MECHANICAL ENGINEERING (ME)

ME LDEA, LOWER DIVISION ED ABROAD, 0-16 Credits

This course is repeatable for 99 credits.

ME UDEA, UPPER DIVISION ED ABROAD, 0-16 Credits

This course is repeatable for 99 credits.

ME 203, COMPUTATIONAL METHODS FOR ENGINEERING, 3 Credits

Introduces computational methods to solve engineering problems. Translates fundamental mathematical and engineering concepts into data structures and algorithms; extends and solidifies fundamental computational skills for effective and efficient practice. Develops skills for effective visualization of data.
Prerequisite: (ENGR 103 with C or better or ENGR 103H with C or better) and (MTH 254 [C] or MTH 254H [C])
Available via Ecampus

ME 206, PROJECTS, 1-16 Credits

This course is repeatable for 16 credits.

ME 217, MECHANICAL ENGINEERING DYNAMICS, 4 Credits

Introduces and applies concepts of kinematics and kinetics of particles and rigid bodies, with applications to mechanical systems of current interest to engineers.
Prerequisite: (ENGR 103 with C or better or ENGR 103H with C or better) and (ENGR 211 [C] or ENGR 211H [C]) and (PH 211 [C] or PH 211H [C])
Available via Ecampus

ME 299, SPECIAL TOPICS, 1-16 Credits

Equivalent to: ME 299H
This course is repeatable for 16 credits.

ME 299H, SPECIAL STUDIES, 1-16 Credits

Attributes: HNRS – Honors Course Designator
Equivalent to: ME 299
This course is repeatable for 16 credits.

ME 306, PROJECTS, 1-16 Credits

This course is repeatable for 16 credits.

ME 310, INTRODUCTION TO THERMODYNAMICS, 4 Credits

Introduces basic concepts of thermodynamics, by applying the first and second laws of thermodynamics. Solves engineering problems involving closed and open systems, as well as basic power and refrigeration cycles. CROSSLISTED as ME 310/NSE 310.
Prerequisite: (MTH 256 with C or better or MTH 256H with C or better) and (ENGR 212 [C] or ENGR 212H [C] or ME 217 [C] or NSE 235 [C])
Equivalent to: NSE 310
Available via Ecampus

ME 316, MECHANICS OF MATERIALS, 3 Credits

Determination of stresses, deflections, and stability of deformable bodies with an introduction to finite element analysis.
Prerequisite: (ENGR 213 with C or better or ENGR 213H with C or better) and (MTH 256 [C] or MTH 256H [C])
Available via Ecampus

ME 320, SYSTEMS DYNAMICS AND CONTROL, 4 Credits

Models and analyzes linear continuous systems in time and frequency domains. Introduces fundamentals of single-input-single-output control system design. CROSSLISTED as ECE 356/ME 320.
Prerequisite: (ME 217 with C or better or ME 317 with C or better or ME 317H with C or better) or (ECE 351 with C or better and ECE 352 [C] and (ENGR 212 [C] or ENGR 212H [C]))
Equivalent to: ECE 356, ECE 451, ME 320H, ME 430, ME 430H
Available via Ecampus

ME 320H, SYSTEMS DYNAMICS AND CONTROL, 4 Credits

Models and analyzes linear continuous systems in time and frequency domains. Introduces fundamentals of single-input-single-output control system design. CROSSLISTED as ECE 356/ME 320.
Attributes: HNRS – Honors Course Designator
Prerequisite: (ME 217 with C or better or ME 317 with C or better or ME 317H with C or better) or (ECE 351 with C or better and ECE 352 [C] and (ENGR 212 [C] or ENGR 212H [C]))
Equivalent to: ECE 356, ECE 451, ME 320, ME 430, ME 430H

