

## ENGR 150 - MECHANICS OF MATERIALS

**Catalog Data:** **ENGR 150 Mechanics of Materials (Credit Units: 4).** Stresses and strains, strain-stress diagrams, axial deformations, torsion, bending and shear stresses in beams, shear force and bending moment diagrams, combined stresses, principal stresses, Mohr's circle, deflection of beams, columns. Prerequisite: CEE 30 or ENGR 30 or MAE 30. Same as CEE 150. ENGR150/CEE150 and ENGRH150/CEEH150 may not both be taken for credit. (Design units: 1)

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

**Reference:** *Mechanics of Materials*, Gere and Timoshenko, 3rd Edition, PWS-ENT, 1990.

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**Course Objective:** To help us learn and apply various analytical methods for determining the mechanical behavior of solid bodies (for example: strength, stiffness, deflection, and stability) subjected to various types of loading which include: axial loading, bending, shear, torsion, or a combination.

A thorough understanding of the mechanical behavior of materials is essential for the safe design of all structures: building, bridges, machines, submarines, ships, airplanes, and pressure vessels

**Course Outcomes:** Students are able to:  
Apply knowledge of mathematics, science, and engineering dealing with mechanics of materials under axial loading, torsion, bending, and combined loading.  
Design components to meet desired needs in terms of strength and deflection.  
Identify, formulate, and solve engineering problems, and that related to the response of materials to various types of loading.  
Understand professional and ethical responsibility  
Recognize the need for life-long learning

**Prerequisite by Topics:** Equilibrium Mechanics, Calculus

**Lecture Topics:** Introduction  
Stress and Strain-Axial loading  
Torsion  
Bending  
Transverse Loading  
Transformations of Stress and Strain  
Design of Beams  
Deflection of Beams  
Columns

**Class Schedule:** Each class meets 3 hours per week for ten weeks and students are assigned to a 1 hour discussion session per week.

**Computer Usage:** Basic computer skills.

**Laboratory Project:** None

**Professional Component:**

CE - Contributes toward the Civil Engineering Major design experience.  
EnE - Contributes toward the Environmental Engineering Major design experience.  
MSE - Contribute toward the Materials Science and Engineering Major design experience.

**Relationship to Program Outcomes:**

CE - The course relates to Program Outcomes 1, 2, 3, 5, 9, and 11 as stated at:  
[http://www.eng.uci.edu/dept/objective\\_civil](http://www.eng.uci.edu/dept/objective_civil)  
EnE - The course relates to Program Outcomes 1, 2, 3, 5, 9, and 11 as stated at:  
[http://www.eng.uci.edu/dept/objective\\_environmental](http://www.eng.uci.edu/dept/objective_environmental)  
MSE - This course relates to Program Outcomes 1 and 5 as stated at:  
[http://www.eng.uci.edu/dept/objective\\_materials\\_science](http://www.eng.uci.edu/dept/objective_materials_science)

**Design Content Description:**

**Approach:** 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 transmission shafts, and (c) factors involved in the design and use of pressure vessels.

**Lecture Portion:** 100%  
Introduction to the phases of design. (1 class)  
Factor of Safety: definition and use (1 class)  
Design and use of thin-walled pressure vessel. (1 class)  
Design of prismatic beams. (2 classes)  
Design of transmission shafts. (2 classes)

**Laboratory Portion:** 0%

**Grading Criteria:**

|             |     |
|-------------|-----|
| Problem Set | 15% |
| Quizzes     | 15% |
| Midterm     | 30% |
| Final       | 40% |

**Estimated ABET Category Content:**

Mathematics and Basic Science: 0 credit units or 0%  
Engineering Science: 3 credit units or 75%  
Engineering Design: 1 credit units or 25%

**Prepared by:** John C. LaRue

**Date:** June 1, 2005

**Last modified:** Fall 2005