CE 246 STRENGTH OF MATERIALS

Required Course

Spring 2009

Instructor(s):	*Name:*	Kutay Orakçal	Hilmi Luş
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Course Data:	Hours:	MM 56, ThTh 78	
	Room:	Orakçal MM: M2171, ThTh: M2170, Luş MM: M2180, ThTh: 2180	

Course Description (Catalog):

CE246 Strength of Materials **(4+1+0)4**

Stress and deformation. Uniaxial tension test, temperature effects in bars. Torsion of circular shafts. Simple bending of beams and associated deflections, shear stresses in beams. Combined stresses due to bending, torsion, shear and axial loads. Transformation of stress, principal stresses, and Mohr's circle. Introduction to energy principles. Failure criteria. Stability and buckling.

Prerequisite: CE 245 Mechanics

Course Objectives (Learning Outcomes):

To establish an understanding of the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior.

To provide students with exposure to the systematic methods for solving engineering problems in solid mechanics.

To discuss the basic mechanical principles underlying modern approaches for design of various types of structural members subjected to axial load, torsion, bending, transverse shear, and combined loading.

To build the necessary theoretical background for further structural analysis and design courses.

Textbook:

Hibbeler, R.C., "***Mechanics of Materials***", 6th SI edition, Prentice Hall

Reference Books:

Beer, F.P., Johnston, E.R., DeWolf, J.T., "***Mechanics of Materials***", 4th edition, McGraw Hill.

Craig, R.R., "***Mechanics of Materials***", 2nd edition, John Wiley and Sons.

Curricular Context

This required course constitutes a transition from fundamental math and science topics to specific applications within the context of structural mechanics and engineering. It provides the foundation for advanced design and structural analysis courses. Estimated design content of the course is 30%.

Laboratory and Computer Usage:

N/A

Class Policies:

Homework and Quizzes: Homework questions to be assigned from each chapter. Unannounced quizzes to be held almost weekly. Quizzes will be based on homework assignments. 20% of the course grade.

Midterm exams: Two exams, each 20% of the course grade.

Final exam: Comprehensive exam at the end of the semester, 40% of the course grade.

Contribution of the Course to Program Outcomes:

(a) An ability to apply knowledge of mathematics, science and engineering

(c) An ability to design a system, component, or process to meet desired needs such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(e) An ability to identify, formulate and solve engineering problems

(k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice

Course Assessment:

Course will be assessed on the basis of the accomplishments regarding the course objectives and the contributions to the program outcomes. The evaluation will consist mainly of the responses from the students, who will provide their comments to various course related questions in the final week of the semester.

Week	Topics	Reading Assignment	Homework Assignment	Content
1	Stress, strain, material properties	Chapters 1-3	Homework I	Review of equilibrium principles. Concepts of stress and strain. Stress components in Cartesian coordinates. Normal and shear stresses. Safety factors and design. Deformation and strain. Normal and shear strains. Mechanical properties of materials. Constitutive relations. Hooke's Law.
2				
3			Homework II	
4	Axially loaded bars	Chapter 4	Homework III	Axial deformation. St. Venant's Principle. Statically determinate and indeterminate axial loading assemblies. Composite bars. Thermal stresses.
5	Torsion	Chapter 5	Homework IV	Torsional deformation of circular shafts. Torque and angle of twist. Statically determinate and indeterminate torsional loading assemblies. Composite shafts. Thin walled members. Design of shafts.
6	Stresses and deflections in beams	Chapters 6, 7, 12	Homework V	Pure bending of beams. Second moments of area. Parallel axis theorem. Principal axes and moments of area. Flexure formula. Flexural stresses.
7			Homework VI Midterm I	Biaxial bending. Eccentric axial load. Composite beams.
8			Homework VII	Derivation of the differential equations for flexural beam deflections. Boundary conditions. Deflection curve. Statically indeterminate beams.
9			Homework VIII	Shear stresses in beams. Transverse shear and the shear formula. Limitations of the shear formula. Shear flow and shear center.
10			Homework IX	Design of beams.
11	Transformation of stress and strain	Chapters 9,10	Homework X Midterm II	Transformation of stress and strain at a point. Stress transformation equations. Mohr's circle. Principal stresses and maximum in-plane shear stress. Combined loading.
12	Buckling of columns	Chapter 13	Homework XI	Stability. Euler buckling load. Issues in column design.
13	Energy methods	Chapter 14	Homework XII	External work and strain energy. Principal of virtual work. Castigliano's theorem.