

MECHANICAL ENGINEERING (ME)

Courses

ME 5040. Adv Engineering Analysis I. 3 Credits.

Analytical methods for the solution of partial differential equations in engineering mechanics and physics, including: eigenfunction expansions; Fourier series; Sturm-Liouville theory and special functions. Prerequisite: Graduate student in engineering, mathematics, or physical sciences or Instructor permission.

ME 5110. Mechanical Behavior Materials. 3 Credits.

Isotropic and anisotropic elasticity; theory of plasticity; deformation mechanisms in crystalline solids; dislocation theory; creep behavior; advanced fatigue and fracture mechanisms. Prerequisites: ME 2110; Instructor permission.

ME 5120. Adv Engineering Materials. 3 Credits.

Advanced material processing; physical and mechanical principles of high-temperature alloys, light-weight materials, thin films, nanomaterials, and biomedical materials; elements of computational materials design. Prerequisite: Senior/Graduate student or Instructor permission.

ME 5160. Continuum Mechanics. 3 Credits.

Tensors, conservation laws, field equations for solids and fluids.

ME 5220. Adv Engr Thermodynamics I. 3 Credits.

Foundations of statistical mechanics. Gases and crystals. Chemical equilibrium. Irreversible processes. Prerequisite: Senior/Graduate student or permission.

ME 5230. Vortex Flows. 3 Credits.

General theorems of vorticity transport in fluids; methods for solution of vortex flows; application to wake vortices, turbulent wall-layer vortices, wing-tip vortices, intake vortices, vortex-structure interaction, vortex reconnection, vortex breakdown, tornadoes and hurricanes. Prerequisites: Content knowledge in fluid mechanics (such as ME 2230) is assumed.

ME 5240. Advanced Heat Transfer I. 3 Credits.

Analytical methods for multidimensional steady and transient heat conduction; phase change and moving boundaries. Thermal radiation exchange in enclosures; view factors; emitting/absorbing gases. Prerequisite: ME 2240 or equivalent; or Instructor permission.

ME 5370. Micro and Nano Systems. 3 Credits.

Operating principles, fabrication and design of engineered systems with submillimeter dimensions. Prerequisite: Senior/Graduate student in engineering or physical sciences.

ME 5410. Adv Bioengineering Systems. 3 Credits.

Advanced bioengineering design and analysis for current biomedical problems spanning molecular, cell, tissue, organ, and whole body systems including their interactions and emergent behaviors.

ME 5440. Biothermodynamics. 3 Credits.

Inter-disciplinary; guides the student through the thermodynamics of living organisms, comprised of the study of energy transformation in the life sciences. Designed for students from the STEM disciplines. Covers Gibbs free energy, statistical thermodynamics, binding equilibria, and reaction kinetics. Prerequisite: ME 2231, ME 2111, or BME 3600. Cross-listed with: BME 5440.

ME 5520. Computational Solid Mechanics. 3 Credits.

Project-based. Computational methods using the finite element analysis (FEA) applied to linear elastic and non-linear problems in the mechanics of deformable solids and structures, contact mechanics, and fracture mechanics. Hands-on computational experience using a commercial FEA software. Prerequisites: ME 1140, MATH 2544, and MATH 3201, or equivalent.

ME 5980. Numerical Methods for Engineer. 3 Credits.

Foundational concepts of numerical integration, numerical differentiation, and numerical approximation and solution of differential and partial differential equations of the type encountered in the analysis of engineering problems and data processing. Prerequisites: MATH 3201; MATH 2522 or MATH 2544. Cross-listed with: CEE 5980.

ME 5990. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.

ME 6040. Adv Engineering Analysis II. 3 Credits.

Advanced analytical techniques for problems in engineering mechanics and physics, including: integral transform methods Green's functions, perturbation methods, and variational calculus. Prerequisite: ME 5040 or equivalent.

ME 6120. Advanced Dynamics. 3 Credits.

Application of Lagrange's equation, Hamilton's principle to mechanical systems. Systems with constraints. Matrix formulation of problems in kinematics, dynamics. Stability of linear, nonlinear systems.

ME 6230. Advanced Fluid Dynamics. 3 Credits.

Stress in continuum; kinematics, dynamics; potential fields; Wing theory; Navier-Stokes equation; hydrodynamic stability; turbulence; laminar, turbulent boundary layer theory; transient flows; free laminar, turbulent flows; mixing.

ME 6250. Advanced Gas Dynamics. 3 Credits.

Transonic flows; hypersonic flows and shock relations; boundary layer interactions; high-temperature gases and aerothermodynamics; rarefied flows; computational methods. Prerequisite: ME 3250 or equivalent.

ME 6270. Turbulence. 3 Credits.

Description of turbulent flows; statistical and modeling of turbulent flows; Navier Stokes as a dynamical system; experimental and numerical approaches. Prerequisite: ME 2230.

ME 6391. Master's Thesis Research. 1-18 Credits.

Research for the Master's Thesis.

ME 6550. Multiscale Modeling. 3 Credits.

Computational modeling of the physics and dynamical behavior of matter composed of diverse length and time scales. Molecular simulation. Coarse-graining. Coupled atomistic/continuum methods.

ME 6990. Special Topics. 1-18 Credits.

Advanced topics in recently developed technical areas. Prerequisite: Three hours with Instructor permission.

ME 6991. Internship. 1-18 Credits.

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

ME 6993. Independent Study. 1-18 Credits.

A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

ME 6995. Graduate Independent Research. 1-18 Credits.

Graduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

ME 7491. Doctoral Dissertation Research. 1-18 Credits.

Research for the Doctoral Dissertation.

ME 7990. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.

ME 7991. Internship. 1-18 Credits.

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

ME 7995. Graduate Independent Research. 1-18 Credits.

Graduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.