ME 330, INTRODUCTION TO FLUID MECHANICS AND HEAT TRANSFER, 4 Credits

Introduces basic concepts of fluid dynamics and heat transfer. Applies conservation equations and dimensional analysis to solve engineering problems relevant to incompressible pipe systems and external flows, as well as conductive, convective, and radiative heat transfer. CROSSLISTED as ME 330/NSE 330.
Prerequisite: ME 310 with C or better or NSE 310 with C or better
Equivalent to: ME 330H, NSE 330
Available via Ecampus

ME 330H, INTRODUCTION TO FLUID MECHANICS AND HEAT TRANSFER, 4 Credits

Introduces basic concepts of fluid dynamics and heat transfer. Applies conservation equations and dimensional analysis to solve engineering problems relevant to incompressible pipe systems and external flows, as well as conductive, convective, and radiative heat transfer. CROSSLISTED as ME 330/NSE 330.
Attributes: HNRS – Honors Course Designator
Prerequisite: ME 310 with C or better or NSE 310 with C or better
Equivalent to: ME 330, NSE 330

ME 331, FLUID MECHANICS, 4 Credits

Introduces the concepts and applications of fluid mechanics and dimensional analysis with an emphasis on fluid behavior, internal and external flows, analysis of engineering applications of incompressible pipe systems, and external aerodynamics. CROSSLISTED as ME 331/NSE 331.
Prerequisite: ME 330 with C or better or ME 330H with C or better or NSE 330 with C or better
Equivalent to: ME 331H, NSE 331, NSE 331H

ME 331H, FLUID MECHANICS, 4 Credits

Introduces the concepts and applications of fluid mechanics and dimensional analysis with an emphasis on fluid behavior, internal and external flows, analysis of engineering applications of incompressible pipe systems, and external aerodynamics. CROSSLISTED as ME 331/NSE 331.
Attributes: HNRS – Honors Course Designator
Prerequisite: ME 330 with C or better or ME 330H with C or better or NSE 330 with C or better
Equivalent to: ME 331, NSE 331, NSE 331H

ME 332, HEAT TRANSFER, 4 Credits

Analyzes conductive, convective and radiative energy transfer using control volume and differential analysis and prediction of transport properties.
Prerequisite: ME 330 with C or better or ME 330H with C or better or NSE 330 with C or better
Equivalent to: ME 332H, NSE 332, NSE 332H

ME 332H, HEAT TRANSFER, 4 Credits

Analyzes conductive, convective and radiative energy transfer using control volume and differential analysis and prediction of transport properties.
Attributes: HNRS – Honors Course Designator
Prerequisite: ME 330 with C or better or ME 330H with C or better or NSE 330 with C or better
Equivalent to: ME 332, NSE 332, NSE 332H

ME 333, THERMODYNAMICS II, 4 Credits

Analyzes advanced power and refrigeration cycles, exergy destruction during steady and transient processes, compressible flow processes and systems with inert and reactive gas mixtures.
Prerequisite: ME 310 with C or better or NSE 310 with C or better

ME 351, INTRODUCTION TO INSTRUMENTATION AND MEASUREMENT SYSTEMS, 4 Credits

Illustrates the function, operation, and application of common mechanical engineering instruments, measurement principles, and statistical analysis. Demonstrates elements of measurement systems, including transduction, signal conditioning, and data recording. Examines function and operation of digital data acquisition systems.
Prerequisite: ME 217 with C or better and (ENGR 202 [C] or ENGR 202H [C]) and (ENGR 213 [C] or ENGR 213H [C])
Equivalent to: ME 451
Available via Ecampus

ME 373, MECHANICAL ENGINEERING METHODS, 4 Credits

Explores analytical and numerical methods for solving representative mechanical engineering problems.
Prerequisite: (ENGR 103 with C or better or ENGR 103H with C or better or ENGR 112 with C or better or ENGR 112H with C or better) and (MTH 256 [C] or MTH 256H [C]) and MTH 341 [C] and ME 203 [C]
Equivalent to: ME 373H
Available via Ecampus

