MECHANICAL ENGINEERING (MECH)

MECH 1500 Drawing Fundamentals 3 s.h.
Visualization of objects for engineering communication. Freehand sketching, orthographic projection, multiview drawing, auxiliary views, sectional views, and dimensioning.
Prereq.: High school geometry or equivalent.

MECH 1501 Engineering Communication with CAD 3 s.h.
Computer-aided drawing for engineering communication. 2D multiview drawings, 3D modeling including wire frame, solid, and surface models. Final design project using these tools is required. Two hours lecture, three hours laboratory per week.
Prereq.: MECH 1500 or equivalent.

MECH 1560 Engineering Communication with CAD 2 s.h.
Commercially available software typically used in engineering practice will be used to develop traditional 2D engineering drawings and 3D solid models representing engineering components and systems. Teams of students will complete an engineering design project. One hour lecture and three hours laboratory per week.
Prereq.: ENGR 1550.

MECH 2603 Thermodynamics 1 3 s.h.
Thermodynamic properties of gases and vapors, and their relationships in energy transformations. The First and Second Laws of thermodynamics. Introduction to thermodynamic cycles and efficiencies of power and refrigeration systems.
Prereq.: MATH 1572, CHEM 1515.

MECH 2606 Engineering Materials 3 s.h.
Properties and uses of engineering materials, manufacturing processes, including heat treatments and forming operations. Introduction to mechanical testing methods. Listed also as MTEN 2606.
Prereq.: MATH 1571 or MATH 1585H.

MECH 2606L Engineering Materials Laboratory 1 s.h.
Experiments design to introduce the students to the basics of engineering materials investigation, instrumentation, data collection and analysis, and reporting. Topics include microstructural and crystallographic investigations, mechanical behavior of solids subjected to static and dynamic axial, flexural, and torsional stresses, diffusion experiments, and phase diagram construction.
Prereq.: C or better in one of MATH 1571, MATH 1571H, MATH 1571E, or MATH 1585H.
Prereq. or Coreq.: MECH 2606.

MECH 2620 Statics and Dynamics 3 s.h.
Principles of engineering mechanics as applied to statics and dynamics, Vector applications to forces and moments; centroid and center of gravity; static equilibrium. Kinematics of particles; Newton's laws; work-energy; and impulse momentum techniques using vector approach,.
Prereq.: MATH 1572 and PHYS 2610 or concurrent.

MECH 2641 Dynamics 3 s.h.
Kinematics of particles and rigid bodies. Newton's laws of motion, work-energy, and impulse momentum techniques applied to particle and rigid body motion using a vector approach.
Prereq.: CEEN 2601.

MECH 3704 Thermodynamics 2 3 s.h.
Power and refrigeration cycles, relations among thermodynamic properties, properties of non-reacting gas mixtures and solutions, chemical reactions and combustion processes, psychrometry and air conditioning principles, and more advanced topics on renewable energy.
Prereq.: MECH 2603 .

MECH 3708 Dynamic Systems Modeling 3 s.h.
Mathematical modeling of linear mechanical, electrical, thermal, fluid, and mixed systems. State space variables. Frequency response. Computer simulation using modern computer tools. Three hours lecture per week.
Prereq.: C or better in MECH 2641, ECEN 2614, and MATH 3705.
Coreq.: MECH 3708L.

MECH 3708L Dynamic Systems Modeling Laboratory 1 s.h.
Mathematical modeling of linear mechanical, electrical, thermal, fluid, and mixed systems. State space variables. Frequency response. Computer simulation using modern computer tools. Three laboratory hours per week.
Prereq.: C or better in MECH 2641, ECEN 2614, and MATH 3705.
Coreq.: MECH 3708.

MECH 3720 Fluid Dynamics 3 s.h.
Physical properties of fluids. Governing equations of fluid dynamics; forces on bodies due to incompressible fluid motion. Dimensional analysis and similitude. Analysis of energy losses in pipe flows. Concept of the viscous boundary layer.
Prereq.: MECH 2603; MECH 2641; MATH 3705.

