

MAE 131A / SE 110A (4 units)  
Fundamentals of Solid Mechanics I

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

**Course Coordinator(s):** Vlado Lubarda

**Textbooks/Materials:**

1. Beer and Johnston: Mechanics of Materials, McGraw-Hill, 6<sup>th</sup> ed., 2011.
2. R.R. Craig: mechanics of Materials, John Wiley, 3<sup>rd</sup> ed., 2011.

**Catalog Description:** Concepts of stress and strain. Hooke's law. Axial loading of bars. Torsion of circular shafts. Shearing and normal stresses in beam bending. Deflections in beams. Statically determinate and indeterminate problems. Combined loading. Principal stresses and design criteria. Buckling of columns.

**Prerequisites:** Math 20D and MAE 130A or SE 101A.

- Required Course
- Technical Elective Course
- Other: \_\_\_\_\_

**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

**Reviewed:** TWG, August 2012