ME 373H, MECHANICAL ENGINEERING METHODS, 4 Credits

Explores analytical and numerical methods for solving representative mechanical engineering problems.
Attributes: HNRS – Honors Course Designator
Prerequisite: (ENGR 103 with C or better or ENGR 103H with C or better or ENGR 112 with C or better or ENGR 112H with C or better) and (MTH 256 [C] or MTH 256H [C]) and MTH 341 [C] and ME 203 [C]
Equivalent to: ME 373

ME 382, INTRODUCTION TO DESIGN, 4 Credits

Applies organization, planning, economics, and the use of creativity and optimization in solving mechanical design problems. Case studies and/or industrial design problems.
Prerequisite: ENGR 213 with C or better and ENGR 248 [C] and ME 217 [C]
Equivalent to: ME 382H
Available via Ecampus

ME 382H, INTRODUCTION TO DESIGN, 4 Credits

Applies organization, planning, economics, and the use of creativity and optimization in solving mechanical design problems. Case studies and/or industrial design problems.
Attributes: HNRS – Honors Course Designator
Prerequisite: ENGR 213 with C or better and ENGR 248 [C] and ME 217 [C]
Equivalent to: ME 382

ME 383, MECHANICAL COMPONENT DESIGN, 4 Credits

Explores machine design, including systems, machine elements, and components. Details the steps in taking applied loads, changing them to stresses, and producing predictions and likelihood of failure. Investigates how specific components behave and how they should be sized to meet design goals. Investigates mechanical systems to identify where failure is likely to occur and how to redesign components to avoid failure.
Prerequisite: ENGR 213 with C or better and ME 217 [C] and ME 316 [C]
Equivalent to: ME 383H
Available via Ecampus

ME 383H, MECHANICAL COMPONENT DESIGN, 4 Credits

Explores machine design, including systems, machine elements, and components. Details the steps in taking applied loads, changing them to stresses, and producing predictions and likelihood of failure. Investigates how specific components behave and how they should be sized to meet design goals. Investigates mechanical systems to identify where failure is likely to occur and how to redesign components to avoid failure.
Attributes: HNRS – Honors Course Designator
Prerequisite: ENGR 213 with C or better and ME 217 [C] and ME 316 [C]
Equivalent to: ME 383

ME 401, RESEARCH, 1-9 Credits

This course is repeatable for 9 credits.

ME 403, THESIS, 1-16 Credits

This course is repeatable for 16 credits.

ME 405, READING AND CONFERENCE, 1-9 Credits

Equivalent to: ME 405H
This course is repeatable for 9 credits.

ME 405H, READING AND CONFERENCE, 1-9 Credits

Attributes: HNRS – Honors Course Designator
Equivalent to: ME 405
This course is repeatable for 9 credits.

ME 406, PROJECTS, 1-15 Credits

This course is repeatable for 15 credits.

ME 407, SEMINAR, 1-2 Credits

Senior seminar; may be repeated two times for 2 credits.
This course is repeatable for 2 credits.

ME 410, INTERNSHIP, 1-16 Credits

This course is repeatable for 16 credits.

ME 412, DESIGN OF MECHANISMS, 4 Credits

Explores the study of mechanical linkages or mechanisms. Categorizes and systematically dissects existing mechanisms to understand the function and behavior of complete devices as well as function and behavior of individual links and joints in a mechanism. Builds upon the knowledge of kinematic analysis of position, velocity, acceleration, and jerk in the context of planar and non-planar mechanisms. Discusses the synthesis of such mechanisms as well as best practices in creating new mechanisms. Uses computation to fully understand and design intended mechanical movements.
Prerequisite: ME 217 with C or better and (ME 383 [C] or ME 383H [C])

ME 414, DESIGN FOR MANUFACTURING, 4 Credits

Provides a project-based design experience that advances understanding of real-world product design, through aligning the mechanical design process with relevant engineering materials and manufacturing knowledge. Discusses common material properties and selection criteria, manufacturing processes and design considerations for manufacturing processes, design for advanced manufacturing, and DIY fabrication methods. Employs professional engineering communication skills, including product documentation, memo-writing, report writing, and video presentations.
Prerequisite: ME 382 with C or better or ME 382H with C or better

