**CE 416 – Structural Dynamics**

**Code and Name:** CE 416 – Structural Dynamics
**Credit Hours:** 3 (Lecture: 3, Tutorial: 1)

**Textbook:**
Dynamics of Structures by A. Chopra, 4th Edition, 2010
**Other References:**
-

**Course Description:**
Analysis of the dynamic response of structures and structural components to transient loads and foundation excitation; single-degree-of-freedom and multi-degree of freedom systems; time and frequency domain analysis; response spectrum concepts; simple inelastic structural systems; and introduction to systems with distributed mass and flexibility; application of computer methods. Introduction to code-based seismic design procedures.

**Pre-requisites:** CE 412 (Indeterminate Structural Analysis)
**Co-requisites:** None

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

1. Construct mathematical models for discrete single and multiple-degree of freedom (SDOF/MDOF) vibratory systems and calculate their free and forced vibration response. (1)
2. Determine the response of SDOF/MDOF systems to arbitrary force or ground motion by Duhamel integral and time-stepping integration methods. (1)
3. Model vibratory systems with distributed mass and flexibility. (1)
4. Understand the origin and nature of seismic ground motion, and be able to construct and use response spectra and conduct dynamic analysis of MDOF systems using modal superposition, spectral modal analysis and equivalent static force methods. (1)
5. Apply code-based seismic design procedures. (2)

**Topics to be covered:**

- An overview of structural dynamics for civil engineering applications
- Equation of motion for single-degree-of-freedom systems, free and forced vibration of undamped and damped SDOF Systems
- Numerical evaluation of dynamic response of SDOF systems to time varying forces or ground excitation using Duhamel integral and time-step integration techniques
- Formulation of equations of motion for multi-degree-of-freedom (MDOF) systems and calculation of response to free and forced vibrations, matrix methods for multi-degree of freedom systems
- Mathematical modelling and solution for dynamic systems with distributed mass and flexibility
- Solution for generalized Eigenvalue problem and determination of modal frequencies and mode shapes
- Origin and nature of seismic ground excitation, construction of response spectra, dynamic analyses of MDOF systems using modal superposition, spectral modal analysis and equivalent static force methods
- Introduction to code-based seismic design procedures.
- Use of computer software for dynamic analysis of structures

**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 is modified by the course instructor.