CIVE 945: Structural Design for Dynamic Loads

Spring Semester 2016
University of Nebraska-Lincoln
MW 4:30 PM – 5:45 PM
Nebraska Hall W131

Prerequisites:

CIVE 443 (Structural Analysis) or similar.
CIVE 842 (Structural Dynamics) or similar.

Description:

Behavior of structural materials and systems under various dynamic loads. Analysis and design for dynamic loads. Computational and analytical techniques. Selected laboratory demonstrations of the dynamic behavior of structural systems.

Course Objectives:

1. Describe the fundamental dynamic parameters of civil structures and their influence on response under various dynamic loads.
2. Select the most appropriate method and solve the equation of motion for a discrete multiple degree-of-freedom structural system.
3. Compute seismic and wind load combinations on structural systems.
4. Solve a multiple degree-of-freedom structural systems using a nonlinear analysis platform under various dynamic loads.
5. Outline probabilistic response evaluation and performance based design.

Optional Textbook References:

1. Chopra, Anil K. (2011). *Dynamics of Structures.* 4th Edition, Prentice Hall, Stamford, CT. 992p.
2. Clough, Ray W. and Penzien, Joseph. (2003). *Dynamics of Structures.* 3rd Edition, Computers & Structures Inc., Berkeley, CA. 730p.
3. Elnashai, Amr S. and Di Sarno, Luigi. (2015). *Fundamentals of Earthquake Engineering: From Source to Fragility*. 2nd Edition, John Wiley & Sons, West Sussex, UK. 494p.
4. Mehta, Kishor C. and Coulbourne, William L. (2013). *Guide to the Wind Load Provisions of ASCE 7-10,* ASCE Press, Reston, VA. 176p.
5. Tamura, Yukio and Kareem, Ahsan (eds). (2014). *Advanced Wind Engineering*. Springer, Tokyo, JP. 410p.

Instructor:

Richard L. Wood (rwood@unl.edu)
362K Whittier Research Facility, office: (402) 472-1916

Office Hours:

Monday 12:30 PM – 2:00 PM (instructor, Whittier 362K)
other times are available by appointment

Digital office hours can be implemented using Adobe Connect with the course instructor via appointment. To facilitate login, a computer with internet is required. However a university IP address is not required.
http://connect.unl.edu/rwood

Email Policy: In each email, use "CIVE 945" as part of the subject line. This will ensure that your email is filtered appropriately and responded in a timely manner.

Course Documents: Blackboard will be used to distribute course material (notes, assignments, reference documents, etc.). It is essential for students to have access to download the appropriate material and verify your e-mail address on blackboard site.

Grading:

Homework (approx. every 1-2 weeks)	30%
Midterm Exam (announced 1 week ahead of time)	30%
Final Project or Exam (TBA)	35%
Attendance, Quizzes, and Participation	5%

At the conclusion of the semester, the **final grades** may be curved if the class average is less than 70% and/or the highest grade is less than 100%. Throughout the semester, the **mean and the standard deviation will be provided to estimate performance on a particular assignment**. Any student is encouraged to inquire directly with the instructor at any time if they have a question on their performance.

Notes:

1. All homework assignments are due at the **start of class** on the due date assigned, unless otherwise noted. Late work will only be accepted within two days of the due date, in the absence of prior approval for extraneous circumstances. Late work will be deducted 25% per calendar day.
2. As indicated on the grading breakdown, there will be **one midterm and possible a final exam**. The subject matter for each exam will be announced in class at least one week before.
3. If a student **misses an exam**, the instructor must be notified as soon as possible. For compelling (and documented) reasons, the instructor reserves the right to provide a make-up exam, change the weight of other exams, or assign a term project in determining the course grade.
4. Discussion regarding grades will be performed within **two days of returning the exams**. Any unclaimed exams will be discarded two weeks after it has been returned to the class.
5. The instructor may choose to use to **unannounced quizzes** at the start or end of class. These quizzes are implemented such that students stay current with the class material. Quizzes are typically closed book and notes.
6. Select assignments may require the use of **MATLAB**. MATLAB is provided to the UNL community free of charge for on-campus or VPN use. For details on procuring a license, visit: http://procurement.unl.edu/matlab-licenses. Assignments done in MATLAB must adhere to the same format as described below and all developed files should have appropriate comments (% syntax format).
7. Select assignments and projects will also require the use of a **structural analysis platform**. This will be provided to the students to install on their personal computers or use of a university computer lab.

8. **Active learning strategies** will be used in class that allow students to participate in class polls, quizzes, and discussions. This will be done as a classroom experiment and will invoke the use of color coded flashcards initially. All students will be given a single flashcard, if lost it is the student's responsibility to replace it.
9. **Class evaluations** will be performed online in Lincoln and on paper in Omaha. To encourage participation of the evaluations for continuous class improvement, an extra credit score of 0.5% will be applied to the final grade for completion of the class evaluation. Details on the documentation for online submission will be provided towards the end of the semester, while attendance noted in the Omaha classroom.

Homework/Assignment Format:

Homework preparation and submission guidelines are established to create professional quality detail.

1. Each assignment is to be solved neatly on **engineering graph paper**. For computer assignments, printouts on white paper are acceptable.
2. Each problem must have a problem statement, problem sketch, diagrams, solution steps, equations used (with variables and then substituted values), and a final answer. The final answer must be **boxed** and include appropriate **units** and **sign conventions**.
3. Use of a **straight edge** is compulsory for sketches, figures, and tables.
4. **All of your work must be shown**. The solution steps are just as important as the final answer and any solution which does not contain the previous steps will receive deduction in points.
5. Multiple pages must be **stapled** or bound.

Academic Dishonesty:

You are encouraged to work together on your assignments, but copying will not be tolerated. For all computer generated work, be sure you work on separate computer terminals and do not turn identical assignments. Scores will be minimally reduced for all suspected parties. Any student who commits this or other acts of misconduct may be subject to further disciplinary action by the University. The regulations in the "Code of Conduct" concerning **academic honesty will be strictly enforced** in this class.

Tentative Course Outline:

	Topic	Reference
I.	Review on Multiple Degree-of-Freedom (MDOF) Systems	Chopra Chapters 9, 10, and 11
II.	Approximate Methods for MDOF Systems	Chopra Chapter 12
III.	Modal Participation and Combinations	Chopra Chapter 12
IV.	Seismic Response of MDOF Systems	Chopra Chapter 12
V.	Introduction to Seismic Hazard	Elnashai and Sarno Chapters 1 and 2
VI.	Design for Seismic Loads	Chopra Chapter 22
VII.	Introduction for Wind Loads	Tamura and Kareem Chapter 1
VIII.	Design for Wind Loads	Tamura and Kareem Chapter 2
IX.	Introduction to Nonlinear Systems	Handouts only
X.	Introduction Nonlinear Modeling Platforms (as time permits)	Handouts only
XI.	Nonlinear Model Calibration and Evaluation (as time permits)	Handouts only
XII.	Probabilistic Response Evaluation and Performance Based Design (as time permits)	Elnashai and Sarno Chapters 4 and 5