

MECHANICAL ENGINEERING COURSES

Department of Mechanical Engineering College of Engineering

MECH 100 01(1-0-0). Introduction to Mechanical Engineering. F. Prerequisite: Mechanical engineering freshmen majors only. The profession of mechanical engineering; history, educational process, ethics, licensing, problem solving, technology.

MECH 102 03(3-0-0). Mechanical Engineering Problem Solving. S. Prerequisite: MATH 160 or concurrent registration; PH 141 or concurrent registration. Programming and engineering problem solving techniques, algorithms and processes from physics, and calculus first principles.

MECH 200 03(2-2-0). Introduction to Manufacturing Processes. F. Prerequisite: Mechanical engineering and engineering science majors only. Engineering drawings, materials, manufacturing, and safety. Hand tools, cutting, drilling, the lathe, mill and numerical control. (\$)

MECH 201 02(1-2-0). Engineering Design I. F. Prerequisite: MECH 102 with a C or better. Engineering design process and the roles of visual communication with emphasis on 3D physical solid modelers and Pro/ENGINEER.

MECH 202 03(2-2-0). Engineering Design II. S. Prerequisite: MECH 200 with a C or better; MECH 201 with a C or better. Engineering design process with emphasis on teamwork, ideation, decision-making, project planning applied to a group design project. (\$)

MECH 237 03(3-0-0). Introduction to Thermal Sciences. F, S. Prerequisite: MATH 160; PH 141. First and second laws of thermodynamics, properties of materials, energy conversion, statistical aspects, heat transfer.

MECH 302 03(3-0-0). Engineering Design III. S. Prerequisite: CIVE 360 with a C or better; MECH 202 with a C or better; MECH 324 with a C or better; MECH 337 with a C or better; MECH 342 with a C or better. Design fundamentals, including design processes, project planning, creativity, manufacturing, and human factors.

MECH 307 04(3-3-0). Mechatronics and Measurement Systems. F, S. Prerequisite: CIVE 261 with a C or better; ECE 204 with a C or better; MATH 340 with a C or better. Instrumentation and measurement system analysis and design; sensors and actuators; computer data acquisition and control. (\$)

MECH 324 04(3-2-0). Dynamics of Machines. F. Prerequisite: CIVE 261; MATH 340 with a C or better or concurrent registration. Analysis and synthesis of moving machinery. (\$)

MECH 325 03(3-0-0). Machine Design. S. Prerequisite: CIVE 360 with a C or better. Design of mechanical components to avoid failure during operation. Stress analysis, failure theories, and specific mechanical components in design context.

MECH 331 04(3-2-0). Introduction to Engineering Materials. F, S. Prerequisite: CHEM 111 with a C or better; CHEM 112 with a C or better; PH 142 with a C or better. Characteristics of metallic, plastic, and ceramic material; basic principles which relate properties of materials to their atomic and microstructure. (\$)

MECH 337 04(3-0-1). Thermodynamics. F, S. Prerequisite: MATH 261 with a C or better; PH 141 with a C or better. First and second laws, property relationships, characteristic functions, thermodynamics solver, various thermodynamics applications.

MECH 338 01(0-3-0). Thermosciences Laboratory. F, S. Prerequisite: Prerequisite: MECH 337 with a C or better; MECH 342 with a C or better. Experimental methods in heat transfer, fluid flow, and thermodynamics.

MECH 342 03(3-0-0). Mechanics and Thermodynamics of Flow Processes. F. Prerequisite: MATH 340 with a C or better; MECH 337 with a C or better or concurrent registration; PH 141 with a C or better. Engineering details of viscous flow with losses, measurements, compressibility, turbomachinery, convective heat transfer.

MECH 344 03(3-0-0). Heat and Mass Transfer. S. Prerequisite: MECH 342 with a C or better. Transport and rate processes, conduction, convection, and radiation.

