Engineering Mechanics (E M)

E M 306 Statics 3 Hours
Vector algebra, force systems, free-body diagrams; engineering applications of equilibrium, including frames, friction, distributed loads; centroids, moments of inertia.

E M 311M Dynamics 3 Hours
Kinematics, dynamics, and energy and momentum methods for points as well as 2D/3D rigid bodies. Describe and predict the motion of different types of rigid bodies in space and time. Vibrations of simple systems.

E M 319 Mechanics of Solids 3 Hours
Internal forces and deformations in solids; stress and strain in elastic and plastic solids; application to simple engineering problems.

E M 119S, 219S, 319S, 419S, 519S, 619S, 719S, 819S, 919S Topics in Engineering Mechanics 1-9 Hours
Used to record credit the student earns while enrolled at another institution in a program administered by the University's Study Abroad Office or the school's International Engineering Education programs.

E M 119T, 219T, 319T, 419T, 519T, 619T, 719T, 819T, 919T Topics in Engineering Mechanics 1-9 Hours

E M 339 Advanced Strength of Materials 3 Hours
Curved beams, shear deformation, beam columns, beams on elastic foundations; inelastic behavior of members; elementary plate bending.

E M 360 Topics in Engineering Mechanics 3 Hours
Advanced work in the various areas of engineering mechanics, based on recent developments.

E M 179S, 279S, 379S, 479S, 579S, 679S, 779S, 879S, 979S Topics in Engineering Mechanics 1-9 Hours
Used to record credit the student earns while enrolled at another institution in a program administered by the University's Study Abroad Office or the school's International Engineering Education Programs.

E M 380 Theory of Plasticity 3 Hours
Physical basis of plastic deformation; mathematical theory of incremental plasticity; total theories; numerical implementation; slip and physical theories of plastic deformation; rate dependent (viscoplastic) models; applications to several engineering problems.

E M 381 Advanced Dynamics 3 Hours
Dynamics of systems of particles and rigid bodies; vibration theory; analytical dynamics, including Lagrangian and Hamiltonian formulations; dynamic stability; continuous systems.

E M 382 Nonlinear Analysis 3 Hours
Methods for analyzing various types of nonlinear differential equations of dynamical systems; exact methods, perturbation and averaging techniques, direct method of Liapunov.

E M 384K Continuum Mechanics 3 Hours
Foundations of the general nonlinear theories of continuum mechanics; general treatment of motion and deformation of continua, balance laws, constitutive theory; particular application to elastic solids and simple materials.

E M 384L Structural Dynamics 3 Hours
Free and forced vibration of single-degree-of-freedom, multiple-degree-of-freedom, and continuous systems. Lagrange's equations and Hamilton's principle; discretization of continuous systems; numerical methods for response and algebraic eigenvalue problems.

E M 386K Analytical Methods I 3 Hours
Basic topics in real and complex analysis, ordinary and partial differential equations, and other areas of applied mathematics with application to applied mechanics.

E M 386L Analytical Methods II 3 Hours
Continuation of Engineering Mechanics 386K.

E M 386M Functional Analysis in Theoretical Mechanics 3 Hours
An introduction to modern concepts in functional analysis and linear operator theory, with emphasis on their application to problems in theoretical mechanics; topological and metric spaces, norm linear spaces, theory of linear operators on Hilbert spaces, applications to boundary value problems in elasticity and dynamical systems.

E M 386N Qualitative Methods in Nonlinear Mechanics 3 Hours
A study of methods for assessing the qualitative behavior of solutions to equations governing nonlinear continuum mechanics.

E M 387 Foundations of Fluid Mechanics 3 Hours
Governing equations in differential and integral forms; applications to both inviscid and viscous flow problems.

E M 388 Solid Mechanics I 3 Hours
Mathematical description of stress, deformation, and constitutive equations of solid mechanics; boundary value problems of elasticity.

E M 388F Fracture Mechanics 3 Hours
Griffith theory of brittle crack propagation, other theories, crack toughness testing concepts.

E M 388L Solid Mechanics II 3 Hours
Continuation of Engineering Mechanics 388. Additional topics in elasticity, plasticity, viscoelasticity, variational methods, and other areas of solid mechanics.

E M 388M Micromechanics 3 Hours
Constitutive characterization of materials based on their microstructure. Relationships between internal structure and mechanical properties for composites, polycrystals, and polymers on the basis of linear elasticity, plasticity, and theories that account for rate-dependence.

