560.752: Structural Dynamics
Fall 2012

Pre-requisites: knowledge of ODEs, linear algebra, rigid-body dynamics, static analysis of structures
Credits: 3
Lectures: MW 3-4:15pm
Room: Krieger 309 (eStudio)

Instructor: Prof. Judith Mitrani-Reiser, *jmitrani@jhu.edu*
Office Hours: Tues 3-5pm and by appointment, Latrobe 202 (Ext 6-7763)

TAs: Caitlin Jacques, *cjacque2@jhu.edu*
Office Hours: M 4:30-5:30pm W 10:30-11:30am, Latrobe 306

Blackboard: https://blackboard.jhu.edu (Login using JHU Enterprise Authentication)

Description: Functional and computational examination of elastic and inelastic single degree of freedom systems with classical and non-classical damping subject to various input excitations including earthquakes with emphasis on the study of system response. Extension to multi-degree of freedom systems with emphasis on modal analysis and numerical methods. Use of the principles of structural dynamics in earthquake response.

Objectives:
(1) Use mathematical models to *describe* structural response induced by dynamic excitation, emphasizing insight into the properties of real structures.
(2) Apply principles of structural dynamics and interpret theoretical and numerical results to better understand seismic behavior and the design of buildings.
(3) Students will learn to think critically through in-class problem solving exercises, including round-robin and other group activities.
(4) Students are expected to apply modern engineering tools to identify, formulate, and execute engineering solutions as well as communicate their results through their term project and formal in-class presentation of their results.

Textbook: Chopra, A.K., 2007. *Dynamics of Structures: Theory and Applications to Earthquake Engineering*, 3rd edition, Prentice-Hall. (a few copies available at Hopkins Bookstore)

On reserve: Clough, R.W., and Penzien, J., 1993. *Dynamics of Structures*, 2nd edition, McGraw-Hill.

Humar, J.L., 1990. *Dynamics of Structures*, 3rd edition, Prentice-Hall.

Grading: A weighted average will be calculated as follows:

Quizzes (6)	10%
Homework (9)	20%
Midterms (2)	50%
Final Project	20%

Note that I will automatically drop your lowest homework and quiz grades. The course grades will be determined as follows:

Score	>97	93-96.9	90-92.9	87-89.9	83-86.9	80-82.9	77-79.9	73-76.9	70-72.9	67-69.9	63-66.9	60-62.9	<60
Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

Homework: Homework contributes to 20% of your final grade. **HW assignments are due at 5pm** on the given date, and should be dropped off in the box outside my office. Any homework assignments turned in late will be penalized with a 50% deduction. No exceptions will be made for deduction of late assignments, and so the lowest homework grade will be dropped. If you believe an error was made in grading the homework, you should write a short justification of your claim and attach it to the original homework assignment in question and return it to the instructor in class or in the mailbox outside her office. The TA or instructor will review your concern and respond to you directly. The "statute of limitations" for submitting such claims is one week after the homework is returned.

Homework Guidelines: Homework assignments that are solved by hand must be submitted on engineering computation paper. Your name, class title (e.g., 'Structural Dynamics'), and solution page number (e.g., '1/10', …, '10/10') must appear on every page of your solutions. Additionally, the first page of your solutions should include the number of hours taken to complete the assignment and the name of any classmates that worked with you on the homework assignment. Any time that MATLAB is used in a homework assignment, you should include a **printout** of the most relevant parts of your script file, clearly identifying any input/output used by your program. Additionally, any relevant m-files and dat-files shall also be **emailed** to the Professor and TA(s), with the name of the homework assignment (e.g., 'Homework #7') written on the subject line. Additionally, your last name, homework number, and problem number shall all be included as part of your MATLAB file names (e.g., 'Mitrani_HW7PR2.m', 'Mitrani_HW7PR2_input.dat').

Quizzes: Quizzes contribute to 10% of your final grade. Short quizzes will be given throughout the semester. Quizzes will be administered at the **beginning of class** so be sure to be in class on time. Make-up quizzes will not be offered, and so the lowest quiz grade will be dropped.

