

MAE 131B
Fundamentals of Solid Mechanics II (4 units)

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

Course Coordinator(s): Claire Scholtes Acevedo, Michael Frazier, Maziar Ghazinejad,

Textbooks/Materials:

1. A.C. Ugural and S.K. Fenster, Advanced Mechanics of Materials and Applied Elasticity (5th Edition), Prentice Hall, 2012

Catalog Description: Analysis of 3-D states of stress and strain. Governing equations of linear elasticity. Solution of elasticity problems in rectangular and polar coordinates. Stress concentration. Failure criteria. Torsion of noncircular and thin-walled members. Energy methods. Plastic collapse and limit analysis.

Prerequisites: MAE 131A or SE 110A and MAE 105. Enrollment restricted to Engineering majors only

Course Type: Technical Elective Course / Can be used as a substitution for MAE 160

Course Objectives:

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, including non-beam-like solids using techniques such as Airy stress functions

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

Objective 4

4.1 Students will demonstrate that they can solve for the response of viscoelastic materials
4.2. Students will demonstrate that they can solve for the response and failure threshold of elastoplastic materials

Course Topics:

1. Analysis of 3-D states of stress and
2. Analysis of 3-D states of Strain
3. Stress-Strain Relations
4. Governing equations of linear elasticity
5. Problems in Elasticity
6. Torsion of noncircular and thin-walled members
7. Failure Criteria and Limit Analysis.
8. Intro to Fracture Mechanics
9. Energy Methods
10. Stability and Buckling

Last updated: 7th April 2025