

MAE131B
Fundamentals of Solid Mechanics II (4 units)

Class/Laboratory Schedule: four hours of lecture, eight hours outside preparation. 12 hours/week total

Class Coordinator: Anne (Hoger) Conn

Textbooks, Required Materials:

A.C. Ugural and S.K. Fenster, Advanced Strength and Applied Elasticity (4th edition), Prentice Hall, 2003.

Catalog Description: Continuous mechanics of solids and its application to the mechanical response of machine and structural elements. Stress and strain in indicial notation; field equations and constitutive relations. Linear elastic stress analysis in torsion, plane stress and plane strain; stress concentrations; fracture mechanics. Extremum principles and structural stability. Viscoelasticity, plasticity, and failure criteria. Theorems of plastic limit analysis.

Prerequisites:

Grades of C– or better in MAE 131A and MAE 105 and admission to engineering major.

- Required Course
- Technical Elective Course
- Other: __ can also be used as a substitution for MAE 160 (Mechanical Behavior of Materials)

Performance Criteria:

Objective 1

1.1 Students will demonstrate that they can apply the equilibrium conditions to determine the distribution of internal forces in a structure

1.2 Students will demonstrate that they can distinguish between normal and shear stresses, dilatational and shear strains, and the corresponding material properties

Objective 2

2.1 Students will demonstrate that they can recognize the qualitative features of the stresses, strains, material properties and area properties associated with axial loading, torsion and bending

2.2 Students will demonstrate that they can solve for stresses in a structural component under axial loading, torsion, and bending, acting individually or in combination

2.3 Students will demonstrate that they can solve for the deformation of a structural component due to axial loading, torsion, and bending loads, acting individually or in combination

Objective 3

3.1 Students will demonstrate that they can solve for the principal stresses in structural components subjected to a combined state of loading

3.2 Students will demonstrate that they can recognize, formulate and solve statically indeterminate structural components

Course Objectives:

(Numbers in parenthesis refer to ME and AE Program Outcomes)

Objective 1: To teach students the concepts of stress, strain, and material properties. (1a)

Objective 2: To teach students how to determine the stresses and deformation of structures under common applied loads. (1a,5e)

Objective 3: To teach students how to formulate and solve structural engineering problems, and interpret the results. (1a,5e)

Course Topics:

1. Concept of stress and strain
2. Hooke's law
3. Axially loaded bars
4. Torsion of circular shafts
5. Pure bending of beams
6. Skew bending and eccentric loading
7. Shearing stresses due to bending
8. Deflections of beams
9. Statically indeterminate beams
10. Beams under combined loading
11. Columns

Prepared By: A. Hoger and H. Murakami, March 2000

Revised: V. Lubarda, April 2008 via Teaching Work Group meeting

Reviewed: TWG, June 2010; August 2011, August 2012