

# M E-MECHANICAL ENGINEERING

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## **M E 159. Graphical Communication and Design** **2 Credits (1+3P)**

Sketching and orthographic projection. Covers detail and assembly working drawings, dimensioning, tolerance specification, and design projects.

**Prerequisite(s)/Corequisite(s):** MATH 1250G.

## **M E 201. Supplemental Instruction to Dynamics** **1 Credit (1)**

Optional workshop for students in M E 237. The workshop focuses on problem solving skills associated with M E 237. Course does not count toward departmental degree requirements. May be repeated up to 1 credits. Restricted to Las Cruces campus only.

**Corequisite(s):** M E 237.

## **M E 202. Supplemental Instruction to Thermodynamics** **1 Credit (1)**

Optional workshop for students in ME 240. The workshop focuses on problem solving skills associated with ME240. Course does not count toward departmental degree requirements. Restricted to Las Cruces campus only.

**Corequisite(s):** M E 240.

## **M E 210. Electronics and System Engineering** **3 Credits (2+3P)**

Introduction to microcontrollers, measurement systems, motion actuators, sensors, electric circuits, and electronic devices and interfacing. Students required to work individually and in teams to design and test simple electromechanical systems. May be repeated up to 3 credits. Restricted to Las Cruces campus only.

**Prerequisite(s):** MATH 1521G or MATH 1521H.

## **M E 222. Introduction to Product Development** **3 Credits (2+3P)**

Introduction to modern methods used in the realization of products. Traditional manufacturing processes, such as metal stamping, turning, milling, and casting are reviewed. Modern methods of rapid prototyping and model making are discussed in context of computer-aided design. Techniques for joining metals, plastics, and composites are discussed. Role of quality control is introduced. May be repeated up to 3 credits.

Restricted to: exclude majors.

**Prerequisite(s):** M E 159 or E T 110.

## **M E 228. Engineering Analysis I** **3 Credits (3)**

Introduction to engineering analysis with emphasis on engineering applications. Topics include ordinary differential equations, linear algebra, and vector calculus with focus on analytical methods. Restricted to Las Cruces campus only.

**Prerequisite(s):** MATH 2530G.

## **M E 234. Mechanics-Dynamics** **3 Credits (3)**

Kinematics and dynamic behavior of solid bodies utilizing vector methods.

**Prerequisite(s)/Corequisite(s):** MATH 2530G. Prerequisite(s): C E 233.

## **M E 236. Engineering Mechanics I** **3 Credits (3)**

Force systems, resultants, equilibrium, distributed forces, area moments, friction, and kinematics of particles. May be repeated up to 3 credits.

**Prerequisite(s)/Corequisite(s):** PHYS 1310G. Prerequisite(s): MATH 1521G or MATH 1521H.

## **M E 237. Engineering Mechanics II** **3 Credits (3)**

Kinetics of particles, kinematics and kinetics rigid bodies, systems of particles, energy and momentum principles, and kinetics of rigid bodies in three dimensions. May be repeated up to 3 credits.

**Prerequisite(s)/Corequisite(s):** MATH 2530G. Prerequisite(s): M E 236.

## **M E 240. Thermodynamics** **3 Credits (3)**

First and second laws of thermodynamics, irreversibility and availability, applications to pure substances and ideal gases.

**Prerequisite:** PHYS 1310G.

## **M E 261. Mechanical Engineering Problem Solving** **3 Credits (2+3P)**

Introduction to programming syntax, logic, and structure. Numerical techniques for root finding, solution of linear and nonlinear systems of equations, integration, differentiation, and solution of ordinary differential equations will be covered. Multi function computer algorithms will be developed to solve engineering problems. May be repeated up to 3 credits.

**Prerequisite(s):** MATH 1521G or MATH 1521H.

## **M E 301. Supplemental Instruction to Engineering Analysis II** **1 Credit (1)**

Optional workshop for students in ME 328. The workshop focuses on problem solving skills associated with ME328. Course does not count toward departmental degree requirements. May be repeated up to 1 credits.

**Corequisite(s):** M E 328.

## **M E 302. Fluids Supplemental Instruction** **1 Credit (1)**

Optional workshop for students in ME 338 or AE 339. The workshop focuses on problem solving skills associated with fluid mechanics. Course does not count toward departmental degree requirements.