MECH 3720L Fluid Dynamics Laboratory 1 s.h.
Introduction to equipment, data acquisition, and techniques for measurement and computation of fluid flows in engineering applications. Effective technical communication skills, analysis and interpretation of data in teams are emphasized.
Prereq.: MECH 3720.

MECH 3725 Heat Transfer 1 3 s.h.
Fundamentals of heat transfer by conduction, convection, and radiation. Heat transfer by combined modes.
Prereq.: MECH 3720 or concurrent.

MECH 3742 Kinematics of Machines 3 s.h.
Position, velocity, and acceleration analysis of mechanisms. Design of link and cam mechanisms to perform desired machine functions. Graphical, analytical, and commercial software applications.
Prereq.: MECH 2641, ENGR 1560 and MECH 1560.

MECH 3751 Stress and Strain Analysis 1 3 s.h.
Analysis of internal forces, stresses, strains, and deflections in three dimensions. Dynamic loading including impact and fatigue. Theories of failure and energy methods. Must be taken concurrently with MECH 3751L.
Prereq.: CEEN 2602, MECH 2606.

MECH 3751L Stress and Strain Analysis 1 Laboratory 1 s.h.
Transmission and reflection photoelasticity. State and dynamic strain gage applications using computer-aided data acquisition. Three hours laboratory per week. Concurrent with: MECH 3751.

MECH 3762 Design of Machine Elements 3 s.h.
Application of fundamental engineering principles to the design of various elements found in machines. Elements include connections, shafts, keys, couplings, springs, gears, belts, chains, bearings, clutches, brakes, screws, etc. Must be taken concurrently with MECH 3762L.
Prereq.: MECH 2641 and MECH 3751.

MECH 3762L Design of Machine Elements Laboratory 1 s.h.
Practical design problems incorporating analysis, material selection, and sizing of machine components utilizing the computer. Three hours laboratory per week. Must be taken concurrently with MECH 3762.

MECH 4800 Special Topics 3 s.h.
Special topics and new developments in mechanical engineering. Subject matter, credit hours, and special prerequisites are announced in advance of each offering. May be repeated to a maximum of 8 s.h. with different content.
Prereq.: Junior standing in Mechanical Engineering, or consent of instructor.

MECH 4808 Mechanical Systems Design 1 2 s.h.
Detailed design of a mechanical engineering system utilizing expertise expected of a new graduate in an industry setting. Design methodology, case studies, oral presentations, and written reports prepare the student to function as part of a design team on a capstone project. MECH 4809 must be taken at the next offering after completing 4808. Grading in MECH 4808 is Traditional/PR. Two hours lecture per week.
Prereq.: MECH 3708, MECH 3725, MECH 3742, and MECH 3762.
Gen Ed: Capstone 2024.

MECH 4808L Mechanical Systems Design Laboratory 1 s.h.
Supplemental activities related to MECH 4808, such as discussion and seminars on industry practices and standards, computer software applications, experimental verification, etc. Three hours laboratory per week. Must be taken concurrently with MECH 4808.
Gen Ed: Capstone 2024.

MECH 4809 Mechanical Systems Design 2 3 s.h.
Detailed design of a mechanical engineering system utilizing expertise expected of a new graduate in an industry setting. Design methodology, case studies, oral presentations, and written reports prepare the student to function as part of a design team on a capstone project. MECH 4809 must be taken at the next offering after completing 4808. Three hours lecture per week.
Prereq.: MECH 4808.
Gen Ed: Capstone 2024.

MECH 4809L Mechanical Systems Design Laboratory 2 1 s.h.
Supplemental activities related to MECH 4808 and MECH 4809, such as discussions and seminars on industry practices and standards, computer software applications, experimental verifications, etc. Three hours laboratory per week. MECH 4808L must be taken concurrently with MECH 4808 and MECH 4809L must be taken concurrently with MECH 4809.

MECH 4823 Heating, Ventilation, and Air Conditioning 3 s.h.
Design of heating and air conditioning systems for residential, commercial, and industrial complexes. Human comfort, psychometries, and environmental issues. Computer simulation of heating and cooling load for steady-state and transient conditions. Selection of controls and equipment.
Prereq.: MECH 3725.

