UNIVERSITY OF CALIFORNIA AT BERKELEY
Department of Civil Engineering
Structural Engineering, Mechanics and Materials

CE 131N, Fall 1995
Instructor: F. Armero

CE 131N Advanced Mechanics of Materials
Course information

Instructor:

Francisco Armero
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e-mail address: armero@ce.berkeley.edu
Office hours: MWF 1:30-3pm
plus by appointment (please use e-mail preferably).

Location and time:

212 O'Brien, MWF 9-10 am.

Textbook:

"Advanced Strength and Applied Elasticity", by Ugural & Fenster, 3^{rd}, Prentice Hall, 1995.

Books on reserve:

1. *"Advanced Strength and Applied Elasticity"*, by Ugural & Fenster, 3^{rd}, Prentice Hall, 1995.
2. *"Advanced Mechanics of Materials"*, by Boresi, Schmidt & Sidebottom, 5^{th} edition, Wiley, 1993.
3. *"Engineering Mechanics of Solids"*, By E. Popov, Prentice Hall, 1990 (on reserve for CE130).

Homework:

Homework will be assigned along the week. The problems assigned in one week will be due the following Friday, at the beginning of the class. Late submissions will be admitted in the class on Monday, but with a 30% penalty. I will not admit any overdue homework after Monday.

Grading system:

One midterm (Monday, October 23), and final. Both exams will be closed books.

Homework 30%, midterm 20%, final 50%.

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Course outline

0. Introduction

PART I: FUNDAMENTAL THEORY

1. Theory of stresses

1.1 The stress tensor.
1.2 Transformation of stresses.
1.3 Principal stresses. Invariants.
1.4 Equations of equilibrium.

2. Theory of strains

2.1. Displacements and strains.
2.2. The strain tensor.
2.3. Transformation of strains.
2.4. Compatibility equations.

3. Stress-strain relations

3.1. Introduction to material response.
3.2. Hooke's law. Thermoelasticity.
3.3. The strain and complementary energy functions.
3.4. Failure criteria.

4. The mechanical boundary-value problem

4.1. Plane problems of elasticity. Saint-Venant's principle.
4.2. The stress function.
4.3. Problems in polar coordinates.
4.4. Example: stress-concentrations.
4.5. Example: thick-walled cylinder.

PART II: APPLICATIONS TO LOAD-CARRYING MEMBERS

5. Torsion

5.1. Review: torsion of circular shafts.
5.2. Prandtl theory.
5.3. Membrane analogy. Open thin-wall sections.
5.4. Hollow and multicell sections.
5.5. Restrained warping.
5.6. Inelastic torsion.

7. Stresses in beams

7.1. Review: deflection of beams.
7.2. Review: symmetric pure bending.
7.3. Asymmetric pure bending.
7.4. Influence of shear stresses.
7.5. Open/hollow thin-wall sections.
7.6. Shear center.

8. Bending of plates

8.1. The Kirchhoff assumption.
9.2. Equilibrium of plates.
9.3. Methods of solution.

9. Energy methods

9.1. The principle of stationary potential energy.
9.2. The principle of virtual work.
9.3. Energy theorems.
9.4. Applications.

10. Stability of columns

10.1 Euler theory.
10.2 The influence of imperfections.
10.3 Energy methods.

Conclusion