

Aerospace and Mechanical Engineering
Graduate Course Offerings
Fall 2004 (3/34/04)

ENG AM 501 Dynamic System Theory Dupont TR 2-4
Prereq: familiarity with differential equations and matrices at the level of ENG AM 404 or CAS MA 242, or consent of instructor. Introduction to analytical concepts and examples of dynamic systems and control. Mathematical description and state-space formulation of dynamic systems: modeling, controllability, and observability. Eigenvector and transform analysis of linear systems including canonical forms. Performance specifications. State feedback: pole placement and linear quadratic regulator. Introduction to MIMO design and system identification using computer tools and laboratory experiments. Meets with ENG SC501.

ENG AM 503 Special Topics In Mechanical Engineering Morgan MW 10-12
An introductory graduate course suitable for students interested in the application of engineering mechanics to the study of the musculoskeletal system at tissue, organ, and whole organism scales. Dynamics of gait and of falling. Mechanical behavior of tissues (anisotropy, viscoelasticity, fracture and fatigue) with emphasis on structure-function relationships in these tissues. Design and performance of orthopaedic implants (composite and asymmetric beam theories, contact mechanics). Discussion of experimental approaches to characterizing the mechanical behavior of biological materials. Tissue remodeling.

ENG AM 513 Compressible Aerodynamics Grace MW 2-4
Prereq: ENG EK 304 & EK 400, and either ENG AM420 or AM422. Aerodynamics and thermodynamics of compressible fluid flow. Laval nozzles, Prandtl-Meyer flow, normal and oblique shock waves. Linearized theory. Application to external and internal flow problems such as airfoils.

ENG AM 515 Vibration of Complex Mechanical Systems Pierce MW 8-10
Prereq: (CAS MA 226 & CAS PY 313 & ENG EK 302 & ENG EK 307 & ENG AM 400 & (ENG AM 307 OR ENG AM 308)) Introductory course in mechanical vibrations for graduate students and for undergraduate students with substantial mastery of core undergraduate subjects in mechanics and mathematics. Course includes an elementary introduction to applicable concepts in linear algebra. Potential and kinetic energy functions of single- and multidegree of freedom systems. Matrix formulations of forced vibrations of linear systems. Natural frequencies, resonance, and forced vibration response. Natural modes and mode shapes. Rayleigh's principle. Rayleigh's dissipation function, transient and forced responses of damped vibrations. Random excitation of vibrations. Impedance matrix. O'Hara-Cunniff theorem, modal masses, modal analysis. Vibrations of simple continuous systems such as strings, beams, rods, and torsional shafts. This course cannot be taken for credit in addition to ENG AM 441.

ENG AM 522 Underwater Acoustics Carey TR 8-10
Prereq: Eng AM 400 or equivalent. The ocean environment. Physical processes in deep and shallow water. Time and frequency domain wave equations for homogeneous and inhomogeneous acoustics. Spectral and ray methods for wave propagation in layered fluid and elastic media. Uncoupled and adiabatic normal mode theory. Parabolic equations and computational techniques for fluids and solids. Noise sources and surface effects. Sensors, transducers, and signal processing techniques.

ENG AM 706 Acoustics & Aerodynamic Sound Howe TR 6-8
Prereq: ENG AM 420, ENG AM 421, or equivalent. Theoretical foundations of fluid and structural acoustics. Solutions of the wave equation; vibrations of plates and membranes; multiple expansions, influence of source motion; reciprocity; compact Green's functions; radiation from vibrating bodies; matched expansions; acoustics energy equation; aerodynamic sound.

ENG AM 725 Acoustic Bubble Dynamics Roy TR 10-12
Prereq: ENG AM 520, AM 542, or equivalent. Bubbles and acoustic cavitation play an important role in many aspects of application of sonic and ultrasonic energy in fluids and biological tissue. This course

will introduce the study of bubble phenomena in sound fields. The fundamental physical acoustics of bubbles (and the fundamental physics which can be illustrated by the study of bubble dynamics) will be stressed. The family of Rayleigh-Plesset equations for time-dependent bubble behavior will be derived from the Navier-Stokes equations. Analytical approximations to the Rayleigh-Plesset equations in various limiting cases will be derived and studied. Approximations to the thermodynamic behavior of oscillating bubbles will be considered in detail. Thermal, acoustic and viscous contributions to dissipation will be treated. Numerical solutions will also be studied, specifically in the context of highly nonlinear behavior during acoustically forced oscillations. Other topics covered will include scattering of sound and acoustic radiation, acoustics of bubbly liquids, bubble-mediated bioeffects, shape instabilities, acoustic levitation, sonoluminescence, heat and mass transfer during bubble oscillations, sonochemistry and cavitation detection and monitoring.

ENG AM 761 Experimental Modal Analysis & System ID McDaniel MW 2-4

Prereq: ENG AM 515 or equivalent. Fundamental concepts of modal testing; analysis of multi-degree-of-freedom systems; viscous and hysteretic damping models; proportional and non-proportional damping; receptance, mobility and inertance frequency response functions; random and transient vibrations; practical issues concerning mobility measurement techniques; modal parameter extraction in frequency domain and time domain; structural modification; effects of non-linearities on modal analysis; engineering applications.

FOR COURSES IN OTHER DEPARTMENTS PLEASE CHECK THE STUDENT LINK UNDER
“ACADEMICS.”