MECH 407 03(3-0-0). Laser Applications in Mechanical Engineering. F. Prerequisite: PH 142. Review of electromagnetic waves; applications of lasers and optics in engineering, e.g. position sensing, flowfield measurement, cutting and welding.

MECH 408 03(2-0-1). Applied Engineering Economy. F. Prerequisite: MATH 161. Credit not allowed for both MECH 408 and MECH 410. The basic principles and calculations of engineering economy with application to real problems, including energy and the environment.

MECH 410 01(0-0-1). Engineering Economy Principles/Calculations. F, S, SS. Prerequisite: MATH 161. Offered as an online course only. Basic principles and calculation of engineering economy. (NT-O)

MECH 411 03(3-0-0). Manufacturing Engineering. S. Prerequisite: CIVE 360; MECH 331. Casting, forming, machining, and welding processes used in manufacturing operations. (NT-V)

MECH 417 03(2-2-0). Control Systems. F. Prerequisite: MATH 340; MECH 302. Feedback and forward loop control design and simulation; discrete time and frequency domain methods with implementation considerations.

MECH 424 03(3-0-0). Advanced Dynamics. S. Prerequisite: MECH 324. Kinematics and dynamics of rigid bodies. Hamilton's principle and Lagrange's equations for lumped parameter extended bodies and distributed systems.

MECH 431 03(3-0-0). Metals and Alloys. F. Prerequisite: MECH 331. Engineering metals and alloys, modification of properties by alloying, plastic deformation, and heat treatment. Fundamentals of physical metallurgy. (NT-V)

***MECH 432 03(3-0-0). Engineering of Nanomaterials.** F. Prerequisite: MECH 331. Structure, properties and processing of extremely small (10⁻⁹m) synthetic and natural materials.

MECH 437 03(2-0-1). Internal Combustion Engines. F. Prerequisite: MECH 344. Application of thermodynamics, heat transfer, and fluid mechanics to internal combustion engines.

MECH 460 03(3-0-0). Aeronautics. S. Prerequisite: MECH 342. Thermodynamics and fluid mechanics principles applied to the mechanics, aerodynamics, performance, stability, and control of airplanes.

MECH 463 03(2-2-0). Building Energy Systems. S. Prerequisite: MECH 344. Credit not allowed for both MECH 463 and MECH 676. Comfort, psychrometrics, loads, solar radiation, heating and cooling system design, transport, solar system design, economics.

MECH 468 03(3-0-0). Space Propulsion and Power Engineering. F. Prerequisites: ECE 204; MECH 337; MECH 342.

° Alternate year offering (odd); * Alternate year offering (even); + Field trips; \$ Special course fee; NT Approved for nontraditional course offering (C = correspondence, O = online, T = telecourse, V = videotape/DVD); GT-subcode--State Guarantee Transfer course, the subcode refers to the specific category the course fulfills. (See Introduction for more information.) Date printed: 6/10/2010

MECH 470/ BIOM 470 03(3-0-0). Biomedical Engineering. F.
Prerequisite: MATH 155 or MATH 160; PH 141. Credit not allowed for both MECH 470 and BIOM 470.
Engineering application in human/animal physiology, diagnosis of disease, treatment, rehabilitation, human genome manipulation.

MECH 486A-B 04(1-12-0). Engineering Design Practicum.
Capstone engineering design project; transition experience to the mechanical engineering profession in industry and graduate education.
A) Practicum I. F. Prerequisite: MECH 302 with a C or better; MECH 307 with a C or better; MECH 325 with a C or better; MECH 331 with a C or better; MECH 344 with a C or better. (\$) **B)** Practicum II. S. Prerequisite: CIVE 363 with a C or better; MECH 338 with a C or better; MECH 486A with a C or better. (\$)

MECH 495 Var. Independent Study.

MECH 498 Var[1-3]. Undergraduate Research. Var[1-3].
Prerequisite: Participation in the University Honors or instructor's permission.

