MAE 3083 MECHANICS OF MATERIALS
Fall 2008

2008-09 Catalog Data: Stress and strain; mechanical properties of materials; Hooke's law; axial, torsion, pure bending and transverse loading of members; transformations of stress and strain; failure criteria; strain measurements; thin-walled pressure vessels; design for strength; energy methods; design for impact; column buckling and stability (3 credits).

Required or Elective: Required

Prerequisites by Topic: MAE 2081 Applied Mechanics: Statics.

Corequisite by Topic: None.

Textbook (T) and References (R): (T) F. P. Beer, E. R. Johnston, and J. T. DeWolf, Mechanics of Materials, 4th edition 2006, McGraw-Hill Higher Education, New York.

Course Learning Outcomes: The student will be able to:

1. Understand the concepts of stress and strain, relationships between stress and strain in various materials, Hooke's law, mechanical properties of materials, and statically indeterminate problems
2. Understand and find the stresses, strains, and deformations in members under axial loading, torsion, and pure bending
3. Draw shear and bending-moment diagrams for beams, understand the relations among load, shear, and bending moment, and design prismatic beams for bending
4. Determine the shearing stresses in beams and understand the shearing stresses in thin-walled members
5. Conduct transformations of stress and strain, determine the principal stresses under a given loading, understand the failure criteria, know how to design for strength, know the stresses in thin-walled pressure vessels, and know the measurements of strain
6. Determine the slope and deflection of beams subjected to transverse loadings, use the methods of superposition to treat beams subjected to combined loads, and use the moment-area theorems to determine the slope and deflection at a specific point of a beam
7. Understand the stability of structures and buckling of columns, find the critical load for the buckling of columns, and design columns under a centric load and an eccentric load
8. Understand the concept of strain energy, use the energy methods to determine the stresses and deformations in structures, and know how to design for impact
9. Recognize the need for, and establish the ability to engage in, life-long learning, by applying the knowledge learnt from this course to analyze the mechanics of structures

Topics Covered and Associated Time:

1. Introduction – concept of stress (2 lecture classes)
2. Stress and strain – axial loading (5 lecture classes)
3. Torsion (3 lecture classes)
4. Pure bending (6 lecture classes)
5. First hour-exam (covers Topics 1-4) (1 lecture class)
6. Analysis and design of beams for bending (3 lecture classes)
7. Shearing stresses in beams and thin-walled members (2 lecture classes)
8. Transformations of stress and strain (4 lecture classes)
9. Principal stresses under a given loading (2 lecture classes)
10. Second hour-exam (covers Topics 6-9) (1 lecture class)
11. Deflection of beams (6 lecture classes)
12. Columns (3 lecture classes)
13. Energy methods (4 lecture classes)
14. Final Exam (covers all the topics)

Class Schedule: Three one hour lectures per week

Contribution of Course to Meeting the Requirements of Curriculum: This course meets the one and one-half years of engineering science topics.

Relationship of Course to Program Outcomes: See assessment matrix.

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