CEE 4130 (5130) MATRIX AND FINITE ELEMENT METHODS

Elective Course

Catalog Description:

Lec. 3. Credit 3.

Prerequisite: CEE3320 or ME4640(5640) and MATH 2010 or MATH4510(5510). Matrix formulations using flexibility and stiffness methods for structural analysis of skeletal structures. Finite Element formulations and applications.

Math & Basic Sciences:	0	Credits	Course Coordinator:	Guillermo Ramirez
Engineering Topics:	3	Credits	Contains Significant Design:	No
General Education:	0	Credits	Updated:	09/30/2013
Other:	0	Credits	Specify Type if Other:	

Text Book(s) and Supplemental Material(s):

Sennett, Robert E., Matrix Analysis of Structures, Waveland Press, Inc., 2000.

Course Goal(s):

To extend the students' understanding of the analysis of structural systems using matrix and finite element methods. To develop the ability to use computer programs to perform structural analysis calculations.

Instructional Outcomes for the Course:

Students will be expected to

1. Be able to use energy methods to find internal forces and deflections in simple planar structural systems.
2. Be able to analyze planar trusses, continuous beams, and planar frames using matrix methods, in particular the stiffness method.
3. Be able to model and solve structural systems having non-prismatic members, inclined supports and/or spring supports.
4. Be able to implement the stiffness method in computer language and use it to solve planar structural systems.
5. Be able to interpret the data resulting from analyzing structural systems with computer programs.
6. Be able to understand the basics of the finite element methods

Criterion 3 Student Outcomes addressed by this Course:

a) An ability to apply knowledge of mathematics, science, and engineering (Level 3)

c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (Level 3)

e) An ability to identify, formulate, and solve engineering problems (Level 4)

k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (Level 3)

Program Criteria addressed by this Course:

1. Apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science, consistent with the program educational objectives (Level 3)
2. Apply knowledge of four technical areas appropriate to civil engineering (Level 3)
3. Design a system, component, or process in more than one civil engineering context (Level 3)

Course Topics:

1. Introduction to computer methods for the analysis of structural systems: flexibility "vs." stiffness methods (5%)
2. Introduction to energy methods (10%)
3. Development of the stiffness method for planar trusses and implementation of the method in computer language (25%)
4. Development of the stiffness method for continuous beams and implementation of the method in computer language (25%)
5. Development of the stiffness method for planar frames and implementation of the method in computer language (25%)
6. Introduction to finite element procedures in the analysis of structural systems (10%)

Additional Topics/Assignments for dual-level (4000/5000) courses:

The students registered in 5000 level will have additional computer programming tasks such as writing subroutines to include different types of member loads in the structural systems and run their programs to analyze different structural systems exploiting the symmetry of the structural system