***MECH 507 03(3-0-0). Laser Diagnostics for Thermosciences.** F.
Prerequisite: PH 142.
Basics of optics, spectroscopy, and lasers. Physics and applications of laser diagnostic techniques used in thermosciences.

MECH 509 03(3-0-0). Manufacturing Quality Design and Control. S.
Prerequisite: MATH 340; STAT 315.
Design of decision-making models for industrial engineering. (NT-O/V)

***MECH 510 02(1-0-1). Advanced Engineering Economy.** SS.
Prerequisite: MECH 410; STAT 315.
Evaluation of independent and interrelated proposals with compound interest, discrete and continuous cash flows, complete and incomplete information. (NT-O/V)

MECH 512 03(3-0-0). Reliability Engineering. F. Prerequisite: MECH 513; STAT 315.
Models to predict time to failure of mechanical or electronic devices, reliability data analysis and case studies. (NT-O/V)

MECH 513 03(3-0-0) Simulation Modeling and Experimentation. F.
Prerequisite: STAT 315.
Logic/analytic modeling in simulations. Event and transient entity-based simulation languages. Simulation design, experimentation and analysis. (NT-O)

°MECH 514 03(2-2-0). Manufacturing and Robotic Systems. S.
Prerequisite: MECH 417.
Examination of electromechanical systems of manufacturing applications and robotics.

MECH 520 03(3-0-0). Finite Element Analysis in Mechanical Engr. S.
Prerequisite: CIVE 360; MATH 340.
Application of FEA as a tool to analyze mechanical engineering problems.

MECH 524 03(3-0-0). Principles of Dynamics. F. Prerequisite: MECH 324.
Kinematics and dynamics of rigid body motion; Lagrangian and Hamiltonian formulations of mechanics; applications to engineering problems. (NT-V)

MECH 525/BIOM 525 03(0-0-0). Cell and Tissue Engineering. S.
Prerequisite: BC 351 or BMS 300 or BMS 500/NB 501 or BZ 310.
Credit allowed for only one of the following: BIOM 525, CBE 525, and MECH 525.
Cell and tissue engineering concepts and techniques with emphasis on cellular response, cell adhesion kinetics, and tissue engineering design.

MECH 526 04(2-2-0). Fundamentals of Vehicle Dynamics. S.
Prerequisite: MECH 324.
Kinetics of vehicle suspensions, steady-state and transient stability and control, tires, wheel and suspension geometry and loads, dampers, steering.

°MECH 529 03(3-0-0). Advanced Mechanical Systems. S.
Prerequisite: MECH 307.
Modeling, analysis, and synthesis of practical mechanical devices in which dynamic response is dominant consideration.

MECH 530 03(3-0-0). Advanced Composite Materials. F.
Prerequisite: CIVE 360; MECH 331.
Materials aspects of advanced composite constituents and how their combination yields synergistic results. (NT-V)

MECH 531/BIOM 531 03(3-0-0). Materials Engineering. S.
Prerequisite: MECH 331 or MECH 431.
Selection of structural engineering materials by properties, processing, and economics; materials for biomedical and biotechnology applications. (NT-O)

MECH 532/BIOM 532 03(3-0-0). Materials Issues in Mechanical Design. F. Prerequisite: MECH 331. Credit not allowed for both MECH 532 and BIOM 532.
Failure mechanisms from materials viewpoint with emphasis on use in design. Fracture, creep, fatigue, and corrosion. (NT-V/O)

+MECH 536 03(3-0-0). Materials Applications in Renewable Energy. F. Prerequisite: MECH 331.
Materials science applied to renewable energy, transmission and storage; study of solar cells, fuel cells, Li-ion batteries and related technologies. Required field trips.

MECH 538 03(3-0-0). Mechanical Engineering Thermodynamics. F.
Prerequisite: MECH 337.
First and second laws of thermodynamics applied to engineering devices and systems. Introduction to availability, energy, and lost work analysis.

