum grade of C and ME A280 with a minimum grade of C and ME A403 with a minimum grade of C.

ME A420 Automotive Engineering 3 Credits

Introduces the design and manufacturability of automotive systems including the vehicle powerplant, drivetrain, suspension and frame.

Registration Restrictions: Admission to the Bachelor of Science in Mechanical Engineering

Prerequisites: (EE A306 with a minimum grade of C or ME A306 with a minimum grade of C) and ES A331 with a minimum grade of C and ME A280 with a minimum grade of C.

ME A421 Engineering Finite Element Analysis 3 Credits

Covers the mathematical formulation of the finite element analysis (FEA) method; elemental matrices, nodal loads, assembly, and solution of finite element problems; static, modal, and dynamic solid-mechanics FEA problems; heat transfer, fluid mechanics, and electromagnetic FEA problems; and FEA software: preprocessing, processing, and postprocessing.

Special Note: Not available for credit to students who have completed ME A621. Recommended for students to take MATH A314.

May Be Stacked With: ME A621

Prerequisites: ES A210 with a minimum grade of C and ES A331 with a minimum grade of C and ES A341 with a minimum grade of C and ES A346 with a minimum grade of C.

ME A432 Analytical Dynamics 3 Credits

Kinematics and kinetics of rigid bodies, introduction to analytical mechanics, Lagrange's equations and Hamiltonian mechanics. Applications to engineering problems.

Special Note: Not available for credit to students who have completed ME A632.

Registration Restrictions: Admission to the Bachelor of Science in Mechanical Engineering.

May Be Stacked With: ME A632

Prerequisites: ES A210 with a minimum grade of C and MATH A302 with a minimum grade of C.

ME A434 Materials Selection for Design 3 Credits

Evaluates materials selection early in the design process and the associated design degrees of freedom. Covers procedures to select optimum material(s) under multiple constraints resulting from functional, reliability, safety, cost and environmental issues.

Registration Restrictions: Admission to the Bachelor of Science in Mechanical Engineering

Prerequisites: ES A331 with a minimum grade of C and ME A334 with a minimum grade of C.

ME A438 Design of Mechanical Engineering Systems 3 Credits

Capstone course in which mechanical engineering students design a mechanical engineering component or system starting with the initial design specification to the implementation and testing. Students apply knowledge and skills learned in their undergraduate curriculum.

Registration Restrictions: Student must be in senior year of BSME degree program or obtain faculty permission. Completion of GER Tier 1 (basic college-level skills) courses.

Prerequisites: ME A403 with a minimum grade of C or concurrent enrollment.

Attributes: UAA Integrative Capstone GER.

ME A441 Heat and Mass Transfer 3 Credits

Application of heat and mass transfer concepts to engineering problems including steady state and transient conduction, numerical analysis of heat transfer problems, laminar and turbulent free and forced convection, and black body and real surface radiation.

Prerequisites: ES A341 with a minimum grade of C and ES A346 with a minimum grade of C and MATH A302 with a minimum grade of C.

ME A441L Heat and Mass Transfer Lab 1 Credit

Provides supplemental explanation and practical exercises applying heat and mass transfer concepts to engineering problems including steady state and transient conduction, numerical analysis of heat transfer problems, laminar and turbulent free and forced convection, and black body and real surface radiation.

Prerequisites: ME A441 with a minimum grade of C or concurrent enrollment.

ME A442 Advanced Fluid Mechanics 3 Credits

Covers advanced topics in fluid mechanics, including derivation of flow equations, ideal fluid flows, incompressible viscous flows and compressible inviscid flows.

Special Note: Not available for credit to students who have completed ME A642.

May Be Stacked With: ME A642

Prerequisites: ES A341 with a minimum grade of C and MATH A302 with a minimum grade of C.

ME A451 Aerodynamics 3 Credits

Covers fundamentals of aerodynamics including boundary layer theories, aerodynamics of lifting flow over airfoils, wings of finite span and airfoil theory in subsonic, transonic, and supersonic flows.

Special Note: Not available for credit to students who have completed ME A651.

May Be Stacked With: ME A651

Prerequisites: MATH A302 with a minimum grade of C and ES A341 with a minimum grade of C and ME A313 with a minimum grade of C.

ME A454 Manufacturing Design 3 Credits

Covers the capabilities and limitations of different manufacturing processes in terms of their feasibility, capital needs, economic considerations, and environmental impact. Analyze the steps in processing a part and taking into account the geometrical complexity, process capabilities, surface finish, and tolerances for assembly. Part design for machining, molding, casting, and sheet metal operations. Introduces methods for applied design for manufacturing and assembly.

Registration Restrictions: Admission to the Bachelor of Science in Mechanical Engineering.

