

MECHANICAL ENGINEERING (ME)

ME 230 Thermodynamics 4 Credit Hours

The course is a general introduction to thermodynamics with emphasis on engineering applications. Properties of pure substances. Work and heat. The first and second laws of thermodynamics. Entropy and efficiency. Applications to systems and control volumes. Mixtures of gases and vapors, air conditioning. Introduction to cycles. This course will become the first in a two-course series for mechanical engineering students, and will also be elected as a terminal course by IMSE students. Four hours lecture.

Prerequisite(s): PHYS 150 and (MATH 116 and (CHEM 134 or MPLS with a score of 215) or CHEM 144)

Restriction(s):

Can enroll if Major is Engineering, Bioengineering, Industrial & Systems Engin, Manufacturing Engineering, Electrical Engineering, Mechanical Engineering

ME 260 Design Stress Analyses 4 Credit Hours

An introduction to statics and stress analyses with emphasis on both mechanics fundamentals and design applications. (F,W,S).

Prerequisite(s): PHYS 150 and (ENGR 250* and (MATH 205* or ECE 385*) or MPLS with a score of 215 or MATH 215*)

Restriction(s):

Can enroll if College is Engineering and Computer Science

ME 265 Applied Mechanics 4 Credit Hours

A comprehensive introduction to the science of applied mechanics, encompassing a study of forces and the stresses, deflections, and motions which they produce. Topics include the concept of equilibrium and static force analysis; the mechanics of deformable bodies (internal stresses, constitutive relationships, strains, deflections, flow, failure); statics of indeterminate systems; kinematics; kinetics of particles, systems of particles, and rigid bodies. Four hours lecture. This course is not open to ME majors (F,W,S).

Prerequisite(s): PHYS 150 and (MATH 205* or MATH 215*) or MPLS with a score of 215

Restriction(s):

Cannot enroll if Major is , Mechanical Engineering

ME 290 Spec Topics in Mech Engin 1 to 3 Credit Hours

Special topics in mechanical engineering selected according to students' interest and availability of instructors and equipment.

ME 290B Spec Topics in Mech Engin 1 to 3 Credit Hours

TOPIC TITLE: Foundry Technology Introduction to manufacturing methods of component castings. Production planning, pattern technology & prototypes. Monund & core materials, development trends & properties of core materials. sand & ceramic materials. Hygienically safe materials & environmental aspects. Phase diagrams. Cast materials, solidification & microstructure development & mechanical properties of alloys. Shrinkage & porosity formation. Calculation of solidification, mould filling & feeding etc. Computer simulation of the casting process. Stress & warping of castings etc. Integration of CAD/CAM & simulation. Design of castings & material selection. Quality control. Defect formation.

ME 299 Internship/ Co-op 1 Credit Hour

This is a Cooperative Education course. Students wishing to experience a work experience before graduation may elect to participate in the Cooperative Education Program (minimum of two terms). (F,W,S).

Restriction(s):

Can enroll if Class is Junior or Senior or Graduate

ME 325 Thermal Fluid Sciences I 4 Credit Hours

Power and refrigeration cycles. Thermodynamic relations. Ideal gas mixtures and psychrometrics. Reacting ideal gas mixtures. Fluid properties. Fluid flow kinematics. Integral fluid flow analysis; the conservation laws - mass, energy, momentum. Introduction to differential analysis of fluid flow. Dimensional analysis. (F,W,S).

Prerequisite(s): (ENGR 216 or ME 215) and ME 230 and ME 260

Restriction(s):

Can enroll if Class is Sophomore or Junior or Senior

Can enroll if College is Engineering and Computer Science

ME 3251 Applied Thermodynamics 2 Credit Hours

Power and refrigeration cycles. Thermodynamic relations. Ideal gas mixtures and psychrometrics. Reacting ideal gas mixtures. (F,W,S)

Prerequisite(s): ME 230 and ENGR 216

Restriction(s):

Can enroll if Level is Undergraduate

Can enroll if Major is Mechanical Engineering

ME 3252 Fluid Mechanics 2 Credit Hours

Fluid properties. Fluid statics. Fluid flow kinematics. Integral fluid flow analyses; the conservation laws - mass, energy, momentum. Introduction to differential analysis of fluid flow. Diversional analysis. (F,W,S)

Prerequisite(s): ME 230 and ENGR 216

Restriction(s):

Can enroll if Level is Undergraduate

Can enroll if Major is Mechanical Engineering

ME 345 Engineering Dynamics 4 Credit Hours

A comprehensive treatment of statics and the kinematics and kinetics of particles, systems of particles, and rigid bodies from a Newtonian viewpoint utilizing rigorous vector techniques. The time-dependent description of kinematical quantities and of dynamic forces and moments. Matrix methods and digital computer techniques.