MECH 4825L Heat Transfer and Thermodynamics Laboratory 1 s.h.
Experiments involving basic measurement techniques, power and refrigeration cycles, heat transfer, heat exchangers, and energy systems. Three hours laboratory per week.
Prereq.: MECH 3720, MECH 3725.

MECH 4835 Thermal Fluid Applications 3 s.h.
Application of the principles of thermodynamics, fluid dynamics, and heat transfer to design. Design, analysis and computer simulation of thermal fluid systems and components.
Prereq.: MECH 3725.

MECH 5811 Solar Engineering 3 s.h.
Radiational characteristics of solar energy, glass materials and selective coatings. Analysis of flat plate collectors, concentrators, and thermal storage. System simulation and economic analysis for optimization of basic solar systems.
Prereq.: PHYS 2611, MECH 3725 or consent of chairperson.

MECH 5820 Turbulence 3 s.h.
Physics of turbulence in thermal-fluid engineering systems; statistical descriptions, energy cascade and scales of turbulent motion. Modeling and simulation of turbulent flows. Examples of turbulence in mixing layers, combustion, and wall-bounded flows.
Prereq.: MECH 3720 or PHYS 3705 or CHEN 3786 (or equivalent).

MECH 5825 Heat Transfer 2 3 s.h.
Advanced topics in heat transfer. Multi-dimensional conduction, free convection, phase change heat transfer and thermal radiation. Integration of analytical, numerical, and computational methods into design projects.
Prereq.: MECH 3708 and MECH 3725.

MECH 5836 Fluid Power and Control 3 s.h.
Theory of prime movers, turbomachinery, and control systems. Modeling of hydraulic and pneumatic systems and components. Hydraulic fluids, pumps, cylinders, valves, motors, compressors, and actuators. Hydraulic and pneumatic circuit applications and control.
Prereq.: MECH 3725.

MECH 5842 Kinetics of Machines 3 s.h.
Three dimensional kinematics and dynamics of machines. Dynamic analysis and design; balancing of machines.
Prereq.: MECH 3742.

MECH 5852 Stress and Strain Analysis 2 3 s.h.
Continuation of MECH 3751. Introduction to applied elasticity theory including plane stress and strain and stress functions. Plastic and creep behavior of materials. Introduction to instability. Emphasis on design applications.
Prereq.: MECH 3751, MECH 3751L, MATH 3705.

MECH 5872 Engineering Acoustics 3 s.h.
The nature of sound and its propagation; analysis and control of sound and noise production in mechanical equipment; transmission and absorption of sound in engineering materials, ultrasonics, structural acoustics, base measurements, and equipment.
Prereq.: MECH 3708.

MECH 5881 Mechanical Vibrations 3 s.h.
Introduction to mechanical vibrations: single and multi-degree of freedom systems, free and forced vibrations, impedance and modal analysis including applications.
Prereq.: MECH 3708.

MECH 5881L Mechanical Vibrations Laboratory 1 s.h.
Introduction to vibrations measurements. Experiments with mechanical systems, computer simulation of vibration systems. Experimental determination of component models and parameters. Three hours laboratory per week.
Prereq.: MECH 5881.

MECH 5884 Finite Element Analysis 3 s.h.
Fundamental principles of finite element analysis with emphasis on applications to design in areas of stress analysis, vibrations, and heat transfer. Use of commercial software.
Prereq.: MECH 3708, MECH 3725, MECH 3751.

MECH 5885 Computational Fluid Dynamics 4 s.h.
Understand finite differential and finite volumes methods used in CFD. Understand the need for various turbulence models and how to choose them. Become proficient at disseminating the results form a CFD software. Three hours lecture and three hours laboratory per week.
Prereq.: MECH 3720 and MECH 3725.

MECH 5892 Control of Mechanical Systems 3 s.h.
Introduction to theory of feedback and control. Performance and stability of linear systems. Design of feedback control systems. Practical application and introduction to state-space methods. Two hours lecture and three hours laboratory per week.
Prereq.: MECH 3708.