**Corequisite(s):** M E 338 or A E 339.

## **M E 326. Mechanical Design** **3 Credits (3)**

Design methodology and practice for mechanical engineers. May be repeated up to 3 credits.

**Prerequisite(s):** M E 237 and C E 301.

## **M E 328. Engineering Analysis II** **3 Credits (3)**

Advanced engineering analysis with emphasis on engineering applications. Topics include systems of ordinary differential equations, Fourier analysis, partial differential equations, and functions of complex variable with focus on analytical methods. May be repeated up to 3 credits.

**Prerequisite(s):** M E 228.

## **M E 331. Intermediate Strength of Materials** **3 Credits (3)**

Covers stress and strain, theories of failure, curved flexural members, flat plates, pressure vessels, buckling, and composites. May be repeated up to 3 credits.

**Prerequisite(s):** C E 301 and M E 328.

**M E 332. Vibrations****3 Credits (3)**

Vibration of single and n-degree of freedom systems considering free, forced, and damped motion. Lagrange s equations. Dynamic stability. Controls. Matrix iteration. May be repeated up to 3 credits.

**Prerequisite(s):** M E 328, M E 237, and M E 261.

**M E 333. Intermediate Dynamics****3 Credits (3)**

Three dimensional kinematics and kinetics, orbal motion, Lagrange s equations, dynamic stability, and controls. May be repeated up to 3 credits.

**Prerequisite(s):** M E 328 and M E 237.

**M E 338. Fluid Mechanics****3 Credits (3)**

Properties of fluids. Fluid statics and fluid dynamics. Applications of the conservation equations continuity, energy, and momentum to fluid systems. May be repeated up to 3 credits. Restricted to: M E majors.

**Prerequisite(s):** M E 237 and M E 228.

**M E 340. Applied Thermodynamics****3 Credits (3)**

Thermodynamic cycles, Maxwell relations, Gibbs and Helmholtz functions, mixtures, psychometrics, chemical reactions, chemical equilibrium.

**Prerequisite:** M E 240.

**M E 341. Heat Transfer****3 Credits (3)**

Fundamentals of conduction, convection, and radiation. Design of heat transfer systems. May be repeated up to 3 credits.

**Prerequisite(s):** M E 240, M E 338 or A E 339, and M E 228.

**M E 345. Experimental Methods I****3 Credits (2+3P)**

Emphasis on experimental techniques, basic instrumentation, data acquisition and analysis, and written presentation of results. Includes experiments in dynamics and deformable body mechanics. May be repeated up to 3 credits.

**Prerequisite(s)/Corequisite(s):** C E 301. **Prerequisite(s):** M E 228, M E 210, and M E 237.

**M E 349. MAE Career Seminar****1 Credit (1)**

Seminar course covering topics relevant to mechanical and aerospace engineering juniors (job placement, interviewing techniques, resume preparation, etc.). Restricted to: M E and A E majors.

**Prerequisite(s):** Junior Standing.

**M E 400. Undergraduate Research****1-3 Credits**

Performed with the direction of a department faculty member. May be repeated for a maximum of 6 credits.

**Prerequisite:** consent of faculty member.

**M E 401. Heating/Air-Conditioning System****3 Credits (3)**

HVAC system design including heating and cooling load calculations, psychometrics, piping, duct layout, and system control. May be repeated up to 3 credits.

**Prerequisite(s):** M E 340 and M E 341.

**M E 405. Special Topics****3 Credits (3)**

Topics of modern interest to be offered by the departmental staff. May be repeated up to 12 credits.

**Prerequisite(s):** Senior standing.

**M E 425. Design of Machine Elements****3 Credits (3)**

Design of machine elements through the application of mechanics. Fatigue and theories of failure. Design projects assigned.

**Prerequisite(s):** M E 326.

**M E 426. Design Project Laboratory I****3 Credits (6P)**

Students address a design problem in which innovation and attention to detail are emphasized. Solution of the problem entails applications of mechanics and/or the thermal sciences.

**Prerequisite(s)/Corequisite(s):** M E 425.

**M E 427. Design Project Laboratory II****3 Credits (6P)**

Continuation of M E 426.

**Prerequisite:** M E 426.

**M E 445. Experimental Methods II****3 Credits (2+3P)**

Emphasis on experimental techniques, instrumentation and data acquisition in fluid mechanics, heat transfer, and thermodynamics. Laboratory results will be presented in written and verbal formats.