Prerequisite(s): (ME 215* or ENGR 216*) and ME 260 and MATH 216

ME 349 Instrument & Measurement Systems 3 Credit Hours

Modern instrumentation systems are considered beginning with generic issues such as calibration, error analysis, and dynamic response characteristics of instrumentation. Specific transducer systems (temperature, force and pressure, etc.) are presented, as well as interfacing techniques and elementary signal processing. Microprocessors are introduced for use in measurement and control applications. (F,W,S).

Prerequisite(s): (ME 265 or ME 345) and ECE 305

Corequisite(s): ME 349L

Restriction(s):

Can enroll if Class is Sophomore or Junior or Senior

Can enroll if Level is Undergraduate

Can enroll if College is Engineering and Computer Science

ME 3601 Des and Analy of Mach Elem 4 Credit Hours

Application of fundamental mechanics to analysis and design of elementary mechanical components and systems. Topics include: stress and strain analysis; experimental measurement; stress concentration; failure theories; safety factor; fatigue; fracture; combined loading; impact; buckling; energy methods. Components considered: fasteners; springs; bearings; gears; beams; shafts and other power transmission components. Numerical techniques. (F,W,S).

Prerequisite(s): (ENGR 216 or ME 215) and ME 260

Restriction(s):

Can enroll if Class is Sophomore or Junior or Senior

Can enroll if Major is Mechanical Engineering

ME 364 Prob, Stats, and Rel in Mach D 3 Credit Hours

Introduction to planned experiments in machine design and mechanical metallurgy with emphasis on orthogonal test programs with small blocks. Classical statistical analyses (e.g., analysis of variance for randomized complete block and split-plot designs) as well as computer intensive analyses (e.g., permutation and randomization tests). Maximum likelihood analysis for censored and uncensored life data and for strength (quantal response) data. Systems reliability in machine design.

Prerequisite(s): ENGR 216 (MATH 217 or MATH 227) and ME 260 and ENGR 216

ME 371 Heat Transfer 3 Credit Hours

Mechanisms of heat transfer processes. Steady and transient conduction in solids; analytical, numerical, and analogical methods. Thermal radiation processes; steady radiation exchange with black and gray surfaces and enclosures. Hydrodynamic boundary layer theory in convection heat transfer; thermal boundary layer, exact and integral analyses. Aerodynamic heating. Turbulent boundary layers. Reynolds' and Prandtl's analogies. Free convection. Working formulas for forced and free convection, condensation, and boiling. Combined heat transfer mechanisms; heat exchangers. Three hours lecture.

Prerequisite(s): ME 320 and ECE 305*

Corequisite(s):

ME 375 Thermal Fluid Sciences II 4 Credit Hours

Mechanisms of heat transfer processes. Steady state and transient conduction. Numerical methods in conduction. Internal and external flows. Boundary layer theory. Compressible flows. Convection heat transfer in internal and external flows. Heat exchanger theory. Introduction to radiation. (F,W,S).

Prerequisite(s): (ME 325 or ME 320) and ECE 305*

Restriction(s):

Can enroll if Class is Sophomore or Junior or Senior

Can enroll if College is Engineering and Computer Science

ME 379 Thermal-Fluids Laboratory 3 Credit Hours

An experimental investigation of thermodynamic, fluid mechanic, and heat transfer principles. Students will learn about thermal-fluids instrumentation and conduct experiments. In addition, they will design their own experiments to demonstrate their understanding of the principles. (F,W,S).

Prerequisite(s): (ME 320 or ME 325 or ME 3251 or ME 3252) and (ME 349 or BENG 351) and (ME 371* or ME 375*) and (COMP 270 or COMP 106 or CPAS with a score of 40 or COMP 220)

ME 381 Manufacturing Processes I 4 Credit Hours

This course introduces the students to the fundamentals and principles of manufacturing processes for engineering materials. It seeks to transfer an understanding of the application of principles of engineering materials and their influence on manufacturing processes. Topics covered include structure and manufacturing properties of metals, casting, heat treatments, bulk deformation processes, sheet metal working processes, processing of polymers and composites, surfaces and coating, powder metallurgy, machining and joining. Case studies of design for manufacturing and measurement of product quality; economical aspects and cost considerations in manufacturing systems will be studied. Three lecture hours and three laboratory hours.

Prerequisite(s): ENGR 250 and (ME 260 or ME 265)

Corequisite(s): ME 381L

ME 399 Internship/ Co-op 1 Credit Hour

A four-month professional work experience period of the Engineering Internship Program, integrated and alternated with the classroom terms.