Prerequisites: ES A331 with a minimum grade of C and ME A280 with a minimum grade of C and ME A334 with a minimum grade of C.

ME A455 HVAC Systems Optimization 3 Credits

Design of thermal and heating, ventilation, and air-conditioning (HVAC) systems with emphasis on economic considerations and optimization. Concepts of thermodynamics, fluid mechanics and heat transfer will be integrated under a design framework. A semester long project is conducted to design a thermal system, perform system simulations, and to optimize the design based on economic and technical considerations.

Special Note: Not available for credit to students who have completed ME A655.

May Be Stacked With: ME A655

Prerequisites: ES A341 with a minimum grade of C and ES A346 with a minimum grade of C.

ME A456 Renewable Energy Systems Engineering 3 Credits

The study and design of renewable energy systems from a technical engineering standpoint. Solar, hydrokinetic, conventional hydroelectric, wind, geothermal, and biological energy systems will be examined. Additional topics include feasibility analysis and energy storage techniques.

Special Note: Not available for credit to students who have completed ME A656.

May Be Stacked With: ME A656

Prerequisites: ES A341 with a minimum grade of C and ES A346 with a minimum grade of C.

ME A459 Fracture Mechanics 3 Credits

Presents theoretical, experimental, and applied fracture of solids, structures, and machines, subcritical crack growth including fatigue, creep, and corrosion, embrittlement, safety, and life cycle design and analysis. Uses studies to illustrate the course topics.

Special Note: Not available for credit to students who have completed ME A659.

Registration Restrictions: Admission to the Bachelor of Science in Mechanical Engineering

May Be Stacked With: ME A659

Prerequisites: ES A331 with a minimum grade of C.

ME A460 Turbomachinery 3 Credits

Introduces the application of energy, momentum and continuity equations to designing turbomachinery such as pumps, compressors and turbines.

Special Note: Not available for credit to students who have completed ME A660.

May Be Stacked With: ME A660

Prerequisites: ES A341 with a minimum grade of C and ES A341L with a minimum grade of C and ME A313 with a minimum grade of C.

ME A471 Automatic Control 3 Credits

Linear system representation by transfer functions, signal flow graphics and state equations. Feedback, time and frequency response of linear systems. Stability analysis by Routh-Hurwitz criterion and frequency domain methods. Specifications of higher order linear systems. System design and compensation.

Crosslisted With: EE A471.

Prerequisites: (EE A306 with a minimum grade of C or ME A306 with a minimum grade of C or EE A353 with a minimum grade of C) and ES A210 with a minimum grade of C and MATH A302 with a minimum grade of C.

ME A494J Nonlinear Control 3 Credits

Introduction to nonlinear phenomena, multiple equilibria, bifurcations, complex dynamical behavior, limit cycles, and stability analysis of linear systems via Lyapunov's stability theorem. Covers stabilization, sliding mode control, and model reference adaptive control.

Special Note: Not available for credit to students who have completed ME A694J.

May Be Stacked With: ME A694J

Prerequisites: EE A471 with a minimum grade of C or ME A471 with a minimum grade of C.

ME A608 Mechanical Vibrations 3 Credits

Modeling of vibratory mechanical systems with single and multiple degrees of freedom. Study of free and forced vibrations with or without damping by lumped-parameter methods and finite element analysis. Vibrations of rotor systems and vibration monitoring.

Special Note: Not available for credit to students who have completed ME A408.

Registration Restrictions: Graduate standing or instructor permission.

May Be Stacked With: ME A408

ME A610 Biomechanics 3 Credits

Applies the principles of mechanics to biological systems with an emphasis on the human body. Both analytical mathematical modeling and experimental approaches are explored.

Registration Restrictions: Graduate standing or instructor permission

ME A615 Composite Materials 3 Credits

This course presents the mechanics and manufacturing of composite materials and their applications. The analysis, design, processing/fabrication, repair, and evaluation of composite materials and structures are considered.

Special Note: Not available for credit to students who have completed ME A415.

Registration Restrictions: Graduate standing or instructor permission.

May Be Stacked With: ME A415

ME A621 Engineering Finite Element Analysis 3 Credits

Covers the mathematical formulation of the finite element analysis (FEA) method; elemental matrices, nodal loads, assembly, and solution of finite element problems; static, modal and dynamic solid-mechanics FEA problems; heat transfer, fluid mechanics, and electromagnetic FEA problems; and FEA software: preprocessing, processing, and postprocessing.

Special Note: Not available for credit to students who have completed ME A421.