ME 420, APPLIED STRESS ANALYSIS, 4 Credits

Elasticity theory, failure theories, energy methods, finite element analysis.
Prerequisite: ME 316 with C or better

ME 422, MECHANICAL VIBRATIONS, 4 Credits

Analyzes and models the dynamic responses of single and multiple degree-of-freedom systems.
Prerequisite: ME 217 with C or better
Equivalent to: ME 422H

ME 422H, MECHANICAL VIBRATIONS, 4 Credits

Analyzes and models the dynamic responses of single and multiple degree-of-freedom systems.
Attributes: HNRS – Honors Course Designator
Prerequisite: ME 217 with C or better
Equivalent to: ME 422

ME 424, FINITE ELEMENT ANALYSIS OF MECHANICAL COMPONENTS, 4 Credits

Applies modern Finite Element Analysis (FEA) software to the design of mechanical components, and development of the underlying theoretical and computational approach.
Prerequisite: ME 316 with C or better and MTH 341 [C]
Available via Ecampus

ME 444, THERMAL SYSTEMS DESIGN AND ANALYSIS, 4 Credits

Integration of the concepts, laws, and methodologies from fluid mechanics, heat transfer, and thermodynamics, into a set of practical tools for thermal energy systems design and analysis.
Prerequisite: (ME 332 with C or better or ME 332H with C or better or NSE 332 with C or better or NSE 332H with C or better) and (ME 312 (may be taken concurrently) [C] or ME 312H (may be taken concurrently) [C] or NSE 312 (may be taken concurrently) [C] or NSE 312H (may be taken concurrently) [C])

ME 445, INTRODUCTION TO COMBUSTION, 4 Credits

Studies combustion science based on the background of chemistry, thermodynamics, fluid dynamics, mass transfer, and heat transfer. Introduces concepts including stoichiometry, energetics of chemical reactions, flame temperature, equilibrium product analyses, chemical kinetics, and chain reactions.
Prerequisite: ME 330 with C or better or ME 330H with C or better or NSE 330 with C or better

ME 450, APPLIED HEAT TRANSFER, 4 Credits

An intermediate heat transfer course seeking to lay a foundation for determining the heating and cooling characteristics with a variety of modern and classical processes. Included is design of multi-component heat transfer systems.
Prerequisite: ME 332 with C or better or ME 332H with C or better or NSE 332 with C or better or NSE 332H with C or better

ME 452, THERMAL AND FLUIDS SCIENCES LABORATORY, 4 Credits

Analyzes experiments related to thermodynamics, heat transfer, and fluid mechanics. Focuses on proper experimental methods and data and discusses uncertainty analysis related to thermal and fluids measurements.
Prerequisite: ME 330 with C or better or ME 330H with C or better or NSE 330 with C or better
Equivalent to: ME 452H

ME 452H, THERMAL AND FLUIDS SCIENCES LABORATORY, 4 Credits

Analyzes experiments related to thermodynamics, heat transfer, and fluid mechanics. Focuses on proper experimental methods and data and discusses uncertainty analysis related to thermal and fluids measurements.
Attributes: HNRS – Honors Course Designator
Prerequisite: ME 330 with C or better or ME 330H with C or better or NSE 330 with C or better
Equivalent to: ME 452

ME 453, STRUCTURE AND MECHANICS LABORATORY, 4 Credits

Techniques for measurement of structural response and material properties. Proper use of rosette strain gauges, load cells, and displacement transducers. Full-field strain measurement using photoelasticity and digital image correlation. Proper implementation of material testing standards. Characterization of anisotropic composite materials.
Prerequisite: ME 351 with C or better or ME 451 with C or better

ME 460, INTERMEDIATE FLUID MECHANICS, 4 Credits

Focuses on the study of ideal fluid flow as applied to aerodynamics and external flows; thin airfoil theory, panel method and blade element method.
Prerequisite: ME 331 with C or better or ME 331H with C or better or NSE 331 with C or better or NSE 331H with C or better