MECH 6900 Special Topics 2-4 s.h.
Special topics and new developments in mechanical engineering. Subject matter and credit hours to be announced in advance of each offering. May be taken three times.
Prereq.: As announced or permission of instructor.

MECH 6904 Advanced Thermodynamics 3 s.h.
Laws of equilibrium thermodynamics; relations between properties and aspects of the Second Law. Exergy analysis. Macroscopic and microscopic considerations for the prediction of properties. Microscopic description based on classical and quantum statistics. General stability criteria, statistical equilibrium, and trend toward equilibrium fluctuations.
Prereq.: Permission of graduate advisor.

MECH 6915 Failure Analysis 3 s.h.
Advanced methods in failure analysis of metallics, ceramics, polymers, and composites. Numerous practical examples will be discussed. Individual student projects using scanning electron microscopy are required. Three hours lecture and three hours laboratory.

MECH 6925 Computational Heat Transfer 3 s.h.
Numerical modeling techniques and methods in heat transfer. Computational analysis of conduction and convection by the finite element method, finite difference method, and the method of coordinate transformation.
Prereq.: MATH 3705 Differential Equations and MECH 3725 Heat Transfer I, or permission of instructor.

MECH 6930 Advanced Fluid Mechanics and Heat Transfer 3 s.h.
Viscous and inviscid flows, Navier-Stokes equations, Euler equations, and complex variables methods. Analytic solutions to advanced heat transfer problems, advanced boundary-value problems.
Prereq.: MECH 3725 Heat Transfer I or equivalent.

MECH 6945 Advanced Dynamics 3 s.h.
Three-dimensional vector statics; kinematics and kinetics of particles and rigid bodies; energy, momentum, and stability. LaGrange's equations of motion for particles and rigid bodies impulse; small oscillations; nonholonomic and dissipative systems.
Prereq.: Permission of graduate advisor.

MECH 6950 Engineering Tribology 3 s.h.
Fundamentals of surface interactions by the effects from surface topography, physical & chemical energies, and mechanical contact. Surface damage mechanisms by frictional contacts including adhesion, abrasion, and fatigue. Fundamental lubrication theories including hydrodynamic, hydrostatic, elastohydrodynamic and boundary layers. Design considerations and selection of tribological machine components. Restrictions: Undergraduate level physics, chemistry, and materials mechanics and science.

MECH 6952 Applied Elasticity 3 s.h.
Equations or equilibrium, compatibility and boundary conditions-their applications to plane stress and plane strain problems. Stress functions, strain energy methods, stress distribution in anile symmetrical bodies; special problems in structures involving torsion and bending of prismatical bars.
Prereq.: MECH 3751 Stress and Strain Analysis I or equivalent, or permission of graduate advisor.

MECH 6962 Mechanical Design Analysis 3 s.h.
The study of analytical aspects and the application of engineering science topics to machine elements and machinery. Some case studies in mechanical design.
Prereq.: Permission of graduate advisor.

MECH 6963 Advanced Stress Analysis 3 s.h.
Theory and engineering applications of the most recent techniques of experimental stress analysis, brittle coatings, photoelasticity, strain gauges, photostress.
Prereq.: MECH 3751 Stress and Strain Analysis I or equivalent or permission of graduate advisor.

MECH 6983 Modern Power Sources 3 s.h.
Analytical and descriptive study of modern power plants. Combustion and environmental problems with fossil-fueled power plants. Electromagnetic circuits and devices with emphasis on the principles of electromechanical energy conversions.
Prereq.: Permission of graduate advisor.
Cross-Listed:as CHEN 6983 and ECEN 6983.

MECH 6985 Electromechanical Motion Devices 3 s.h.
Thermodynamics of batteries, and electric and fuel cells. Power from nuclear isotopes. Features common to rotating electromagnetic fields. Analysis and design of electromechanical power components. Logical circuit design with I/O structure and interface.
Cross-Listed:as CHEN 6985 and ECEN 6985.

MECH 6990 Thesis 2-6 s.h.
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MECH 6992 Graduate Projects 3 s.h.
Analysis, design, research, or other independent investigation on projects selected with the advice and approval of the student's graduate committee.