Restriction(s):

Can enroll if Class is Junior or Senior or Graduate

ME 410 Finite Element Method wth Appl 3 Credit Hours

A presentation of the basic concepts and fundamentals of the Finite Element Method of Analysis in general, followed by applications to both continuum and field problems. Selected areas of application: dynamics and vibration including wave propagation; acoustics; fluid mechanics including film lubrication and ground water flow; heat transfer; elasticity and stress/strain analysis including structures; electrical field problems including electrostatics and electromagnetics (F,W,S).

Prerequisite(s): (ME 345 and (ME 360 or ME 3601) and ME 375*) or (BENG 370 and BENG 325*)

ME 4191 Structural Mech & Design 4 Credit Hours

A presentation of the methods of plane elasticity to solve a variety of problems arising in the analysis and design of structures. Review of the concepts of plane stress and strain, basic equations of plane elasticity and problems, energy methods approximate/numerical techniques, elastic-plastic bending and torsion, instability of columns and frames. (F,W,S).

Prerequisite(s): ME 345 and (ME 3601 or ME 360)

Restriction(s):

Can enroll if Class is Junior or Senior

Can enroll if Level is Undergraduate

Can enroll if College is Engineering and Computer Science

ME 4201 Design of Turbomachinery 4 Credit Hours

Principles of turbomachinery design and practices. Euler's equation for energy transfer calculations. Two- and three-dimensional velocity diagrams. Characteristic curves of axial and radial flow compressors. Design procedures of fans and blowers. Basic design and selection of pumps. Student is required to conduct a turbomachinery design project by applying the theory learned from the course. (W).

Prerequisite(s): ME 325 or ME 320

Restriction(s):

Can enroll if Class is Junior or Senior

Can enroll if Level is Undergraduate

Can enroll if College is Engineering and Computer Science

ME 4202 Design Turbo. and Wind Gen. 4 Credit Hours

Principles of turbomachinery design and practices with emphasis on wind power generation. Euler's equation for energy transfer calculations. Two- and three-dimensional velocity diagrams. Aerodynamics of wind turbines. Wind turbine design and control. Power generation of wind turbines, wind energy system economics and environmental impacts. Design procedures and characteristics of compressors, fans and blowers. Basic design calculations and selection of pumps. A turbomachinery design project by using the theory learned from the course may be required.

Prerequisite(s): ME 375

Restriction(s):

Cannot enroll if Class is Freshman

Can enroll if College is Engineering and Computer Science

ME 4301 Computational Thermo-Fluids 3 Credit Hours

This course introduces students to fundamentals and practical skills of computational fluid dynamics and heat transfer. Governing equations and their mathematical classification. Spatial and temporal approximation techniques, stability, consistency, and convergence. Finite-difference and finite-volume formulations. Survey of methods for solving discretized equations. Applications to technological flow and heat transfer problems.

Prerequisite(s): ME 325 and ME 375*

Restriction(s):

Can enroll if Class is Senior

Can enroll if College is Engineering and Computer Science

ME 4361 Design of HVAC Systems 4 Credit Hours

A comprehensive treatment of the design principles and practices in the heating, ventilating, and air conditioning. Psychrometrics, design loads, distribution systems, equipment selection.

Prerequisite(s): (ME 325 or ME 320 or ME 3251 or ME 3252) and (ME 375* or ME 371*)

Restriction(s):

Can enroll if Class is Junior or Senior

Can enroll if Level is Undergraduate

Can enroll if College is Engineering and Computer Science

ME 442 Control Syst Anly and Design 4 Credit Hours

Modeling of mechanical systems and feedback controllers using Laplace transform techniques and block diagram analysis. System response characteristics and stability criterion. Introduction of feedback concepts, including analysis and design of feedback controllers using root locus techniques. Frequency response concepts and use of frequency response measures in stability analysis and controller design.

Prerequisite(s): ECE 305 and ME 345

Corequisite(s): ME 442L

ME 4461 Mech Vibration & Noise Control 4 Credit Hours

Fundamentals of mechanical vibration and principles of noise control. Use of transducers and instruments to conduct sound and vibration measurements. Free and forced vibration in single and multiple degrees-of-freedom systems, damping, eigenvalues, eigenvectors, frequency response function, modal analysis, description of sound fields, acoustical materials and material testing, acoustics of rooms and enclosures, sound quality, and principles of noise control. Students will be required to conduct either a vibration or a noise control project. Two one-and-one-half hour lectures and one three-hour laboratory. (F).

