4453 Laser Methods in Engineering (3) Prereq.: senior standing in the College of Engineering. Basic principles of lasers and their application to engineering problems.

4533 Engineering Use of Electronic Computers (3) Prereq.: ME 2533 or equivalent; or graduate standing. General rules of programming; construction of programs to solve mathematical problems common to all engineers; numerical methods including solutions to linear and nonlinear differential equations, least-squares approximation, interpolations, and integration.

4563 Mathematical Methods in Engineering (3) See MATH 4058.

4573 Interactive Computer Graphics (3) Prereq.: experience in mathematics and computer programming. Also offered as CSC 4536. Analytical treatment of graphics using the digital computer; graphical display and input devices; computer graphics systems and standards; two- and three-dimensional transformations; geometric modeling; interactive techniques; basic data structures; realism in 3-D graphics; future trends.

4583 Applied Interactive Graphics and Computer-Aided Design (3) F Prereq.: ME 4573 or equivalent. Also offered as CSC 4587. Application of interactive graphics techniques to solve specific problems in engineering design and data retrieval.

4611 Thermal System Laboratory (1) Prereq.: ME 2334 or equivalent and credit or registration in ME 4433 and 3603. 3 hrs. lab. Oral presentations required. Thermal system analysis and independent experimentation.

4621 Thermal Science Laboratory (1) Prereq.: ME 3603, 3834, 4433, or equivalent. Laboratory demonstrations and experimentation in fluid mechanics, thermodynamics, and heat transfer concepts.

4633 Internal Combustion Engines (3) Prereq.: ME 2334 or 3333 or equivalent. Classification of internal combustion engines, gas turbines, cycles with different components, spark-ignition gasoline engines, detonation, carburetion, compression-ignition engines, combustion and diesel knock, fuel atomization and atomizers, combustion chambers, two- and four-stroke cycle engines, and supercharging.

4643 Thermal Environmental Engineering (3) Prereq.: ME 2334 and credit or registration in ME 4433; or equivalent. Design of thermal environment for humans, animals, processes, and inanimate objects; the means of control.

4663 Power Plant Engineering (3) Prereq.: ME 2334 and 4433; or equivalent. Power plants for industrial and central-station use; emphasis on cycles, design, capabilities, and economics of the plant as a whole; components used in various types of plants.

4673 Introduction to Modern Control Theory (3) Prereq.: ME 4183 or equivalent. State space modeling, controllability, observability and stability, pole placement, optimal control laws via minimum principle and dynamic programming.

4683 Sensors and Actuators (3) V Prereq.: EE 3590; ME 3433. Basic knowledge and operational principles of various transduction (sensing and actuating) methods, especially electro mechanical sensors and actuators; actual designing, building, and testing transducers.

4723 Advanced Materials Analysis (3) F Prereq.: ME 2734, 3701 or equivalent. 1 hr. lecture; 6 hrs. lab. Concepts and operation of modern analytical instruments using photon or electron beams and X-rays; macroscopic and microscopic examination of materials coupled with separate and combined testing of mechanical, tribological, and corrosion properties.

4733 Deformation and Fracture of Engineering Materials (3) F Prereq.: CE 3400 and either ME 2733 or equivalent. Effect of temperature, strain rate, corrosion, and microstructure on stress-strain behavior and fracture of engineering materials, including metals, ceramics, and plastics.

4743 Kinetics in Materials Processes (3) Prereq.: ME 2334, ME 2733 or equivalent. Applications of the principles of diffusion, phase transformation, and thermodynamics to describe the kinetics of micro structural evolution in engineering materials.

4763 Fundamentals of Corrosion Science and Engineering (3) F Prereq.: ME 2733 or equivalent, and any first course in thermodynamics. Corrosion principles; polarization, passivation, inhibition, and other phenomena; principal methods used in corrosion prevention.

4783 Composite Materials: Manufacturing, Properties, and Design (3) Prereq.: ME 2733 and CE 3400 or equivalent. Constituent materials, micro- and macromechanics, mechanical behavior, fracture, manufacturing and design of components made of composite materials, including polymer, ceramic, and metal matrix materials.

4813 Interdisciplinary Fluid Dynamics: Physical Concepts (3) Prereq.: Diff. Equations and Introductory Physics. Also offered as HNRS 4813. An introduction to fluid dynamics from a multi-disciplinary perspective, emphasizing theoretical, mathematical and physical concepts of fluid flows, and their application to a range of physical scales and disciplines.


4843 Gas Dynamics (3) Prereq.: ME 2334; a grade of "C" or better in MATH 2090; or equivalent. Derivation and review of basic equations of compressible fluid flow; reduction of the general problem to 1-D flow, 1-D flow in nozzles with and without friction; 1-D flow with heat addition; normal shock wave, Prandtl-Meyer turn, and oblique shock waves.

4853 Turbomachinery (3) Prereq.: ME 2334, 3834, and 4433. Preliminary design of axial- and radial-flow pumps, compressors, and turbines; determination of optimum flow angles and dimensions, blade design, blade selection, and performance prediction.

4933 Advanced Topics in Mechanical Engineering (3) May be taken for a max. of 6 hrs. of credit when topics vary. Two sections may be taken concurrently.

4943 Special Problems in Aerospace Engineering (3) Prereq.: senior standing in mechanical engineering or related discipline. May be taken for a max. of 12 sem. hrs. of credit when topics vary. Aerodynamic problems of special interest in the analysis and design of water, land, air, and space transportation systems.