ME 461, GAS DYNAMICS, 4 Credits

Studies idealized compressible flows, including in nozzles and diffusers, as well as shocks/expansion waves and their interactions. Introduces supersonic flight and propulsion systems.
Prerequisite: (ME 310 with C or better or NSE 310 with C or better) and (ME 330 [C] or ME 330H [C] or NSE 330 [C]) and (ME 373 [C] or ME 373H [C] or NSE 233 [C])
Recommended: ME 312

ME 480, MATERIALS SELECTION, 4 Credits

Develops and applies a formalized approach to materials selection within the engineering design process. Examines property definitions, measurements, and trends among the major materials families. Configures and uses property comparison charts derived from a comprehensive materials database. Identifies active design constraints and trade-space approaches to conflicting design objectives. Evaluates materials selection case studies, and application of concepts to student-defined projects with an emphasis on balancing sustainability metrics against traditional performance criteria and dollar costs.
Prerequisite: MATS 321 with C or better or MATS 321H with C or better or NSE 321 with C or better

ME 483, MECHANICS OF COMPOSITE MATERIALS, 4 Credits

Review of applied stress analysis in isotropic materials. Analyze anisotropic materials, fibers and matrices, mechanics of composites including properties and applications, principles of composites manufacturing, experimental characterization of composites, composites light-structures.
Prerequisite: ME 316 with C or better

ME 484, FRACTURE OF MATERIALS, 3 Credits

Fracture mechanics and fatigue mechanisms: mechanisms of ductile and brittle fracture. Environmentally induced fracture and fatigue. Considerations in design of engineering materials and structures will be discussed.
Prerequisite: MATS 322 with C or better or ENGR 322 with C or better

ME 499, SPECIAL TOPICS, 0-16 Credits

Equivalent to: ME 499H
This course is repeatable for 16 credits.
Available via Ecampus

ME 499H, SPECIAL TOPICS, 0-16 Credits

Attributes: HNRS – Honors Course Designator
Equivalent to: ME 499
This course is repeatable for 16 credits.

ME 501, RESEARCH, 1-16 Credits

This course is repeatable for 16 credits.

ME 502, INDEPENDENT STUDIES, 1-16 Credits

This course is repeatable for 16 credits.

ME 503, THESIS, 1-16 Credits

This course is repeatable for 999 credits.

ME 505, READING AND CONFERENCE, 1-16 Credits

This course is repeatable for 16 credits.

ME 506, PROJECTS, 1-16 Credits

This course is repeatable for 99 credits.

ME 507, SEMINAR, 1-16 Credits

This course is repeatable for 16 credits.

ME 512, DESIGN OF MECHANISMS, 4 Credits

Explores the study of mechanical linkages or mechanisms. Categorizes and systematically dissects existing mechanisms to understand the function and behavior of complete devices as well as function and behavior of individual links and joints in a mechanism. Builds upon the knowledge of kinematic analysis of position, velocity, acceleration, and jerk in the context of planar and non-planar mechanisms. Discusses the synthesis of such mechanisms as well as best practices in creating new mechanisms. Uses computation to fully understand and design intended mechanical movements.
Recommended: ME 217 and ME 383

ME 513, BIO-INSPIRED DESIGN, 4 Credits

Intersection of design and biology that seeks to systematically mine biological knowledge to solve design problems. Investigates inspiration from nature from three different types: visual, conceptual, and computational. Includes design rules, heuristics, principles or patterns to solve engineering problems. Algorithmic bio-inspiration emulates natural algorithms for control or optimization problems.

ME 516, MODELING AND ANALYSIS OF COMPLEX SYSTEMS, 4 Credits

Introduction to challenges and considerations when designing complex systems. Fundamentals of systems engineering and methods used in practice. Models and tools used to enable the use of models for trade studies during the design of complex systems. Model-based design environments and methodologies. Introduction to decision support tools in design.