Prerequisite(s): ME 345 and (ME 349* or ME 348*)

Restriction(s):

Can enroll if Class is Junior or Senior

Can enroll if Level is Undergraduate

Can enroll if College is Engineering and Computer Science

ME 4471 Solar Energy Sys Anly&Design 4 Credit Hours

The course introduces students to the fundamentals of solar energy conversion and solar energy systems. Principles in thermodynamics and heat transfer required to understand the solar energy use is reviewed. Design of different types of solar energy systems are explored and assessed. Issues relating to the practical implementation of solar energy will also be considered.

Prerequisite(s): ME 325 and ME 375*

Restriction(s):

Can enroll if Class is Senior

Can enroll if Major is Mechanical Engineering

ME 452 Sustainable Energy & Environ 4 Credit Hours

This course introduces students to the fundamentals of energy sources and their environmental impacts. It covers a wide range of conventional and alternative energy sources, which includes renewable and presents the tools for assessing their sustainability and environmental impacts. It also reviews issues related to energy storage, transportation and distribution, and challenges and future opportunities. A course project involving design of practical plans of implementation of sustainable energy technologies will be assigned.

Prerequisite(s): ME 325 and ME 375*

Restriction(s):

Can enroll if Class is Senior

Can enroll if College is Engineering and Computer Science

ME 4521 Intro Sust Energy Systems 3 Credit Hours

The course provides an overview of energy technology from a broad perspective that encompasses technical and environmental aspects. It covers a wide range of traditional and alternative energy sources and presents assessments of their availability, sustainability, and environmental impacts as well as evaluation of their potential role in solving the global energy problem.

Prerequisite(s): ME 375

Restriction(s):

Can enroll if Class is Junior or Senior

Can enroll if College is Engineering and Computer Science

Can enroll if Major is Mechanical Engineering

ME 460 Design for Manufacturing 3 Credit Hours

Design decisions based on manufacturability and process-property relationships. Design for assembly. Manufacturing tolerances and quality control methods including NDT. Design methodology used for product development.

Prerequisite(s): (ME 360 or ME 3601) and ME 381

ME 467 Senior Design I 3 Credit Hours

A guided design project course with emphasis on decision-making process associated with establishing alternatives and evaluation procedures to synthesize designs. Students will propose design projects and work in teams. Written and oral presentations will be required at the close of the term.

Prerequisite(s): ME 330 and ME 345 and ME 360 and ME 371

ME 4671 Senior Design I 4 Credit Hours

A guided design project with emphasis on the decision-making process associated with establishing alternatives and evaluation procedures to synthesize designs. Students propose design projects and work in teams to produce analytical designs, conduct evaluative experiments, and construct a physical design prototype. Engineering ethics and responsibility. Written and oral presentations are required at the close of the term. (F,W,S).

Prerequisite(s): ME 345 and (ME 360 or ME 3601) and (ME 375 or ME 371) and (ME 378* or ME 379*)

Restriction(s):

Can enroll if Class is Junior or Senior

Can enroll if Major is Mechanical Engineering

ME 4681 ME/BENG Dual Senior Design 4 Credit Hours

Full Title: Interdisciplinary Senior Design for ME/BENG Dual Degree Students A guided interdisciplinary design project course where student teams propose design projects, design a device, system or process related to mechanical-and bio-engineering and conduct evaluative experiments and/or construct a physical prototype. Engineering ethics and responsibility. At the end of the semester, the students are required to submit written reports and give oral presentations with a demonstration of their projects. Credit can only be awarded for one of the following courses: BENG 4671, ME 4671, and ME 4681. (W)

Prerequisite(s): BENG 351 and BENG 370 and BENG 364 and ME 375 and (BENG 375 or BENG 381)

Restriction(s):

Can enroll if Class is Junior or Senior

Can enroll if Major is Bioengineering, Mechanical Engineering

ME 469 Senior Design II 1 to 4 Credit Hours

Student teams develop mechanical or interdisciplinary design projects, or continue projects begun in ME 4671. Work includes mechanical engineering design, and could possibly include fabrication and testing. Projects can involve efforts by interdisciplinary teams. Written and oral presentations are required.

Prerequisite(s): ME 4671

ME 472 Prin & Appl of Mechatronic Sys 4 Credit Hours

This course provides the student with hands-on interdisciplinary experience of mechatronic systems, which integrate mechanical, electrical/electronic components with computer and microprocessors to design a high performance system. Subjects will be covered including Mechanical and Electrical Actuator Systems, Digital Transducers and Modulators, Microcomputers and Microcontrollers Interfacing Actuators using graphic programming techniques, Programmer Logic Controllers (PLC), and Modeling of Fluid Systems. Laboratories form the core of the course. They cover microprocessor controlled mechanical actuator system for motion controls, materials handling, PLC programming and fluid power systems. The labs make extensive use of Simulink?, a MATLAB? toolbox, Mikro - C and/or Arduino. Each student builds control circuits on a breadboard kit to simulate a real operation. Student will be required to perform a course design project with mechatronic application in nature.