MECH 539 03(3-0-0). Advanced Fluid Mechanics. F. Prerequisite: MECH 342 or CIVE 300.
Properties, kinematics; vorticity; exact solutions; instability; boundary layers; turbulence; wakes; compressible flow; supersonic flow; shockwaves.

°MECH 551 03(3-0-0). Physical Gas Dynamics I. F. Prerequisite: MECH 342.
Characteristics of real gases in reacting and nonequilibrium systems; equilibrium air; statistical mechanics; chemical thermodynamics.

°MECH 552 03(3-0-0). Applied Computational Fluid Dynamics. F.
Prerequisites: CBE 331 or CIVE 300 or MECH 342.
Introductory theory of CFD, formulation of engineering problems for CFD analyses, mesh generation, solver settings, and postprocessing.

MECH 555 03(3-0-0). Ceramic Materials Engineering. S.
Prerequisite: MECH 331.
Ceramic materials engineering and its application to materials technologies.

MECH 557 03(3-0-0). Turbomachinery. S. Prerequisite: MECH 337; MECH 342.
Application of fundamental principles of thermodynamics and fluid mechanics to turbomachinery.

***MECH 558 03(3-0-0). Combustion.** F. Prerequisite: MECH 342.
Combustion processes: explosions, detonations, flame propagation, ignition, generation of pollutants in moving and stationary energy conversion systems.

***MECH 561 04(4-0-0). Space Propulsion and Mission Analysis.** S.
Prerequisite: MATH 340.
Analysis of space flight missions and propulsion systems.

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***MECH 564 03(3-0-0). Fundamentals of Robot Mechanics and Controls.** S. Prerequisite: MECH 417.
Kinematics of robots, controls for robots.

°MECH 567 03(3-0-0). Broad-Beam Ion Sources. S.
Prerequisite: MATH 340.
Physical processes in broad-beam electron-bombardment ion sources for space propulsion and ion machining applications.

***MECH 569/*ECE 569 03(3-0-0). Micro-Electro-Mechanical Devices.** S. Prerequisite: ECE 331 with a C- or better or MECH 344. Credit not allowed for both MECH 569 and ECE 569.
Micro-electro-mechanical processes and applications in sensors, optics, and structures.

MECH 570/BIOM 570 03(3-0-0). Bioengineering. S.
Prerequisite: MECH 307; MECH 324. Credit not allowed for both MECH 570 and BIOM 570.
Physiological and medical systems analysis using engineering methods including mechanics, fluid dynamics, control, electronics, and signal processing. (NT-O)

MECH 573/BIOM 573 03(3-0-0). Structure and Function of Biomaterials. S. Prerequisite: MECH 331. Credit not allowed for both MECH 573 and BIOM 573.
Structure-function relationships of natural biomaterials; application to analysis of biomimetic materials and biomaterials used in medical devices. (NT-V/O)

MECH 575 03(3-0-0). Solar and Alternative Energies. F.
Prerequisite: MECH 337; MECH 342; MECH 344.
Solar radiation, flat-plate collectors, energy storage, space heating and cooling, power generation, applications, simulation.

°MECH 609 03(1-0-2). Experimental Optimization. SS.
Prerequisite: MECH 509.
Application of design of experiments, response surface and optimization methods to experimental investigations.

MECH 626 03(3-0-0). Race Car Vehicle Dynamics. F.
Prerequisites: CIVE 562; MECH 524; MECH 526.
Quasi-static, steady-state and transient analyses of racing suspensions including modal analysis in roll, pitch, heave, yaw and warp.

***MECH 628 03(3-0-0). Applied Fracture Mechanics.** S.
Prerequisite: CIVE 560.
Stress distribution near cracks; energy criteria for fracture; design criteria; fracture toughness testing. (NT-T)

°MECH 644 03(3-0-0). Conduction Heat Transfer. F.
Prerequisite: MECH 344.
Linear and nonlinear, isotropic and nonisotropic conduction; analytical, numerical techniques; inverse methods.