ME 517, OPTIMIZATION IN DESIGN, 4 Credits

Optimization methods as applied to engineering design, theory and application of nonlinear optimization techniques for multivariate unconstrained and constrained problems. Model boundedness and sensitivity.

ME 518, COMPUTATIONAL SOLID MODELING, 4 Credits

Explores the computational representation of three-dimensional objects found in Computer-Aided Design, Computer-Aided Manufacturing, Computer-Aided Engineering software tools which are now necessary tools in the engineering design process. Introduces students to algorithms and data structures used to create, manipulate, and reason about solids. Acquiring the knowledge of such methods facilitates the use and development of tools for analyzing, designing, and manufacturing existing and future technological artifacts.
Recommended: Good standing. Strong foundations in computer programming. Previous course experiences beyond Matlab and Excel programming (e.g. experience with Python, C#, or Julia)

ME 520, APPLIED STRESS ANALYSIS, 4 Credits

Elasticity theory, failure theories, energy methods, finite element analysis.
Recommended: ME 316

ME 521, LINEAR ELASTICITY, 4 Credits

A general introduction to the theory of elasticity. The solution of 2-D problems using the Airy stress function in rectangular and polar coordinates. The solution of 3-D problems using the Galerkin vector, the Papkovich-Neuber solution, and complex variable methods. Applications to asymptotic fields at discontinuities, contact and crack problems, and thermoelasticity.
Recommended: ME 316

ME 522, MECHANICAL VIBRATIONS, 4 Credits

Analyzes and models the dynamic responses of single and multiple degree-of-freedom systems.

ME 523, ADVANCED STRESS ANALYSIS, 4 Credits

An introduction to the mechanics of nonlinear elastic, plastic, and viscoelastic material behavior including large deformations.
Recommended: ME 316

ME 526, NUMERICAL METHODS FOR ENGINEERING ANALYSIS, 3 Credits

Numerical solutions of linear equations, difference equations, ordinary and partial differential equations. CROSSLISTED as ME 526/NSE 526.
Equivalent to: NSE 526
Recommended: Programming experience and previous exposure to numerical methods

ME 531, LINEAR MULTIVARIABLE CONTROL SYSTEMS I, 4 Credits

Theoretical design of control systems for systems modeled by linear multivariable differential equations. Topics covered include controllability, observability, state feedback control, pole placement, output feedback, estimator design, and control designs that include both estimators and regulators.

ME 533, NONLINEAR DYNAMIC ANALYSIS, 4 Credits

Course focuses on understanding the behavior of nonlinear dynamic systems of interest to mechanical engineers.
Recommended: ME 317

ME 540, INTERMEDIATE THERMODYNAMICS, 4 Credits

Applies fundamentals of classical thermodynamics to analyze steady-state and transient problems, including phase and chemical equilibrium. Uses computational tools to solve real-world problems. Interprets classical thermodynamics concepts using statistical thermodynamics models.
Recommended: ME 312/NSE 312

ME 541, LIQUID-VAPOR PHASE CHANGE AND HEAT TRANSFER, 4 Credits

Advanced treatment of underlying physics and engineering modeling approaches for heat transfer associated with vapor/liquid phase change processes. Topics include thermodynamics and mechanical aspects of phase change processes, pool boiling, filmwise and dropwise condensation, internal convective boiling and condensation, and other emerging areas in phase change heat transfer.

ME 545, INTRODUCTION TO COMBUSTION, 4 Credits

Studies combustion science based on the background of chemistry, thermodynamics, fluid dynamics, mass transfer, and heat transfer. Introduces concepts including stoichiometry, energetics of chemical reactions, flame temperature, equilibrium product analyses, chemical kinetics, and chain reactions.
Recommended: ME 330

ME 546, CONVECTION HEAT TRANSFER, 3 Credits

An advanced treatment of forced and natural convection heat transfer processes emphasizing underlying physical phenomena. Current topical literature will be considered; analytical and numerical problem solving is included.
Recommended: ME 332 and ME 373

ME 549, SELECTED TOPICS IN HEAT TRANSFER, 3 Credits

Topics in heat transfer including advanced problems in conduction, radiation, and convection. Additional examination of heat transfer in multiphase systems, inverse problems, combined modes, equipment design, solution techniques and other topics of current interest considered, including extensive use of current literature. Not all topics covered each year.
This course is repeatable for 9 credits.

