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

– Analysis and Control of Civil Infrastructure Systems –

Syllabus

Spring 2018

Instructor:

Tzuyang Yu, Ph.D. (Falmouth 107C, ext.4-2288, Tzuyang_Yu@UML.EDU)

Thurs. 4:30 p.m.∼5:30 p.m. (or by appointment)

Teaching Assistant:

N/A

Time and Venue:

Wednesday, 6:30 p.m.∼9:20 p.m., TBA

Webpage: http://tyu.eng.uml.edu/14.557_2013/

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

Course Description

The first part of this course aims to provide an understanding of the dynamic behavior of civil engineering structures with an emphasis on buildings and bridges. Free vibration and forced vibration (harmonic, periodic, arbitrary, impulse) of structures (single- and multi-degree-of-freedom) are investigated. Seismic response and resistant design of structures are introduced using design codes. The second part presents a rational basis for the preliminary design of motion-sensitive structures. Modelling and analysis of structures equipped with modern control and energy dissipation devices are introduced. Topics including the role of damping in controlling motion, and optimal distribution of stiffness and damping in structural control are covered. Passive damping systems including tuned mass dampers and base isolation systems are discussed. An introduction to blast resistant design of buildings is also provided. Matlab (Matrix Laboratory ®, MathWork, 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^{th} ed., Prentice Hall, Upper Saddle River, NJ; 2012.

References:

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

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.

Schedule

Week	**Date**	**Topics**
1	01/24	Introduction; Free vibration of single-degree-of-freedom (SDOF) systems
2	01/31	Forced vibration of SDOF systems – Part I
3	02/07	Forced vibration of SDOF systems – Part II
4	02/14	Free vibration of multi-degree-of-freedom (MDOF) systems – Part I
5	02/21	Free vibration of MDOF systems – Part II
6	02/28	Forced vibration of MDOF systems – Part I
7	03/07	**Mid-term Exam**
8	03/14	(*Spring Break)*
9	03/21	Forced vibration of MDOF systems – Part II
10	03/28	Seismic response of SDOF and MDOF systems; Structural damping
11	04/04	Seismic resistant design
12	04/11	Passive and active structural motion control
13	04/18	Optimal stiffness distribution
14	04/25	Optimal passive damping distribution
15	05/02	Tuned mass damper (TMD) and based isolation systems; Blast resistant design