M E-MECHANICAL ENGINEERING (M E)

M E 102. Mechanical Engineering Orientation
1 Credit
Emphasis on tours of M E labs and NMSU facilities that illustrate possible career paths for mechanical engineers. Students are introduced to department faculty, student organizations, and support services at NMSU. Topics include role of good communication skills, using modern technology, team building, and intellectual property. Students are advised in planning balance of their academic program. Restricted to majors.

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. Pre/ Corequisite(s): MATH 190G.

M E 201. Supplemental Instruction to Dynamics
1 Credit
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
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. Restricted to Las Cruces campus only. Prerequisite(s): MATH 192.

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. Prerequisite: M E 159.

M E 228. Engineering Analysis I
3 Credits
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 291.

M E 234. Mechanics-Dynamics
3 Credits
Kinematics and dynamic behavior of solid bodies utilizing vector methods. Prerequisite(s)/Corequisite(s): MATH 291G. Prerequisite(s): C E 233.

M E 236. Engineering Mechanics I
3 Credits
Force systems, resultants, equilibrium, distributed forces, area moments, friction, and kinematics of particles. Pre/ Restricted to: Main campus only. Prerequisite(s): MATH 192G. Corequisite(s): PHYS 215G.

M E 237. Engineering Mechanics II
3 Credits
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 291. Prerequisite(s): M E 236 or C E 233.

M E 240. Thermodynamics
3 Credits
First and second laws of thermodynamics, irreversibility and availability, applications to pure substances and ideal gases. Prerequisite: PHYS 215G.

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. Prerequisite(s): MATH 192.

M E 301. Supplemental Instruction to Engineering Analysis II
1 Credit
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
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
Design methodology and practice for mechanical engineers. May be repeated up to 3 credits. Prerequisite(s): M E 234 or M E 237 and C E 301.

M E 328. Engineering Analysis II
3 Credits
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 or MATH 392.
M E 330. Environmental Management Seminar I
1 Credit
Survey of practical and new developments in hazardous and radioactive waste management provided through a series of guest lectures and reports of ongoing research. Restricted to: Main campus only. Restricted to M E majors. Crosslisted with: C E 330, CH 330, E E 330, E S 330, I E 330, WERC 330 and E T 330

M E 331. Intermediate Strength of Materials
3 Credits
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 or MATH 392.

M E 332. Vibrations
3 Credits
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 234 or M E 237, and M E 261.

M E 333. Intermediate Dynamics
3 Credits
Three dimensional kinematics and kinetics, orbital motion, Lagrange's equations, dynamic stability, and controls. May be repeated up to 3 credits.
Prerequisite(s): M E 328 and M E 234 or M E 237.

M E 338. Fluid Mechanics
3 Credits
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 234 or M E 237 and M E 228 or MATH 392.

M E 340. Applied Thermodynamics
3 Credits
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
Fundamentals of conduction, convection, and radiation. Design of heat transfer systems. May be repeated up to 3 credits.
Prerequisite(s): M E 240 and M E 228 or MATH 392.

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 or MATH 392, M E 210, and M E 234 or M E 237.

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
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
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
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
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
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
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 234 or M E 237, or consent of instructor.

M E 456. Experimental Modal Analysis
3 Credits
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 or MATH 392, and M E 261, or consent of instructor.
M E 460. Applied Finite Elements
3 Credits
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.
Prerequisite(s): M E 425.

M E 481. Alternative and Renewable Energy
3 Credits
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 483. Introduction to Combustion
3 Credits
Combustion is one of the most fundamental phenomena related to human activities, such as obtaining thermal energies. Fundamental phenomena and physics related to combustion will be discussed, including thermodynamics, chemical reactions; combustion kinetics, premixed and diffuse flames, and examples. May be repeated up to 3 credits.
Prerequisite(s): CHEM 112G, M E 228 or MATH 392, and M E 340.

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 or E E 201 and M E 345.

M E 502. Elasticity I
3 Credits
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
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
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
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
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
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
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 514. Advanced Composite Materials
3 Credits
Study on the anisotropic elasticity, strength of anisotropic materials and micromechanics. Topics from micromechanics and macromechanics through lamination theory and examples of plate bending, buckling and vibration problems. Course taught on an as-needed basis.

M E 517. Nonlinear Dynamics and Chaos
3 Credits
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
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.

M E 520. Micromechanics
3 Credits
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
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 E 527.
Prerequisite(s): M E 452 or equivalent, or consent of instructor.
M E 529. Nonlinear and Optimal Control
3 Credits
Introduction to optimal control theory, Pontryagin's Maximum Principle, control of simple mechanical systems, Lagrangian and Hamiltonian methods, introduction to geometric control-Lie algebras, distributions, controllability and observability

M E 530. Intermediate Fluid Mechanics
3 Credits
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
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
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
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
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
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
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 598. Special Research Programs
1-3 Credits
Individual investigations, either analytical or experimental. May be repeated for a maximum of 6 credits.