**Prerequisite(s):** (M E 338 or A E 339), M E 340, M E 341, and M E 345.

**M E 449. Mechanical Engineering Senior Seminar****1 Credit (1)**

Senior seminar course covering topics relevant to graduating mechanical engineering seniors (job placement, interviewing techniques, resume preparation).

**Prerequisite:** senior standing.

**M E 452. Introduction to Automation and Control System Design****3 Credits (2+3P)**

Control system design and implementation. Emphasis on practical applications of traditional control algorithms to mechanical engineering applications in thermofluid systems and mechanical systems. Design of feedback analog and digital control systems. Introduction to robots and automation. Lab assignments include programming industrial robotic and automation systems. May be repeated up to 3 credits.

**Prerequisite(s):** M E 328 and M E 237, or consent of instructor.

**M E 456. Experimental Modal Analysis****3 Credits (3)**

Emphasis on hands-on techniques for structural vibration tests for practical applications. Interpretation of experimental results by means of advanced signal processing tools, basic system identification methodology, and reduced-order modeling procedures. May be repeated up to 3 credits.

**Prerequisite(s):** M E 332, M E 228, and M E 261, or consent of instructor.

**M E 460. Applied Finite Elements****3 Credits (3)**

Introduction to the practical aspects of structural finite element modeling. Course focuses on providing a working knowledge of how to effectively incorporate finite element techniques into the design process. May be repeated up to 3 credits. Crosslisted with: M E 518.

**Prerequisite(s):** M E 425.

**M E 481. Alternative and Renewable Energy****3 Credits (3)**

Current and future energy needs of the United States and the world will be considered primarily from the standpoint of renewable energy sources such as solar, wind, ocean, and biomass. Technical, economic, and environmental aspects of each technology will be addressed.

**Prerequisite(s):** M E 341, and (M E 338 or A E 339).

**M E 487. Mechatronics****3 Credits (2+3P)**

Introduction to the analysis and design of computer-controlled electromechanical systems, including data acquisition and conversion, force and motion sensors, actuators, mechanisms, feedback control, and robotic devices. Students required to work in teams to construct and test simple robotic systems. May be repeated up to 3 credits.

**Prerequisite(s):** M E 210 and M E 345.

**M E 502. Elasticity I****3 Credits (3)**

Introduction to stress tensor, strain tensor, constitutive law, energy theorems, plane stress and plane strain. Also covers torsion of shafts and propagation of stress waves in elastic solids.

**M E 503. Thermodynamics****3 Credits (3)**

A comprehensive study of the first and second laws of thermodynamics, nonequilibrium processes, equations of state, and statistical thermodynamics.

**M E 504. Continuum Mechanics****3 Credits (3)**

Basic introduction to the Mechanics of Continuous Media. Its aim is to prepare the student for more advanced courses in Solid and Fluid Mechanics. The topics to be covered include: introduction to Cartesian tensors, tensor algebra and calculus; Lagrangian and Eulerian kinematics; Cauchy and Piola-Kirchhoff stresses; general principles of conservation; constitutive theory for ideal fluids, Newtonian and non-Newtonian fluids, finite and linear elasticity.

**M E 505. Fundamentals of the Theory of Plasticity****3 Credits (3)**

Basic concepts in continuum mechanics, equations of the plastic state, equations of elastic-plastic equilibrium, criteria for yielding, initial and subsequent yield surfaces, two-dimensional and axi-symmetric plasticity problems, dynamic problems.

**Prerequisite(s):** M E 502.

**M E 509. Individualized Study****3 Credits (3)**

Individualized study covering specialized topics in mechanical and aerospace engineering. Consent of instructor required.

**M E 510. Special Topics****1-6 Credits**

Topics in mechanical engineering. May be repeated for a maximum of 6 credits.

**Prerequisite:** consent of the department head.

**M E 511. Dynamics****3 Credits (3)**

An advanced study of the dynamical behavior of systems of particles and rigid bodies, with emphasis on the theoretical background of dynamics.

**M E 512. Vibrations****3 Credits (3)**

Free and forced vibrations for discrete and continuous systems with single or multiple degrees of freedom. Introduction to nonlinear and random vibration and solution techniques for such systems.