***MECH 645 03(3-0-0). Radiation Heat Transfer.** S.
Prerequisite: MECH 344.
Radiation fundamentals; properties; spectral, directional variations; transfer between surfaces; participating media; numerical, Monte Carlo methods. (NT-V)

°MECH 646 03(3-0-0). Convection Heat Transfer. S.
Prerequisite: MECH 344.
Fundamentals; conservation, constitutive equations; second law; forced, free convection; internal, external flows; laminar, turbulent flows. (NT-V)

MECH 650 03(3-0-0). Computational Materials from First Principles. F. Prerequisite: CHEM 461 or MECH 331; CHEM 474 or MECH 337 or PH 361; MATH 340.
Ab initio calculations for molecules, clusters, solutions and solid state materials. Ab initio and classical molecular dynamics simulations.

°MECH 661 03(3-0-0). Theory/Control of Internal Combustion Engines. S. Prerequisite: MECH 437.
Theory and applications of internal combustion engines. Alternative fuels, engine control, and pollution prevention.

°MECH 671/BIOM 671 03(3-0-0). Orthopedic Tissue Biomechanics. F. Prerequisite: CIVE 560. Credit not allowed for both MECH 671 and BIOM 671 or for MECH 671/BIOM 671 and MECH 571/BIOM 571.
Linear elastic, finite deformation, and viscoelastic theories applied to the mechanical behavior of orthopedic tissues (bone, tendon, cartilage).

MECH 676 03(2-2-0). Building Energy Design. S. Prerequisite: MECH 575. Credit not allowed for both MECH 676 and MECH 463.
Design of space heating and cooling systems. Solar thermal electric power systems, industrial and agricultural process heat.

MECH 684 Var. Supervised College Teaching.

MECH 692 Var. Seminar. F, S.

MECH 695A-M Var. Independent Study.
A) Bioengineering. B) Energy conversion. C) Environmental engineering. D) Heat and mass transfer. E) Industrial and systems engineering. F) Mechanics and design. G) Computer-assisted engineering. H) Robotics. I) Solar engineering. J) Computational fluids. K) Materials. L) Plasma engineering. M) Motorsport engineering..

MECH 699A-M Var. Thesis.
A) Bioengineering. B) Energy conversion. C) Environmental engineering. D) Heat and mass transfer. E) Industrial and systems engineering. F) Mechanics and design. G) Computer-assisted engineering. H) Robotics. I) Solar engineering. J) Computational fluids. K) Materials. L) Plasma engineering. M) Motorsport engineering.

°MECH 721 Var. Special Topics in Design and Manufacturing. S. Prerequisite: MECH 514 or MECH 620.
Special topics in engineering design and manufacturing.

***MECH 727 03(3-0-0). Continuum Mechanics.** S. Prerequisite: CIVE 502.
Mechanics of continuous media; cartesian tensors, vector analysis, kinematics of deformation, balance of momentum, mass and energy, constitutive equations.

MECH 729 03(3-0-0). Special Topics in Mechanics and Materials. S. Prerequisite: MECH 524 or MECH 530.
Advanced topics in discipline of engineering mechanics and materials; associated analysis and manufacturing techniques.

MECH 784 Var. Supervised College Teaching.

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MECH 799A-M Var. Dissertation.

A) Bioengineering. **B)** Energy conversion. **C)** Environmental engineering. **D)** Heat and mass transfer. **E)** Industrial and systems engineering. **F)** Mechanics and design. **G)** Computer-assisted engineering. **H)** Robotics. **I)** Solar engineering. **J)** Computational fluids. **K)** Materials. **L)** Plasma engineering. **M)** Motorsport engineering.

° Alternate year offering (odd); * Alternate year offering (even); + Field trips; \$ Special course fee; NT Approved for nontraditional course offering (C = correspondence, O = online, T = telecourse, V = videotape/DVD); GT-*subcode*--State Guarantee Transfer course, the subcode refers to the specific category the course fulfills. (See Introduction for more information.) Date printed: 6/10/2010