ME 550, APPLIED HEAT TRANSFER, 4 Credits

An intermediate heat transfer course seeking to lay a foundation for determining the heating and cooling characteristics with a variety of modern and classical processes. Included is design of multi-component heat transfer systems.
Recommended: ME 332 or NSE 332

ME 552, MEASUREMENTS IN FLUID MECHANICS AND HEAT TRANSFER, 4 Credits

Course emphasis is on measurement techniques and data analysis methods related to fluid mechanics and heat transfer. Proper experimental methods, data and uncertainty analyses related to thermal and fluids measurements are discussed. Local and spatial mapping of fluid and thermal fields are highlighted.
Recommended: ME 331 and ME 332 and ME 351

ME 553, METHODS AND APPLICATIONS OF DIGITAL IMAGE CORRELATION, 4 Credits

Explores methods and applications of digital image correlation in solid mechanics and materials science in depth. Examines selection, configuration, and calibration of optical systems for high-precision stereo (3D) imaging as well as theoretical context for and computational implementation of data processing workflows from raw images to mechanical stress. Uses digital image correlation data for quantitative validation of analytical and numerical (FEA) mechanics models, and characterization of failure and fracture mechanisms. Discusses nonlinear optimization methods for material property and boundary condition identification.
Recommended: Introductory preparation in linear algebra, mechanics, and MATLAB/Python

ME 560, ADVANCED FLUID FLOW, 4 Credits

Examines the study of fluid flow including advanced analysis of inviscid and viscous flows using both analytical and numerical techniques; topics include complex potential flow analysis, unsteady laminar flows, and boundary layer flows.
Recommended: A first course in fluid mechanics. Proficiency in differential calculus. The ability to program in at least one computer language

ME 561, GAS DYNAMICS, 4 Credits

Studies idealized compressible flows, including in nozzles and diffusers, as well as shocks/expansion waves and their interactions. Introduces supersonic flight and propulsion systems.
Recommended: ME 310 and ME 330 and (ME 373 or NSE 233)

ME 564, TURBULENCE MODELING, 3 Credits

Analyze different turbulence modeling techniques such as Reynolds Averaged Navier Stokes (RANS), Large Eddy Simulation (LES), and Direct Numerical Simulation (DNS). Apply these modeling techniques to a range of turbulent flows including free shear flows, boundary layers, and internal flows. Discuss commonly used single and two-point statistics, energy spectra, and feature identification techniques related to turbulence.
Prerequisite: ME 560 with C or better

ME 566, VISCOUS FLOW, 3 Credits

Boundary layer, stability, transition prediction methods, computational methods in fluid mechanics, recent developments.

ME 567, ENGINEERING APPLICATIONS OF COMPUTATIONAL FLUID DYNAMICS, 4 Credits

Basic concepts of computational fluid dynamics, a technique used for solving fully three-dimensional fluid flow problems with no exact solution, will be discussed and applied to general engineering applications using commercially available software.
Recommended: ME 312 and ME 331

ME 568, TURBULENT FLOW DYNAMICS, 4 Credits

An introductory course of the basic physics of turbulent flows, coverage will include statistical methods and physical interpretation of a range of flows including boundary layer flows, internal flows, and environmental flows.
Prerequisite: ME 560 with C or better
Equivalent to: OC 674
Recommended: A first course in fluid mechanics such as ME 331

ME 569, SELECTED TOPICS IN FLUID MECHANICS, 2-4 Credits

Topics in fluid mechanics emphasizing research applications of current interest.
This course is repeatable for 32 credits.