**M E 517. Nonlinear Dynamics and Chaos****3 Credits (3)**

Singular points, periodic solutions, stability, and local bifurcations for ODEs and maps; phase space methods, invariant manifolds, and Poincare maps; nonsmooth, periodic, time-delay, and Hamiltonian systems; perturbation, averaging, and harmonic balance methods; center manifold reduction and normal forms; strange attractors, Liapunov exponents, attractor dimension; dissipative and Hamiltonian chaos

**M E 518. Finite Element Analysis****3 Credits (3)**

Introduction to finite element method. Topics include mathematical modeling, variational formulation, shape functions, truss, beam, solid, and shell elements. Includes static, dynamic, and nonlinear analysis. May be repeated up to 3 credits. Crosslisted with: M E 460.

**M E 520. Micromechanics****3 Credits (3)**

The course covers fundamentals of micromechanics: point force solution, Eshelby's problem, various approximate methods to calculate effective material properties of inhomogeneous materials, variational principles of the mechanics of composites. The history of micromechanics is discussed from Navier and Cauchy to current state of the art.

**Prerequisite(s):** M E 502.

**M E 527. Control of Mechanical Systems****3 Credits (3)**

Rigorous introduction to the control of dynamical systems, with a focus on mechanical systems. Includes basic systems theory, controllability, feedback and stabilization, observers and dynamic feedback, and applications of methods to systems of importance in mechanical engineering. Consent of Instructor required. Crosslisted with: A E527.

**Prerequisite(s):** M E 452 or equivalent, or consent of instructor.

**M E 530. Intermediate Fluid Mechanics****3 Credits (3)**

Application of exact and empirical solutions to fundamental flow problems, including viscous and inviscid behavior. These applications establish a theoretical basis for the origin and physical role of common terms in the governing equations.

**M E 533. Computational and Theoretical Fluid Mechanics****3 Credits (3)**

Application of fluid mechanics theory and computational approaches to advanced flow problems, including viscous/inviscid and laminar/turbulent behavior. Complex flow problems addressed through development of a theoretical formulation, followed by application of computational fluid dynamic (CFD) tools, and finally presentation and validation of solution data.

**Prerequisite:** M E 530 or consent of instructor.

**M E 534. Advance Computational Fluid Dynamics****3 Credits (3)**

Advanced techniques for large-scale numerical simulations of fluid flows: spectral numerical methods, including Fourier and other expansions, Galerkin and collocation projections, computational methods to solve incompressible and compressible Navier-Stokes equations, high-resolution methods for hyperbolic equations with discontinuous solutions, and issues related to implementation on supercomputers.

**Prerequisite(s):** M E 533.

**M E 536. Hydrodynamic Stability and Turbulence**

**3 Credits (3)**

Introduction to fundamentals of hydrodynamic stability, classical linear stability analysis of parallel shear flows and rotating flows, nonlinear stability, basic concepts in turbulence theory

**Prerequisite(s):** M E 533.

**M E 540. Intermediate Heat Transfer**

**3 Credits (3)**

Fundamentals of conduction, convection, and radiation heat transfer. Emphasis on the application of combined heat transfer to the solution of problems not accessible at the undergraduate level.

**M E 570. Engineering Analysis I**

**3 Credits (3)**

Introduction to engineering analysis with emphasis on engineering applications. Topics include linear algebra, linear ordinary differential equations, and linear partial differential equations with focus on analytical methods.

**M E 580. Engineering Analysis II**

**3 Credits (3)**

Engineering analysis with emphasis on engineering applications. Topics include analytical and numerical methods in linear and nonlinear ordinary and partial differential equations.

**Prerequisite:** M E 570 or consent of instructor.

**M E 587. Mechatronics**

**3 Credits (2+3P)**

Introduction to the analysis and design of computer-controlled electromechanical systems, including data acquisition and conversion, force and motion sensors, actuators, mechanisms, feedback control, and robotic devices. Students required to work in teams to construct and test simple robotic systems. Crosslisted with: M E 487.

**M E 598. Special Research Programs**

**1-3 Credits**

Individual investigations, either analytical or experimental. May be repeated for a maximum of 6 credits.

**M E 599. Master's Thesis**

**15 Credits**

Thesis.

**M E 600. Doctoral Research**

**1-15 Credits**

This course number is used for assigning credit for research performed prior to successful completion of the doctoral qualifying examination.

**M E 698. Special Research Programs**

**1-3 Credits**

May be repeated for a maximum of 6 credits.

**M E 700. Doctoral Dissertation**

**15 Credits**

Dissertation.