Prerequisite(s): ME 265

Corequisite(s): ECE 460, ME 442

Restriction(s):

Cannot enroll if Class is Freshman or Sophomore

Can enroll if College is Engineering and Computer Science

ME 481 Manufacturing Processes II 3 Credit Hours

A study of casting, welding, plastic forming, and machining of materials; analysis of forces, energy requirements, and temperature effects; design specifications economically obtainable in terms of dimensional accuracy, surface finish, and material properties, functional characteristics of equipment. Two lectures and a laboratory.

Prerequisite(s): ME 381

ME 483 Dsgn Cons in Poly and Comp Mat 3 Credit Hours

Physical and mechanical behavior of unreinforced and reinforced (composite) polymeric materials in relation to their applications in modern technology. Emphasis is given to the design considerations with these materials in contrast to those with metallic materials. Time-dependent properties, such as creep and stress relaxation, are considered. Manufacturing methods are covered. Three lectures/recitation.

Prerequisite(s): ME 360 or ME 3601

ME 484 Manufacturing Poly Comp Matl 3 Credit Hours

This course will consider the manufacturing processes for production of plastics and composite parts. The emphasis will be on manufacturing principles that are based on rheology, polymer flow and transport phenomena. Design considerations and quality control techniques for manufacturing plastic and composite parts will also be covered.

Prerequisite(s): ME 381 or IMSE 382

ME 490 Directed Design Project 1 to 3 Credit Hours

Design project involving not only design but also analysis, fabrication and/or testing. Topics may be chosen from any of the areas of mechanical engineering. Students who have taken ME 425 and ME 464 will be encouraged to take this course. The student will submit a report on his or her project and give an oral presentation at the close of the term. (F,W,S).

Prerequisite(s): ME 360 or ME 381 or ME 425 or ME 464

Restriction(s):

Can enroll if Class is Senior or Graduate

ME 491 Directed Research Problems 1 to 3 Credit Hours

Special problems selected for laboratory or library investigation with intent of developing initiative and resourcefulness. (F,W,S).

Restriction(s):

Can enroll if Class is Senior or Graduate

ME 492 Guided Study in Mech Eng 1 to 3 Credit Hours

Individual study, design or laboratory research in a field of interest to the student. Topics may be chosen from any of the areas of mechanical engineering. The student will submit a report on his or her project at the close of the term. (F,W,S).

Restriction(s):

Can enroll if Class is Senior or Graduate

ME 493 Advanced Vehicle Energy Sys 3 Credit Hours

This course will introduce the advanced energy conversion systems in automotive vehicles and cover the fundamentals, characteristics, and design consideration of the energy systems. The topic includes using alternative fuels in internal combustion engines, advanced power train systems in hybrid, electric, and fuel cell vehicle, and exhaust energy recovery systems.

Prerequisite(s): ME 325* and ECE 305*

Restriction(s):

Can enroll if Class is Junior or Senior

Can enroll if College is Engineering and Computer Science

ME 496 Internal Combustion Engines I 2 to 3 Credit Hours

Comparison of characteristics and performance of several forms of internal combustion engines including the Otto and diesel types of piston engines and the several types of gas turbines; thermodynamics of cycles, combustion, ignition, fuel metering and injection, pollution from engines and modeling techniques. Lectures, theory demonstrations, and experiments.

Prerequisite(s): (ME 320 and ME 330) or ME 325

ME 4981 Automotive Engineering 4 Credit Hours

Analysis of vehicle performance in terms of acceleration, gradability, speed, fuel economy, ride comfort, stability and safety. Engine-transmission compatibility and matching. Fundamental vehicle dynamics. Computer modeling and simulation of vehicle systems by numerical techniques. Transmission ratio and torque analysis. Design of vehicle systems such as brakes, suspensions, drive line components, steering mechanisms and other subsystems. Four hours lecture. (F,W).

Prerequisite(s): ME 345 and (ME 360 or ME 3601)

Restriction(s):

Can enroll if Class is Junior or Senior

Can enroll if Major is Mechanical Engineering

ME 499 Internship/ Co-Op 1 Credit Hour

A four-month professional work experience period of the Engineering Internship Program, integrated and alternated with the classroom terms.

Restriction(s):

Can enroll if Class is Senior or Graduate

* An asterisk denotes that a course may be taken concurrently.

Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally