



## CIVE.5570 Structural Dynamics (3-0-3)

– Dynamic Analysis of Civil Infrastructure Systems –

Syllabus

Fall 2016

**Instructor:**

Tzuyang Yu, Ph.D. (Falmouth 107C, ext.4-2288, tzuyang\_yu@uml.edu)

Tue., 10:00~11:50 a.m. / Wed., 11:00~11:50 a.m. (or by appointment)

**Teaching Assistant:**

N/A

**Time and Venue:**

Wed., 6:30 p.m.~9:20 p.m., KI305

**Prerequisites:** ENGN.2070 *Dynamics*; CIVE.3500 *Structural Analysis*; MATH.2360 *Engineering Differential Equations*

### Course Description

This course aims to provide an understanding of the dynamic behavior of civil engineering structures with an emphasis on buildings and bridges. Formulation approaches of dynamic governing equations of structural systems are first introduced. Free vibration and forced (harmonic, periodic, arbitrary, impulse) vibration of single-degree-of-freedom (SDOF) and multi-degree-of-freedom (MDOF) systems are analyzed with examples. Response and design spectra of structures are introduced. Numerical methods used for determining the linear and nonlinear responses of structures are also investigated. Introductory earthquake engineering and soil-structure interaction are provided. Finally, analysis and design of structural control methods including tuned mass dampers (TMD) and base isolators are explained. Matlab (Matrix Laboratory ®, Math-Work, Inc.) codes are provided and used in solving numerical examples.

### Grading Policy

There will be four homework assignments (10% each) and two exams (30% mid-term and 30% final). All homework assignments must be turned in on time. The late policy is stated as follows: (1) 25% reduction for "less than one day" late; (2) 50% reduction for "one to two days" late; and (3) 100% reduction for "more than two days" late.

## Textbook and References

### Textbook:

A.K. Chopra, *Dynamics of Structures – Theory and Applications to Earthquake Engineering*, 4<sup>th</sup> ed., Prentice Hall, Upper Saddle River, NJ; 2012.

### References:

J.W. Clough and J. Penzien, *Dynamics of Structures*, McGraw-Hill, New York, NY; 1993.

G.V. Berg, *Elements of Structural Dynamics*, Prentice-Hall, Englewood Cliffs, NJ; 1989.

N.M. Newmark, E. Rosenblueth, *Fundamentals of Earthquake Engineering*, Prentice-Hall, Englewood, NJ; 1971.

J.J. Connor, *Introduction to Structural Motion Control*, Prentice Hall, Upper Saddle River, NJ; 2003.

## Schedule

Week	Date	Topics
1	09/07	Introduction; formulation of dynamic governing equations
2	09/14	Formulation of dynamic governing equations; free vibration of single-degree-of-freedom (SDOF) systems – Part I
3	09/21	Free vibration of SDOF systems – Part II; forced vibration of SDOF systems – Part I
4	09/28	Forced vibration of SDOF systems – Part II; response and design spectra
5	10/05	Free vibration of multi-degree-of-freedom (MDOF) systems – Part I
6	10/12	Free vibration of MDOF systems – Part II
7	10/19	<b>Mid-term Exam</b>
8	10/26	Forced vibration of MDOF systems – Part I
9	11/02	Forced vibration of MDOF systems – Part II
10	11/09	Structural damping; numerical methods
11	11/16	Seismic response of SDOF systems
12	11/23	Special problems
13	11/30	Optimal stiffness and damping distribution
14	12/07	Tuned mass damper (TMD) and based isolation systems