M E-MECHANICAL ENGINEERING

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 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. Restricted to Las Cruces campus only. May be repeated up to 3 credits.
Prerequisite: C- or better grade in MATH 1521G or MATH 1521H or ENGR 190.
Learning Outcomes
1. Ability to apply knowledge if mathematics, science, and engineering; Ability to design and conduct experiments, as well as to analyze and interpret data; Ability to design a system, component or process to meet desired needs within realistic constraints; Ability to identify, formulate, and solve engineering problems; Ability to use the techniques, skills and modern tools necessary for engineering practice.

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.
Prerequisite: C- or better grades in M E 159 or E T 110.
Learning Outcomes
1. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

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. May be repeated up to 3 credits.
Prerequisite: C- or better grades in MATH 2530G.
Learning Outcomes
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

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. May be repeated up to 3 credits.
Prerequisite: C- or better grades in PHYS 1310G.
Learning Outcomes
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

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: C- or better grades in MATH 1521G or MATH 1521H or ENGR 190.
Learning Outcomes
1. Ability to apply knowledge of mathematics, science, and engineering; Ability to identify, formulate, and solve engineering problems; Ability to use the techniques, skills and modern tools necessary for engineering practice.

M E 326. Mechanical Design
3 Credits (3)
Design methodology and practice for mechanical engineers. May be repeated up to 3 credits. C- or better grades are required for all the prerequisite courses.
Prerequisite: (M E 237 or ENGR 234) and C E 301.
Learning Outcomes
1. Ability to design a system, component or process to meet desired needs within realistic constraints; Ability to function on multidisciplinary teams; Understanding of professional and ethical responsibility; Knowledge of contemporary issues.

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: C- or better grades in M E 228.
Learning Outcomes
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

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. Restricted to: M E majors. May be repeated up to 3 credits.
Prerequisite: (C- or better grade in M E 237 or ENGR 234) and (C- or better grade in M E 228 or PHYS 395).
Learning Outcomes
1. Ability to apply knowledge of mathematics, science, and engineering; Ability to design and conduct experiments, as well as to analyze and interpret data; Ability to design a system, component or process to meet desired needs within realistic constraints; Ability to identify, formulate, and solve engineering problems.

M E 340. Applied Thermodynamics
3 Credits (3)
Thermodynamic cycles, Maxwell relations, Gibbs and Helmholtz functions, mixtures, psychometrics, chemical reactions, chemical equilibrium. May be repeated up to 3 credits.
Prerequisite: C- or better grades in M E 240.
Learning Outcomes
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

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: C- or better grades in M E 240, (C- or better grades in M E 338 or A E 339), and (C- or better grades in M E 228 or PHYS 395).
Learning Outcomes
1. Students have the ability to apply knowledge of mathematics, science, and engineering; Students have the ability to identify, formulate, and solve engineering problems.

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: (C- or better grades in M E 228 or PHYS 395), (C- or better grades in M E 210 or PHYS 2140), and (C- or better grades in M E 237 or ENGR 234).
Prerequisite/Corequisite: C E 301.
Learning Outcomes
1. Ability to design and conduct experiments, as well as to analyze and interpret data; Ability to communicate effectively; Ability to use the techniques, skills and modern tools necessary for engineering practice.

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. May be repeated up to 3 credits.
Prerequisite: C- or better grades in M E 326.
Learning Outcomes
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

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. May be repeated up to 3 credits.
Prerequisite: C- or better grades in (M E 338 or A E 339), M E 340, M E 341, and M E 345.
Learning Outcomes
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics An ability to communicate effectively with a range of audiences An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

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. Control System Design
3 Credits (3)
Introduction to the control of dynamical systems, with a focus on mechanical and aerospace systems, including basic systems theory, controllability / observability, feedback and stabilization, PID controls, root-locus plot, and Bode diagram.
Prerequisite: M E 261, M E 328 and (M E 237 or ENGR 234) .
Learning Outcomes
1. Construct a block diagram to find a transfer function for a dynamical system; Analyze control systems by utilizing various linear control theories such as root-locus design method, bode / Nyquist plots, and lead / lag compensation techniques; Design and simulate automatic control systems for mechanical and aerospace engineering applications.

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 457. Engineering Failure Analysis
3 Credits (3)
Introduction to failure theories and causes. Topics include general procedures for failure analysis, ductile and brittle modes of failure, elements of fracture mechanics, fractography, and failures in various engineering applications due to fatigue, wear, corrosion, design or processing defects. May be repeated up to 3 credits.
Learning Outcomes
1. Students will learn how to systematically conduct failure analysis, identify cause(s) of failure, suggest remedial steps to prevent failures and/or improve performance for a variety of engineering applications involving metals, polymers, ceramics and composites.

M E 458. Properties and Mechanical Behavior of Materials
3 Credits (3)
Understanding the microstructure of engineering materials and their influence on mechanical behavior. Topics include Material Structure and Physical Properties, Thermodynamics and Kinetics of Materials, Mechanical Properties, Strengthening Mechanisms, Time and Temperature Dependent Behavior, Degradation, Fatigue, and Fracture.
Learning Outcomes
1. Students will learn how to correlate mechanical behavior of materials with their microstructure, processing history and composition. As practicing engineers, they will be able to recognize impact of operating conditions, predict life span, and design materials to improve reliability and efficiency. They will be able to select appropriate materials for a given application from class of materials such as metals, polymers, ceramics and composites.

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 486. Introduction to Robotics
3 Credits (3)
This course provides students with an introduction to the theories and methods for analysis, design, and control of robotic manipulators. This course is devoted to understanding the spatial descriptions and transformations, kinematics, and dynamics of these mechanisms and how to practically implement these concepts into actual robotic manipulators.
Prerequisite: M E 328 and (ENGR 234 or M E 237).
Learning Outcomes
1. Model and analyze the kinematics and dynamics of robotic manipulators; Program and control these robotic platforms; Apply the theoretical methods into industrial robots; Implement the knowledge and experiences in real-world engineering projects.

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 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 527. Linear Systems Theory
3 Credits (3)
Introduction to control of linear multi-input-multi-output (MIMO) systems. Topics include representation of system dynamics using the state-space model, linearization, internal and input-to-output stability, controllability, observability, optimal control, linear quadratic regulator, and observer. May be repeated up to 3 credits.
Learning Outcomes
1. Students are able to design linear multi-input-multi-output (MIMO) control systems.

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 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 557. Engineering Failure Analysis
3 Credits (3)
Introduction to failure theories and causes. Topics include general procedures for failure analysis, ductile and brittle modes of failure, elements of fracture mechanics, fractography, and failures in various engineering applications due to fatigue, wear, corrosion, design or processing defects. May be repeated up to 3 credits.

M E 558. Properties and Mechanical Behavior of Materials
3 Credits (3)
Understanding the microstructure of engineering materials and their influence on mechanical behavior. Topics include Material Structure and Physical Properties, Thermodynamics and Kinetics of Materials, Mechanical Properties, Strengthening Mechanisms, Time and Temperature Dependent Behavior, Degradation, Fatigue, and Fracture. May be repeated up to 3 credits.
Prerequisite: CHME 361.

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.