ME 806 - Renewable Energy: Physical and Engineering Principles
Credits: 3
The goal of this course is to become "fluent in energy" and to learn about the engineering fundamentals of renewable energy technologies. The course begins by giving an overview of U.S. energy usage and sources, as well as history and trends. Various renewable energy topics are then introduced and discussed. Where applicable, topics are discussed in detail from a fluid and thermal sciences point of view. Guest lectures and a field trip may be included. This course is open to all engineering graduate students. Prereq: Thermodynamics, Fluid Dynamics, or equivalent, or instructor permission.

ME 807 - Analytical Fluid Dynamics
Credits: 4
Kinematics of flow; constitutive relationships; development of the Navier-Stokes equations; vorticity theorems; potential flow. Prereq: fluid dynamics.

ME 809 - Computational Fluid Dynamics
Credits: 3
Review of matrix methods, basics of finite differences, basics of spectral methods, stability, accuracy, Navier-Stokes solvers. Prereq: heat transfer or permission.

ME 812 - Waves in Fluids
Credits: 3
Linear and nonlinear dynamics of hyperbolic and dispersive wave systems with application to acoustic waves, surface and internal gravity waves, Rossby waves, and capillary waves. Key physical concepts include wave-generation mechanisms, wavelength and amplitude dispersion, group velocity and energy propagation, steady streaming, and mode interactions. Prereq: fluid dynamics; or permission.

ME 824 - Vibrations Theory and Applications
Credits: 4
Discrete vibrating systems. Linear system concepts; single-degree-of-freedom systems with general excitation. Matrix theory and eigenvalue problems. Many degrees of freedom, normal mode theory for free and forced vibration. Numerical methods; introduction to continuous systems; applications to structural and mechanical systems. Prereq: statics; dynamics or permission.

ME 827 - Advanced Mechanics of Solids
Credits: 4
Stress, strain, stress-strain relations, anisotropic behavior, introduction to elasticity, plane stress/strain, bending and torsion of members with general cross-sections, introduction to thin plates and shells, energy methods. Prereq: strength of materials or permission.

ME 835 - Mechanics of Composite Materials
Credits: 4

ME 843 - Satellite Systems, Dynamics, and Control
Credits: 3
General satellite systems with emphasis on spacecraft dynamics and control. Course topics include general satellite information such as types of satellites, missions, and orbits, as well as satellite subsystems. Basic spacecraft dynamics and orbital mechanics topics are covered. Advanced topics will include attitude and orbit estimation, and automatic attitude control. Prereq: systems modeling or permission.

ME 860 - Physical Metallurgy I
Credits: 4
Introduction to physical metallurgy: dislocations, thermodynamics of materials, diffusion, phase transformations, and strengthening mechanisms in solids. Prereq: introduction to materials science or permission. Lab.

ME 870 - Design with Microprocessors
Credits: 4
Basic operation of microprocessors and microcontrollers explained, and interfacing these devices to sensors, displays and mechanical systems explored. Topics include: number systems, architecture, registers, memory mapping, interrupts and interfacing for system design. Methods of programming and interfacing with mechanical/electrical systems are covered and then implemented in lab. Prereq: introduction to electrical engineering. Lab.

ME 872 - Control Systems
Credits: 4
Development of advanced control systems design concepts such as Nyquist analysis; lead-lag compensation; state feedback; parameter sensitivity; controllability; observability; introduction to nonlinear and modern control. Includes interactive computer-aided design and real-time digital control. Prereq: permission. (Also offered as ECE 872.) Lab.

ME 873 - Electromechanical Analysis and Design
Credits: 4
Analysis and design of electromechanical systems using lumped parameter models and magnetic finite element analysis (FEA). Electrostatic and magnetic field equations discussed and used to derive magnetic and electric lumped model elements. A brushless dc motor analyzed using lumped models and FEA. Various drive types discussed and the motor system analyzed to obtain torque-speed curves. Design principles given and utilized in a design project. Prereq: systems modeling, simulation, and control or permission.

ME 877 - Computer Aided Engineering
Credits: 4
In this course, modules of Solid Works (beyond its basic solid modeling capabilities) and other software is used to demonstrate how computer based tools can be used in engineering practice, in particular design analysis and optimization. Emphasis placed on using knowledge from past engineering courses to obtain theoretical calculations to compare with the results from the computer software package. Prereq: Strength of Materials; Mechanics III; Heat Transfer; and Fluid Dynamics (or equivalent); or permission.

ME 885 - Solid Mechanics in Manufacturing
Credits: 4
Characterization of material properties will be studied with emphasis on plastic deformation. Also, numerical approaches to solve for the forces, stresses, and strains in manufacturing processes will be covered. In particular, two prominent mass production manufacturing areas, metal forming and cutting, will be examined. Prereq: introduction to materials science, dynamics.
ME 886 - Introduction to Finite Element Analysis
Credits: 4
Topics include basic matrix theory, potential energy approach, direct
stiffness method, calculus of variations, development of finite element
theory, and modeling techniques. Applications in solid mechanics, heat
transfer, fluids, and electromagnetic devices, via both commercially
available codes and student written codes. Prereq: Mechanics of
Materials, Heat Transfer or permission. Special fee. Lab.

ME 895 - Special Topics
Credits: 1-4
New or specialized courses and/or independent study. May be repeated
for credit.

ME 899 - Master's Thesis
Credits: 1-8
May be repeated up to a maximum of 8 credits. Cr/F.

ME 906 - Convection Heat Transfer
Credits: 4
An analytical study of heat transfer to laminar and turbulent boundary
layers of compressible and incompressible fluids. Basic differential
equations governing the heat transfer are derived and analytical solutions
are obtained where possible and checked with experimental results.

ME 909 - Viscous Flow
Credits: 3
Exact solutions of the Navier-Stokes equations; laminar boundary layers;
wakes and jets; Stoke's flow; stability of parallel flows and boundary
layers; transition to turbulence. Prereq: analytical fluid dynamics or
permission.

ME 910 - Turbulence
Credits: 3
Modern analysis of turbulent flow: the governing equations; stationary
random functions and the various averaging techniques; empirical results
on turbulence; homogenous turbulence; the Kolmogorov theory for
isotropic turbulence; upper bound theory; turbulence in the atmosphere
and oceans; applications to problems in science and engineering. Prereq:
ME 807 or permission.

ME 922 - Continuum Mechanics
Credits: 4
Cartesian tensors. Lagrangian and Eulerian description of a continuum.
The material time derivative. Deformation gradient. Displacement and
Momentum balance equations. Cauchy and Piola-Kirchhoff stress
tensors. Balance of energy; stress power, rate of work, and internal
energy. Entropy and the second law of thermodynamics. Constitutive
equations for elasticity and plasticity. Newtonian and non-Newtonian
fluids. Inviscid and viscous flow. Naiver-Stokes equations. Ideal and
rotational flows.

ME 927 - Theory of Plasticity
Credits: 4
Analysis of stress and deformation in inelastic solids; general
development of stress invariants, variational principles, constitutive
relations, and yield and loading functions. Special emphasis on ideal
plasticity, strain-hardening, creep, limit analysis, and limit design.