CE 355 STRUCTURAL ANALYSIS

Required Course

Fall 2008

Instructors: *Name:* Cem Yalçın, Hilmi Luş

Course Data: Hours: Monday 34, Wednesday 34

Course Description:

CE 355 Structural Analysis **(4+0+0)4**

Assumptions, principles of equilibrium in determining reactions, bending moments and shear diagrams. Influence lines. Determination of displacements by virtual work. Castigliano's theorem and moment area theorems. Statically indeterminate structures. Force and displacement method of approach using slope-deflection method. Flexibility and stiffness methods. Virtual work, strain energy, moment area and moment distribution methods. Matrix methods of structural analysis. Introduction to computer programs and use of program packages for structural analysis.

Prerequisite CE 246 Strength of Materials

Course Objectives:

Develop understanding of and appreciation for basic concepts in structural analysis such as equilibrium, stability, static and kinematic indeterminacy, compatibility, and superposition. Develop intuition about structural behavior through sketches of deflected shapes and internal forces. Introduce the basic principles of mechanics regarding work and energy, and their uses in structural engineering. Introduce Methods used in the analysis of structures within the frameworks of force and displacement formulations.

Recommended Books:

A. Ghali, A.M. Neville and T.G. Brown, *"Structural Analysis: A Unified Classical and Matrix Approach,"* 5th edition, Spon Press, 2003. *TA645 .G48 1997*.

R.C. Hibbeler, *"Structural analysis,"* Prentice Hall, 2002. *TA645 .H47 2002*.

Auxiliary References:

H. West, *"Analysis of structures: an integration of…,"* Wiley, 1989. *TA645 .W43 1989*.

J.C. McCormac, *"Structural analysis,"* Harper & Row, 1984. *TA645 .M3 1984*.

Curricular Context

This course provides a transition from basic strength of materials to structural design courses. It introduces analysis methods for determinate and indeterminate systems. Estimated design content is 10%.

Laboratory and Computer Usage: N/A

Class Policies:

Homework: Assigned but not collected. They will be returned with comments if handed in.

Quiz: 4 unannounced quizzes, from homework questions. 20% of final grade.

Exams:2 in term exams, 25 % each. Final exam, 30%. Final exam is comprehensive.

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

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

(i) A recognition of the need for, and an ability to engage in life-long learning

(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	Suggested Reading (Ghali et al.)	Objectives
1	Introduction and overview	C1, C2, C3	Structure and load models. Indeterminacy & stability. Superposition. Brief review of truss analysis.
2	Beams & Statically Determinate Frames	S 10.1-10.5	Shear force and bending moment diagrams for frames. Geometry of beam deformations. Evaluating deflections by direct integration. Qualitative sketches of deflections in beams and frames. Moment-area theorems.
3			
4	Work & energy (Exam I: November 6th, Thursday)	C7, C8, C9	Principle of virtual work. Calculation of displacements with virtual work. Betti's and Maxwell's theorems. Strain energy. Complementary energy and work. Castigliano's theorems. Influence lines. Müller-Breslau's principle.
5			
6			
7			
8	Force (Flexibility) method of analysis	C4	Redundancy. Compatibility equations. Flexibility matrix. Analysis for environmental effects.
9	Moment Distribution	S 11.7-11.11	Moment distribution without and with joint translation.
10			
11	Displacement method of analysis (Exam II: December 27th, Friday)	C5, S 6.1-6.4	Kinematic indeterminacy. Degrees of freedom and coordinate system. Stiffness matrix for a truss element. Stiffness matrix for a frame element. Equilibrium equations.
12			
13	Computer programs	C22	How does a computer do it?