1. CEE 4130 (5130) – Matrix and Finite Element Methods

2. Course credit hours: 3
   Contact hours per week: 3
   Credit category: Engineering Topics

3. Course coordinator: G. Ramirez

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

5. Course information:

2020 Catalog description	Matrix formulations using flexibility and stiffness methods for structural analysis of skeletal structures. Finite element formulations and applications.
Prerequisite(s)	CEE 3320 or ME 4640(5640) and MATH 2010 or MATH 4510(5510)
Course type	Elective

6. Course instructional outcomes:

Course Outcome No.	Course Outcome (CO)	ABET Student Outcome
CO1	Use energy methods to find internal forces and deflections in simple planar structural systems	1
CO2	Analyze planar trusses, continuous beams, and planar frames using matrix methods, in particular the stiffness method	1
CO3	Model and solve structural systems having non-prismatic members, inclined supports and/or spring supports	1
CO4	Implement the stiffness method in computer language and use it to solve planar structural systems	1
CO5	Interpret the data resulting from analyzing structural systems with computer programs	1
CO6	Understand the basics of the finite element methods	1

ABET criterion 3 Student Outcomes addressed by this course:

SO No.	Student Outcome (SO)
3.1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

7. 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%)

Program criteria (curriculum) 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
2. Analyze and solve problems in at least four technical areas appropriate to civil engineering

8. Additional topics, assignments, or requirements for dual-level (4000/5000) course:
   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, include internal hinges, linear spring supports, and run their programs to analyze different structural systems exploiting the symmetry of the structural system.

9. Date: 02/25/2020