Registration Restrictions: Graduate standing or instructor approval

May Be Stacked With: ME A421

ME A630 Advanced Mechanics of Materials 3 Credits

Theory of stress and strain, stress-strain-temperature relations, equilibrium, and energy methods and their application to the torsion of shafts, bending of straight and curved beams, beams on elastic foundations, thin and thick walled cylinders, elastic and inelastic stability of columns, plates and shells, stress concentrations, creep, and contact stresses.

Registration Restrictions: Graduate standing and instructor permission

ME A632 Analytical Dynamics 3 Credits

Topics include kinematics and kinetics of rigid bodies, introduction to analytical mechanics, Lagrange's equations and Hamiltonian mechanics. Students will engage with applications to engineering problems.

Special Note: Not available for credit to students who have completed ME A432. Additional work is required at the graduate level.

Registration Restrictions: Graduate standing or instructor approval

May Be Stacked With: ME A432

ME A642 Advanced Fluid Mechanics 3 Credits

Advanced topics in fluid mechanics, including derivation of flow equations, ideal fluid flows, incompressible viscous flows and compressible inviscid flows.

Special Note: Not available for credit to students who have completed ME A442.

Registration Restrictions: Graduate standing or instructor permission.

May Be Stacked With: ME A442

ME A651 Aerodynamics 3 Credits

Fundamentals of aerodynamics including boundary layer theories, aerodynamics of lifting flow over airfoils, wings of finite span and airfoil theory in subsonic, transonic, and supersonic flows. Literature review and research on selected aerodynamics topics.

Special Note: Not available for credit to students who have completed ME A451.

Registration Restrictions: Graduate standing or instructor permission.

May Be Stacked With: ME A451

ME A655 HVAC Systems Optimization 3 Credits

Design of thermal and heating, ventilation, and air-conditioning (HVAC) systems with emphasis on economic considerations and optimization. Concepts of thermodynamics, fluid mechanics and heat transfer will be integrated under a design framework. A semester long project is conducted to design a thermal system, perform system simulations, and to optimize the design based on economic and technical considerations.

Special Note: Not available for credit to students who have completed ME A455.

Registration Restrictions: Graduate standing or instructor permission.

May Be Stacked With: ME A455

ME A656 Renewable Energy Systems Engineering 3 Credits

The study and design of renewable energy systems from a technical engineering standpoint. Solar, hydrokinetic, conventional hydroelectric, wind, geothermal, and biological energy systems will be examined. Additional topics include feasibility analysis and energy storage techniques.

Special Note: Not available for credit to students who have completed ME A456. ME A656 includes additional reviews of articles and a written report.

Registration Restrictions: Graduate standing or instructor approval

May Be Stacked With: ME A456

ME A659 Fracture Mechanics 3 Credits

Presents theoretical, experimental, and applied fracture of solids, structures, and machines, subcritical crack growth including fatigue, creep, and corrosion, embrittlement, safety, and life cycle design and analysis. Case studies are used to illustrate the course topics.

Special Note: Not available for credit to students who have completed ME A459. Additional work is required at the graduate level.

Registration Restrictions: Graduate standing or instructor approval

May Be Stacked With: ME A459

ME A660 Turbomachinery 3 Credits

Introduces the application of energy, momentum and continuity equations to designing turbomachinery, such as pumps, compressors and turbines.

Special Note: Not available for credit to students who have completed ME A460.

Registration Restrictions: Graduate standing or instructor permission

May Be Stacked With: ME A460

ME A664 Corrosion Processes and Engineering 3 Credits

The study of different corrosion processes and mechanisms. Topics include the concepts, materials, and mechanisms of corrosion with application to engineering design for corrosion prevention.

Registration Restrictions: Prerequisite and graduate standing, or faculty permission.

Prerequisites: ES A346.

ME A672 Advanced Linear Systems 3 Credits

Presents a state space linear algebra approach to multiple input, multiple output systems. Concepts of controllability and observability motivate design techniques for optimal open loop and closed loop systems. Analysis and design of optimal feedback control systems and design of observers and estimators are presented.

Special Note: Not available for credit to students who have completed EE A472.

Registration Restrictions: Graduate standing or instructor permission

May Be Stacked With: EE A472

ME A686 Project 3 Credits

Project arranged among the advisor, graduate advisory committee and student to solve a practical engineering problem.

Registration Restrictions: Graduate standing and instructor permission

ME A694J Nonlinear Control 3 Credits

Introduction to nonlinear phenomena, multiple equilibria, bifurcations, complex dynamical behavior, limit cycles, and stability analysis of linear systems via Lyapunov's stability theorem. Covers stabilization, sliding mode control, and model reference adaptive control.

Special Note: Not available for credit to students who have completed ME A494J.

May Be Stacked With: ME A494J

ME A699 Thesis 1-6 Credits

Individual study of an advanced engineering problem resulting in a thesis.

Registration Restrictions: Graduate standing and instructor permission