ENGR H150 - HONORS MECHANICS OF MATERIALS
(Elective for AE, ME and MSE)

Catalog Data: **ENGRH150: Mechanics of Structures (Credit Units: 4)** Covers the same material as ENGR150 but in greater depth Prerequisite: MAE30 or ENGR30; Mathematics 2J. Same as MAE150. Only one course from ENGRH150, ENGR150/MAE150, CEE150, and CEEH150 may be taken for credit. (Design units: 2)

Textbook: Beer and Johnson, *Mechanics of Materials,* 3rd Edition, McGraw-Hill, 2001.

References: Chandrupatla and Belegundu, *Introduction to Finite Elements In Engineering*, 3rd ed., Prentice Hall, 2001.

Coordinator: Farghalli A. Mohamed (MSE); Jann N. Yang (CEE); John C. LaRue (ENGR)

Relationship to Program Outcomes: This course relates to the Program Outcomes:
AE: a, c, e, f and i as stated at:
http://undergraduate.eng.uci.edu/degreeprograms/aerospace/mission
ME: a, c, e, f, and i as stated at:
http://undergraduate.eng.uci.edu/degreeprograms/mechanical/mission
MSE:

Course Outcome/Performance Criteria: Students will:
Learn the fundamentals of stress, strain and elastic behavior.
Draw axial force, shear and bending moment diagrams of one-dimensional members subject to simple and combined loading.
Compute stress and strains in cables, bars, beams and columns; compute deflection of beams; and compute buckling load of compression members.
Learn the most widely used failure criteria to assess the safety of structures.
Learn the basic principles of mechanics of materials and apply them to assemblies of one-dimensional elements (trusses and frames).
Write a finite element program (e.g. in MATLAB) for the analysis of arbitrarily complex trusses and frames.
Identify, formulate, and solve engineering problems that are related to the response of materials to various types of loads.
Appreciate the complexity of structural dynamics; understand the concept of lumped mass and apply it to the dynamics of trusses.

Prerequisites By Topic: Newtonian mechanics, kinematics and dynamics of motion. Statics of solid bodies and structures. Differential and integral calculus of real functions in real variables. Linear algebra: elementary matrix manipulations. Familiarity with scientific programming.

Lecture Topics: Stresses; Stress in Axially Loaded Members (1 week)
Strains; Stress-Strain Diagram; Axial Deformation (1 week)
Torsion (1 week)
Shear Force and Bending Moment Diagrams (1 week)

Bending Stress in Beams (1 week)
Transverse Loading and Shearing Stress in Beams (1 week)
Stresses Under Combined Loading (1 week)
Transformation of Stresses; Design of Beams (1 week)
Deflection of Beams; Statically Indeterminate Problems (1 week)
Columns (1 week)

Class Schedule: Meets for 3 hours of lecture and 1 hour of discussion each week for ten weeks.

Computer Usage: Students will use a commercial programming language (e.g. MATLAB) to write a finite element code that allows the solution of arbitrarily complex trusses and frames.

Laboratory Component:

Professional Component: Contributes towards the Aerospace and Mechanical Engineering Design.

Design Content Description

Approach: Various design projects: For example, students will design, fabricate and test a minimum-weight truss structure that satisfies prescribed load-bearing requirements, subject to other design constraints. Students will design, fabricate and test a minimum-weight truss structure that satisfies prescribed load-bearing requirements subject to other design constraints. In addition to this, the design activity involves short design problems which are incorporated into the homework assignments and which introduce the phases of design. These problems address: (a) factor of safety and allowable stresses, (b) basic considerations for the design of prismatic beams, and (c) factors involved in the design and use of pressure vessels.

Grading Criteria:

Problem Sets:	35%
Design Project:	10%
Midterm Exam:	25%
Final Exam:	30%
	100%

Estimated ABET Category Content:

Mathematics and Basic Science: ___credit units or ___%
Engineering Science: __2_credit units or __50_%
Engineering Design: __2_credit units or _50__%

Prepared by: Farghalli A. Mohamed **Date:** July 2008

CEP Approved: Winter 2008