ME 580, MATERIALS SELECTION, 4 Credits

Develops and applies a formalized approach to materials selection within the engineering design process. Examines property definitions, measurements, and trends among the major materials families. Configures and uses property comparison charts derived from a comprehensive materials database. Identifies active design constraints and trade-space approaches to conflicting design objectives. Evaluates materials selection case studies, and application of concepts to student-defined projects with an emphasis on balancing sustainability metrics against traditional performance criteria and dollar costs.
Recommended: MATS 321

ME 583, COMPOSITE MATERIALS, 3 Credits

Explores fibers and matrices, mechanics of composites, reinforcement and failure mechanisms, properties and applications.
Recommended: ME 420 and ME 483 with a minimum grade of C

ME 596, SELECTED TOPICS IN THERMODYNAMICS, 3 Credits

Topics in thermodynamics including advanced problems in classical thermodynamics and statistical thermodynamics of current interest. Topics will likely be considered, including extensive use of literature. Not all topics covered each year.
This course is repeatable for 32 credits.

ME 597, PRECISION MOTION GENERATION, 4 Credits

Introduces fundamental knowledge in mechatronic systems used in manufacturing equipment such as CNC machine tools, and their computer numerical controls. Students will be exposed to sensors and actuators utilized in machine tools, industrial robots and for process automation. Fundamental knowledge to model and identify dynamics of motion delivery systems, design and analysis of accurate position control algorithms for precision motion generation will be covered. Digital motion control design will be introduced. Motion planning and real-time path interpolation algorithms will be covered. Students will be able to design NC systems for 2D motion platforms.
Recommended: ME 430

ME 599, SPECIAL TOPICS, 0-16 Credits

This course is repeatable for 32 credits.

ME 601, RESEARCH, 1-16 Credits

This course is repeatable for 16 credits.

ME 603, DISSERTATION, 1-16 Credits

This course is repeatable for 999 credits.

ME 605, READING AND CONFERENCE, 1-16 Credits

This course is repeatable for 16 credits.

ME 606, PROJECTS, 1-16 Credits

This course is repeatable for 16 credits.

ME 607, SEMINAR, 1-16 Credits

This course is repeatable for 16 credits.

ME 611, MODERN PRODUCT DESIGN, 4 Credits

Modern product development, design and prototyping are covered. Product development and prototyping is examined from a research standpoint in this course. Customer outcomes gathering, functional modeling, product architecture, modern techniques for concept generation and selection are explored. Also covered are recently developed theories and techniques for prototyping. The topics' place in the overall design process is shown through a product development and prototyping project.

ME 615, DESIGN UNDER UNCERTAINTY, 4 Credits

Tackles the problem of decision making in engineering design. The fundamental challenge faced in making decisions in engineering designs is that they are almost exclusively decisions made under uncertainty. Sources of uncertainty could result from engineering models, experiments conducted, or lack of knowledge of future events. The course will cover three basic topics 1) how do we quantify uncertainty, 2) how do we account for the uncertainty in decision making, and 3) how do we make design selection decisions about products or systems we design.
Prerequisite: ME 517 with C or better

ME 617, DESIGN AUTOMATION, 4 Credits

Design automation is the field of study whereby advanced numerical methods are used to automate difficult or tedious design decisions. Typically, such methods are based on numerical optimization and artificial intelligence. They work in tandem with other engineering digital tools like computer-aided design, computer-aided manufacturing, and finite-element analysis. This course builds upon a fundamental understanding of optimization to introduce students to a range of different techniques that may be used to support engineering decision-making. This includes heuristic methods, AI tree-search, discrete and stochastic algorithms. The course concludes with discussion of recent innovations in multi-objective, multi-disciplinary and robust optimization.
Prerequisite: ME 517 with C or better

ME 667, COMPUTATIONAL FLUID DYNAMICS, 3 Credits

Application of modern computational techniques to solve a wide variety of fluid dynamics problems including both potential and viscous flow with requirements for computer code development.
Prerequisite: (ME 560 with C or better or ME 565 with C or better or ME 566 with C or better) and (ME 526 [C] or ME 575 [C])