7153 Advanced Vibrations (3) Prereq.: ME 4143 or equivalent. Modeling and response of continuous vibratory systems; inverse problems in vibration; active vibration control; dynamic absorption; wave propagation and reflection; numerical methods for continuous systems.

7233 Advanced Machine Design (3) S Prereq.: ME 4244 or equivalent.

7243 Bearing Design and Lubrication (3) Prereq.: consent of instructor. Derivation of fluid flow in bearings; principles of hydrodynamics lubrication and application to journal and thrust bearings; effect of environment on type of lubrication systems and lubricants; heat generation in bearing and heat transfer; compressible fluid and solid lubricants.

7263 Computer-Aided Geometric Modeling (3) S Prereq.: ME 4573 or equivalent. Mathematical elements of modeling complex free-form geometry in two and three dimensions for design, analysis, and display; wireframe, surface, and solid geometric modeling; computer graphics and algebraic, computational, and projective geometry.

7433 Advanced Heat Transfer I (3) F Prereq.: MATH 4058 or equivalent. Steady and transient heat conduction.

7443 Advanced Heat Transfer II (3) F Prereq.: ME 7843 or equivalent. Convection heat transfer.

7453 Advanced Heat Transfer III (3) S Prereq.: consent of instructor. Radiation heat transfer and advanced topics.

7533 Numerical Methods in Applied Mechanics (3) Computer methods used to solve engineering problems; advanced numerical methods.

7663 Advanced Experimental Methods (3) S Prereq.: consent of instructor. 2 hrs. lecture; 3 hrs. lab. Applied course in contemporary analog and digital laboratory tools and techniques.

7633 Advanced Engineering System Dynamics (3) Prereq.: ME 4183 or equivalent. Dynamic system modeling; bond graphs; state-determined systems; simulation;
Controllability/observability.

7643 Advanced System Modeling (3) Prereq: ME 7633 or equivalent. Mathematical models and dynamic behaviors of engineering systems in multi-energy domains; bond-graph modeling methods, simulations using contemporary software.

7673 Advanced Mechanical Systems Control (3) Prereq: ME 4183 or equivalent. Design and analysis of nonlinear control systems; adaptive and robust control techniques; state estimation; stability theory; control and stabilization of distributed parameter systems.


7733 Flow and Fracture in Solids (3) S Prereq.: CE 4440 or equivalent. Plastic deformation of single crystals and polycrystalline aggregates; theories of ductile and brittle fracture; internal friction; fatigue, creep and stress rupture; residual stresses; plastic forming of metals.


7753 Thermodynamics of Solid Materials (3) Prereq.: ME 2733 and any first level course in Thermodynamics. Review of first and second laws of thermodynamics; material property relationships; chemical equilibrium in reactions; solid solutions and phase diagram enunciations; reaction kinetics and non-equilibrium thermodynamics.

7763 Advanced Corrosion Science and Engineering (3) Prereq.: ME 4763 or equivalent. Advanced topics in corrosion; stress corrosion, high temperature corrosion, hydrogen embrittlement, etc.; thermodynamics of surfaces and corrosion.

7783 Inviscid Fluid Flow (3) S Prereq.: ME 7863 or equivalent. Potential flow theory and gas dynamics; multidimensional compressible flow; computational gas dynamics.

7813 Computation of Boundary Layer Flows and Heat Transfer (3) Prereq.: ME 3834 and 4433 or equivalent, and ME 4533 or equivalent. Finite-difference methods for the solution of parabolic or boundary layer equations; use of a computer program for two-dimensional boundary layers; wall boundary layers, jets and wakes, flows in pipes, annuli, nozzles, and diffusers.

7823 Computation of Fluid Flow and Heat Transfer (3) Prereq.: ME 3834, 4433 and ME 4533; or equivalent. Finite-difference methods for solving equations of fluid motions and energy; computer program used to solve complex problems involving fluid flow, heat transfer, and chemical reaction; mathematical models for turbulence, radiation, and combustion; their computing implications; application of prediction procedures for practical situations.

7833 Viscous Fluid Flow (3) Prereq.: ME 7863 or equivalent. Navier-Stokes equations; Stokes and Oseen approximations for low Reynolds number flows; incompressible laminar boundary layer theory; transition, turbulent boundary layers, compressibility effects, and numerical methods.

7853 Advanced Boundary Layer Theory (3) S Prereq.: ME 7843 or equivalent. NonNewtonian and turbulent fluid mechanics.

7863 Fluid Dynamics (3) F Prereq.: credit or registration in MATH 4038 or equivalent. Fluid dynamics as continuum mechanics; potential flow using complex variables in two dimensions and superposition in three dimensions; viscous flow and Navier-Stokes equations; compressible flow, including mach waves, shocks, and linearized aerodynamics.

7901 Seminar (1) All graduate students are expected to attend this course every semester; only 1 sem. hr. of credit in this course allowed toward degree. Pass-fail grading.

7903 Independent Study in Mechanical Engineering (3) May be taken for a max. of 6 hrs. of credit. Directed independent study for graduate students.

7933, 7943 Mechanical Engineering Problems (3,3) May be taken for a max. of 6 hrs. of credit when topics vary, with consent of department. Mechanical engineering treatment of various areas of interest.

8000 Thesis Research (1-12 per sem.) “S”/“U” grading.

9000 Dissertation Research (1-12 per sem.) “S”/“U” grading.