



## CE 311 – Structural Engineering

**Code and Name:** CE 311 – Structural Engineering

**Credit Hours:** 4 (Lecture: 4, Tutorial: 1)

**Textbook:**

- Structural Analysis: R.C. Hibbeler, 6th SI edition, Pearson, 2013

**Other References:**

- *Structural Analysis by Aslam Kasim Ali* - Class handouts as required

**Course Description:**

Introduction to structural systems and their design; structural design process; computation of loads on structures; analysis of statically determinate trusses, beams, frames, cables and arches under static loads; shear and moment diagrams for beams and frames; deflections of beams and trusses; influence lines for moving loads; virtual work and energy principles; analysis of statically indeterminate structures by slope deflection and moment distribution methods; introduction to computer applications in structural analysis and design.

**Pre-requisites :** CE211 Solid Mechanics, MA226 Linear Algebra, CE202 Dynamics

**Co-requisites:** None

**Course Learning Outcomes:**

With relation to ABET Student Outcomes (From Fall 2019-SOs: 1-7)

1. Recognize various types of structural systems used in civil engineering and to describe various types of loads acting on structures (1)
2. Analyze the deformations and deflection of beams and frames by using energy methods and semi graphical methods (1)
3. Analyze the internal forces in statically determinate trusses, cables and arches (1)
4. Discuss the stability and determinacy of frames beams & trusses & analysis of indeterminate structures (1)
5. Draw the shear force, axial force and bending moment diagrams for determinate frames and beams subjected to various type of loadings (1)
6. Construct the influence line diagram for moving loads on determinate beams (1)
7. Acquire and apply new knowledge as needed using appropriate learning strategies (7)

**Topics to be covered:**

- Introduction to Structural Engineering, Classification of structural system, Structural components and load path, Design Codes
- Types of loads and their computation for various parts of the structure, Internal loadings developed in structural members (SFD, BMD)
- Theoretical basis for beam deflections, deflections by double integration method, Moment area theorems for beam deflections (cont.), deflections by conjugate beam method, structural idealization, determinacy and stability,
- Structural idealization, determinacy and stability (cont.), Analysis of statically determinate trusses
- Cables
- 3-hinged Arches, Influence line diagrams for determinate structures and Influence line diagrams (cont.)
- Deflections by Energy methods, virtual work and Unit load method
- Application of Castigliano's 2nd theorem for truss deflections, and for beam/frame deflections
- Introduction to statically indeterminate structures. Force Method
- Analysis of statically indeterminate structures by moment distribution method.

**Grading Policy:**

The grading for the course is: 60% coursework and 40% Final Exam. The course work consists of two Midterm Exams, where each midterm exam is worth 20%. It also includes quizzes, and projects for the remaining 20% that let for the course instructor decision.