Midterms: Exams (2 midterms) contribute to 50% of your final grade. These exams will be written in order to test your understanding of the topics covered in class, homework, and quizzes. I encourage you to ask lots of questions in class and through the Discussion section of Blackboard to help prepare you for examinations. Students who are unable to take a scheduled exam (with a documented excuse) will schedule an alternate time to take the exam.

Project: The final project contributes to 20% of your final grade. Your final project will focus on contemporary seismic design issues. Fifty points of the project will be devoted to the final project report and fifty points will be devoted to the development of the project concept, PowerPoint slides, and the delivery of your in-class presentation describing the project. You can work with a partner on this project, but this is optional.

Disabilities: Any student with a disability who may need accommodations in this class must obtain an accommodation letter from Student Disability Services, 385 Garland, (410) 516-4720, studentdisabilityservices@jhu.edu

Ethics: The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. All violations of academic ethics will be prosecuted. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. For further information, please see the guide on "Academic Ethics for Undergraduates" and the Ethics Board Website (http://ethics.jhu.edu).

Schedule:	Date	Topic	Reading	HW
Single-Degree of Freedom Systems (SDOF)	03 Sept	**NO CLASS: Labor Day**		
	05 Sept	Lecture 1: Intro & Equations of Motion	Ch. 1	
	10 Sept	Lecture 2: Free Vibration	Ch. 2	Quiz 1
	12 Sept	Lecture 3: Response to Harmonic Excitation	Ch. 3A	HW 1 due
	17 Sept	Lecture 4: Response to Harmonic Excitation	Ch. 3B	Quiz 2
	19 Sept	Lecture 5: Response to Arbitrary Excitation, Step, and Ramp Forces	Ch. 4AB	HW 2 due
	24 Sept	Structural Dynamics Lab Day with C. Jacques **Latrobe 13 (STIRM Lab)**		
	26 Sept	Structural Dynamics Lab Day with C. Jacques **Latrobe 13 (STIRM Lab)**		
	01 Oct	Lecture 6: Guest Lecture on Public Policy by Prof. Rutkow		
	03 Oct	Lecture 7: Guest Lecture on Public Health with Prof. Barnett		HW 3 due
	08 Oct	Lecture 8: Response to Pulse Excitation	Ch. 4C	Quiz 3
	10 Oct	Lecture 9: Numerical Methods and Midterm Review	Ch. 5	HW 4 due
	15-16 Oct	**Mon is Fall Break and class meets on Tues Midterm 1**		
	17 Oct	Lecture 10: Overview of Final Project and Movie		
Multi-Degree of Freedom Systems (MDOF)	22 Oct	Lecture 11: EQ Engineering (Linear Systems) and	Ch. 6	
	24 Oct	Lecture 12: EQ Engineering (Linear Systems)	Ch. 6	HW 5 due
	29 Oct	Lecture 13: EQ Engineering (Nonlinear Systems)	Ch. 7	Quiz 4
	31 Oct	Lecture 14: Equation of Motion for MDOF System	Ch. 9	HW 6 due
	05 Nov	Lecture 15: Natural Vibration	Ch. 10A	Quiz 5
	07 Nov	Lecture 16: Free Vibration Response	Ch. 10B	HW 7 due
	12 Nov	Lecture 17: Damping	Ch. 11A	Quiz 6
	14 Nov	Lecture 18: Modal Analysis	Ch. 12A-C	HW 8 due
	19 Nov	**NO CLASS**		
	21 Nov	**NO CLASS: Thanksgiving**		
	26 Nov	Lecture 19: Earthquake Analysis	Ch. 13A,B	
	28 Nov	Lecture 20: Midterm Review and Earthquake Analysis	Ch. 13A,B	HW 9 due
	03 Dec	**Midterm 2**	Ch. 18	
	05 Dec	Lecture 21: EQ Design & Building Codes		
	20 Dec 9am-12pm	**Final Project Presentations**		