CE 560 Advanced Mechanics of Materials
Fall 2003

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PREREQUISITES:

Prerequisites for this course is an introductory course in the mechanics of solids.

OBJECTIVES:

The objective of this course is to introduce advanced topics in the theory of solid mechanics through the "strength of materials approach". Although the emphasis will be on applications, students will be tested on their understanding of the theoretical development of all formulas.

TEXTBOOK:

The text for this course is: *Advanced Mechanics of Materials* Sixth Edition, by Boresi and Schmidt

WEBPAGE:

The class webpage can be reached through my home page via the Civil Engineering Department's home page.

ASSIGNED WORK:

In addition to assigned problems, certain derivations and example problems presented in the lectures will be designated as work to be rewritten formally. The assigned problems and rewrites of class derivations and examples will be due at the beginning of class, the Monday after they are assigned. You should take advantage of office hours to help complete assignments that you find difficult. You are likewise encouraged to work with others. However, all work turned in must be original work - not a simple copy of someone else's work. Such copying will be considered a breach of academic honesty and appropriate action will be taken.

EXAMINATIONS:

There will be two examinations - a Mid-term and a final examination.

GRADING:

The assignments will be graded as either satisfactory (S) or unsatisfactory (U). All unsatisfactory work must be redone and handed in the Monday following the returned work. Failure to complete all work with a satisfactory grade will result in a reduced course grade. Likewise, an excessive number of unsatisfactory grades, even if the work was satisfactorily redone, will result in a penalty.

The final course grade will be based primarily on the two examinations with adjustments made for unsatisfactory grades. If all assignments were originally satisfactory, then the course grade will be based completely on the examinations with 90% or above an A, 80% - 89% a B, etc. Graduate students are expected to correctly complete assignments on time, and you should gage your work load so that you can do so.

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TOPICS

1. Stress (Ch. 2)
   (a) Definition of Cauchy stress
   (b) Stress notation, matrix and tensor
   (c) Symmetry of the stress tensor
   (d) Transformations
   (e) Invariants of the stress tensor
   (f) Principal stresses
   (g) Plane stress
   (h) Mohr's circle
   (i) Equilibrium equations
2. Strain (Ch. 2)
   (a) Deformation and the displacement functions
   (b) Definition of strain
   (c) Compatibility
3. Linear elastic materials and Hooke's law (Ch. 3)
4. Fundamentals of plasticity (Ch. 4)
   (a) Perfectly plastic behavior
   (b) Yield criteria
   (c) Yield surfaces and stress space
   (d) Plastic moments in beams
   (e) Flow theories
5. Energy (Ch. 5, Notes)
   (a) Virtual work
   (b) Strain energy
   (c) Stationary energy
   (d) Castigliano's theorems
   (e) Statically indeterminate structures
6. Torsion (Ch. 6)
   (a) Derivation of torsion formula for circular shafts
   (b) Non-circular cross sections
      i. St. Venant's Semi-inverse method
      ii. Prandtl's stress function
      iii. Numerical methods
      iv. Experimental methods
      v. Thin walled sections
         A. Simply connected cross sections
         B. Multiply connected cross sections
      vi. Numerical solutions
      vii. Perfectly plastic materials
7. Flexural stresses (Ch. 7)
   (a) Derivation of the flexure formula
   (b) Principal moments of inertia
   (c) Non-symmetrical bending
   (d) Beam deflections
   (e) Plastic moments and hinges
8. Shear stresses in beams (Ch. 8)
   (a) Derivation of the shear stress formula
   (b) Thin wall sections - simply connected
   (c) Shear flow and shear center
   (d) Thin wall sections - multiply connected
9. Selected topics to be covered, time permitting:
   (a) Curved beams (Ch. 9)
   (b) Beams on elastic foundations (Ch. 10)
   (c) Thick-wall cylinders (Ch. 11)
   (d) Stability (Ch. 12)
   (e) Limit Analysis (Notes)
   (f) Plates (Ch. 13)