

**UNIVERSITY OF SOUTH FLORIDA
DEPARTMENT OF MECHANICAL ENGINEERING**

EML 3500 Mechanics of Solids

CATALOG DESCRIPTION: State of stress, deformation, and stability of elastic bodies subjected to various external force systems. Approach to design and test of mechanical and structural components. Role of material properties.

PREREQUISITES: EGN 3311

TEXTBOOK AND/OR OTHER REQUIRED MATERIAL: Mechanics of Solids, C.R. Hibbeler – 6th ed., Prentice Hall, Upper Saddle River, New Jersey 2005

COURSE OBJECTIVES: Outcomes (a,b,c,d,e,f,g) Department Objectives (A,C,D)

1. Students learn theoretical methods to determine the state of stress and deformation in elastic beam and plate structures. (a,c,e,A,C)
2. Students learn the common types of standard tension specimens used to evaluate ductile and brittle materials. (a,c,e,A,C)
3. Students learn to identify statically indeterminate structures, and use appropriate compatibility equations to solve. (a,c,e,A,C)
4. Student learn to be sensitive to many factors that contribute to determining a suitable factor of safety. (a,c,e,f,A,C)
5. Students learn to analyze various stress concentration features. (a,c,e,A,C)
6. Students learn to determine torsional deformation and shear stress in circular bars. (a,c,e,A,C)
7. Students learn the importance of physical testing to verify analytical results. (a,b,c,A,C)
8. Students learn to work as a team member on a class design project. Each team presents their design to the class at the end of the semester. (a,c,e,g,A,C)
9. Students learn to analyze columns for buckling, and the importance of understanding how instability can lead to catastrophic failure. (a,c,e,A,C)

TOPICS COVERED:

Ch1 Shear, Allowable Stresses
Ch2 Deformation-Strain
Ch3 Mechanical Properties Testing
Ch3 Hook's Law, Poisson's Effect
Ch3 Materials Failure
Ch4 Axial Loading, Saint-Venant's Principle
Ch4 Principle of Superposition, Force Method
Ch4 Thermal, Residual Stresses, Stress Concentrations
Ch5 Torsion
Ch6 Bending
Ch7 Transverse Shear
Ch8 Combined Loadings
Ch9 Stress Transformations. Plane Stress
Ch9 Mohr's Circle-Plane Stress, Maximum Shear Stress
Ch10 Strain Transformation. Plane Strain
Ch10 Mohr's Circle-Plane Strain
Ch10 Maximum Shear Strain, Theories of Failure
Ch 13 Buckling of Columns

CLASS/ LABORATORY SCHEDULE: 2 – 1.25 Hr Classes Per Week, 15 Week Semester

CONTRIBUTION TO PROFESSIONAL COMPONENT: This course is designed to develop a solid foundation in

theoretical methods and experimental techniques to determine the state of stress,

deformation, and stability of elastic bodies subjected to various external force systems. Develop skills to design and test mechanical and structural components. Gain an understanding of the critical role materials and their properties play in the design of safe and cost effective products.

RELATIONSHIP OF COURSE TO PROGRAM OBJECTIVES:

- A. To teach students to understand and to apply concepts of basic science, mathematics, computation, and engineering science essential to professional practice.
Students learn how to identify and analyze stress concentrations (holes, notches, corner radii) and techniques for minimizing their effects.
- C. To develop those skills essential to the design process, including problem formulation, synthesis, analysis, construction, testing and evaluation.
Students learn analytical and experimental methods to determine the state of stress and deformation in bars, beams and plates. Students learn the importance of standardized testing methods (ASTM, etc.) and verifying analytical results by testing.
- D. To develop skills necessary for effective professional interaction including multi-disciplinary collaboration, successful oral and written communication.
Throughout the semester students have the opportunity to present solutions to homework problems in class. A class project provides student teams a meaningful design experience, and oral communication skill development.

PREPARED BY : Alex A. Volinsky, Ph.D., Assistant Professor of Mechanical Engineering, April 6, 2006

