**Structural Dynamics**
CVEN 5111, Fall 2017
MW 1:00-2:15pm, ECCS 1B12 (classroom)

**Instructor:**
Assoc. Prof. Richard Regueiro, richard.regueiro@colorado.edu; office hours: TuTh 2-3:30pm, ECOT 421, phone: 303.492.8026

**Course Description:**
Focuses on the response of single- and multi-degree of freedom structures subjected to harmonic, impulsive and arbitrary loads (including earthquake base excitation). Sources and modeling of damping will be discussed. Analytical and numerical solutions will be considered for both linear and nonlinear structural systems. Elastic and inelastic response spectra will be discussed.

**Course Objectives:**
*-Be able to model analytically the linear dynamic behavior of simple two-dimensional (2D) frame structures.*
*-Be able to model numerically the linear and nonlinear dynamic behavior of simple 2D frame structures.*
*-Gain preliminary understanding of application of structural dynamic analysis to earthquake engineering problems.*

**Prerequisites:**
CVEN 3525 (Matrix Structural Analysis) and CVEN 3161 (Mechanics of Materials), or equivalents; some basic programming experience, such as Matlab or Python. Review tutorials on the learn.colorado.edu webpage if you are unfamiliar with Matlab.

**Primary Reference (required)**:
- A.K. Chopra, *Dynamics of Structures: Theory and Applications to Earthquake Engineering, 5th Edition*, Pearson Education, Inc., 2017.

**Other books on reserve in the Engineering Library:**
- R.W. Clough, J. Penzien, *Dynamics of Structures, 2nd Edition*, Computers and Structures, Inc., 2003.
- L. Meirovitch, *Analytical Methods in Vibrations, 1st Edition*, Macmillan Publishing Co., Inc., 1967.

**Course Organization: (subject to change),** reference to Chapters in Chopra
**You are responsible for readings in the Chopra book, to either keep pace with lectures or problem sets.*

**(1) Single-Degree-of-Freedom (SDOF) Systems:**
- Equations of Motion (Ch1)
- Free Vibration (Ch2, Sects 1,2)
- Response to Harmonic Excitations (Ch3, Parts A,B)
- Response to Arbitrary, Step, and Pulse Excitations (Ch4)
- Numerical Methods (Ch5, selected)
- Earthquake Response of Linear Systems (Ch6, Sects 1-7)
- Earthquake Response of Inelastic Systems (Ch7, Sects 1-7,13)
- Generalized SDOF Systems (Ch8, selected), time permitting

**(2) Multi-Degree-of-Freedom (MDOF) Systems:**
- Equations of Motion (Ch9, Sects 1-4, 9-11)
- Free Vibration (Ch10, Parts A,B)
- Damping (Ch11, Sects 1,2)
- Dynamic Analysis of Linear Systems (Ch12, Parts A,B)
- Earthquake Analysis of Linear Systems (Ch13, Sects 1,2,7,8)

**Course Grading:**

| | |
|---|---|
| Problem sets, including computing assignments with Matlab | 30% |
| In-class Midterm Exam (date/time TBD by Instructor) | 30% |
| In-class Final Exam (date/time TBD by University) | 40% |

**Rules for Problem sets and Matlab computing assignments:**
-One problem set is allowed *1 week late*. Otherwise, no late problem sets will be accepted past the first 5 minutes of class when the problem set is due.
-You must report numerical values in problem set solutions in *BOTH U.S. customary units (sec, ft, kip, ksi, …) and SI units (sec, m, kN, kPa, …)*. U.S. customary units are used in the Chopra book.
**If you do not report numerical values in both units, you will automatically receive a 10% point deduction from the problem set point total.*
-You can work together on problem sets (including computing with Matlab) but must hand in your own solutions. You are encouraged to try the problems yourself before working with other students. This will help you prepare for the in-class midterm and final exams.
-Your solutions must be written clearly by hand, or typeset with an equation editor, such as MS Word, MathCad, Latex, etc. *If your solutions are illegible because of poor handwriting, points will be deducted.*
-You must turn in a hardcopy version of your problem set solutions.

**Rules for In-class exams:**
-The in-class midterm and final exams are Open Book, Open Notes, but you are only allowed a standard, non-programmable calculator. No phones, laptops, or programmable calculators are allowed during the exams. You can purchase a non-programmable calculator for approximately $10 if you don't have one.

**Honor Code:**
Please refer to the following webpage: http://www.colorado.edu/policies/student-honor-code-policy
**Any violation of the Honor Code (such as copying verbatim a fellow student's problem set solutions, or cheating on the in-class midterm or final exam) will result in an immediate assignment of final letter grade of "F" in the course.*

**Special considerations:**
-If you have a disability and require special accommodations, please provide Dr. Regueiro with a letter from Disability Services outlining your needs. Refer to the webpage http://disabilityservices.colorado.edu/
-If you have a conflict as a result of religious observances, please notify Dr. Regueiro at least 2 weeks in advance of the exam or assignment due date.
http://www.colorado.edu/policies/observance-religious-holidays-and-absences-classes-andor-exams

**Access to Bechtel Lab:** Sign up on the sheet outside ECOT 441 and list that you are taking CVEN5111, for you to be able to access the Bechtel Lab (ECCE 157 and 161) using your Buff OneCard. If you already have Buff OneCard access to Bechtel, you do not need to sign up again. Your identikey username and password will allow you to login to the computers. Matlab, and other software potentially used in the course, is installed on these machines.

**Webpage:** learn.colorado.edu

**Zoom information for Remote access to lectures real-time (Distance students only!):**
-Zoom meeting ID 549-679-396
-Join via web browser: https://cuboulder.zoom.us/j/549679396

***This course requires the use of the Zoom conferencing tool which is currently not accessible to users using assistive technology. If you use assistive technology to access the course material, please contact your faculty member immediately to discuss.***

For help getting Zoom up and running, please visit the following link:
http://www.colorado.edu/oit/services/conferencing-services/web-conferencing-zoom