E M 388N Mechanics of Soft Materials 3 Hours
Introduction to soft tissues and soft tissue mechanics; continuum mechanics (kinematics, stress, balance laws and hyperelasticity); and nonlinear finite element analysis in soft tissue mechanics.

E M 388S Soft Tissue Biomechanics 3 Hours
Introduction to soft tissues and soft tissue mechanics; continuum mechanics (kinematics, stress, balance laws and hyperelasticity); and nonlinear finite element analysis in soft tissue mechanics.

E M 388T Thin Film Mechanics 3 Hours
Discuss an extensive overview of mechanics-related subjects including stress, strain, fracture, delamination, instability, characterization, and important applications of thin films.

E M 388V Theory of Viscoelasticity 3 Hours
Introduction to linear viscoelasticity; methods of characterizing viscoelastic material behavior; analytical and approximate solution techniques for engineering problems, including contact, wave propagation, and thermoviscoelastic problems.

E M 389J Experimental Mechanics 3 Hours
Principles and techniques of measurement in mechanics; includes discussion of strain gauges, optical interference methods, photoelasticity, and dynamic measurements.

E M 391 Behavior and Mechanics of Active/Smart Materials 3 Hours
Continuum physics and thermodynamics including thermal, mechanical, electrical and magnetic behaviors of active/smart materials. Linear and non-linear behavior of ferroelectrics, ferromagnetic materials, and shape memory alloys. Crystal symmetry, domain structure, phenomenological constitutive models, phase-field modeling, and dielectric elastomers.

E M 392R Random Vibrations 3 Hours
Introduction to probability theory and its application to random excitation of linear and nonlinear systems; a probabilistic discussion of failure and fatigue in structures.

E M 393N Numerical Methods for Flow and Transport Problems 3 Hours
Approximate solution methods for flow and transport problems in engineering and applied science. Finite element, finite difference, and residual methods for linear and nonlinear problems.

E M 394 Structural Stability 3 Hours
Fundamental theory of buckling of elastic structural elements such as bars, frames, rings, plates, and shells; also special stability topics including inelastic buckling, creep buckling, and buckling under dynamic loading.

E M 394F Finite Element Methods 3 Hours
Derivation and implementation of the finite element method; basic coding techniques; application to problems of stress and diffusion.

E M 394G Computational Techniques in Finite Elements 3 Hours
Organization and data management in finite element codes; element models and calculations; equation solving; preprocessing and postprocessing.

E M 394H Advanced Theory of Finite Element Methods 3 Hours
Contemporary topics in the theory and application of finite element methods.

E M 394V Wave Propagation I 3 Hours
Solutions of linear wave equations; waves in elastic media, including plates and cylinders; transient waves, transform methods, asymptotic approximation.

E M 397, 697, 997 Topics in Advanced Engineering Mechanics 3,6,9 Hours

E M 397.1, 697.1, 997.1 Advanced Topics in Viscoelasticity 3,6,9 Hours

E M 397.2, 697.2, 997.2 Individual Research 3,6,9 Hours

E M 397.3, 697.3, 997.3 Advanced Computational Flows and Transport 3,6,9 Hours

E M 397.4, 697.4, 997.4 Grid Generation and Adaptive Grids 3,6,9 Hours

E M 397.5, 697.5, 997.5 Adaptive Boundary/Finite Element Methods 3,6,9 Hours

E M 397.6, 697.6, 997.6 Introduction to Machine Learning and Data Sciences 3,6,9 Hours
Discuss machine learning algorithms, including linear models, kernel machines, tree-based algorithms, density estimation, clustering, dimensionality reduction and deep neural networks; foundations of machine learning, including optimization theory, probability theory, advanced linear algebra, statistics; evaluation of machine learning methods; and convolutational neural networks.

E M 397R, 697R, 997R Individual Research 3,6,9 Hours
Must be arranged by mutual agreement between student and faculty member.

E M 397S Mechanics Seminar 3 Hours
Current topics in mechanics.

E M 397T Computational Mechanics Seminar 3 Hours
Current topics in computational mechanics.

E M 698 Thesis 6 Hours

E M 398R Master's Report 3 Hours
Preparation of a report to fulfill the requirement for the master's degree under the report option.

E M 398T Supervised Teaching in Engineering Mechanics 3 Hours
Teaching methods and objectives, criteria for evaluating teaching effectiveness, procedures and regulations, laboratory teaching.

E M 399W, 699W, 999W Dissertation 3,6,9 Hours