Department of Civil Engineering
Gary S. Prinz, PhD, PE

CVEG 5323 – Structural Dynamics
Course Syllabus, Spring 2015

Classroom: BELL 2267
Mtg. Times: M-W-F, 8:35-9:25am

Website: www.ssrl-uark.com/teaching/

Instructor: Gary S. Prinz, PhD, PE
Office: Bell 4156
Office Hours: M-W-F, 9:25-10:25am
Email: prinz@uark.edu

Required Text:
S.S. Rao, *Mechanical Vibrations*, 5th Edition, Pearson Education Inc., 2011.
ISBN: 978-0-13-212819-3.

Prerequisites: CVEG 3304

Course Objectives:

The aim of this course is to give students the ability to analyze the response of single degree-of-freedom, discrete multi-degree-of-freedom, and continuous structural systems under dynamic loadings. After completion of the course students should be able to:

1. Solve un-damped SDOF systems subjected to free and forced vibration;
2. Solve damped SDOF systems subjected to free and forced vibration (including: harmonic vibration, pulse, ramp, and impulse loads);
3. Solve SDOF systems subjected to base excitation;
4. Understand the response spectrum
5. Formulate the equations of motion and solve un-damped and damped MDOF systems subjected to free and forced vibration;
6. Determine natural frequencies and vibration mode shapes for un-damped and damped MDOF systems;
7. Understand modal analysis and its application to solving for the response of MDOF systems;
8. Solve the dynamic response of continuous mass systems, including: 1) transverse vibrations in a string, 2) longitudinal vibrations in a rod, 3) torsional vibration in a shaft, and 4) transverse vibration in Bernoulli-Euler beams.

Grades: Grades are based on homework and exam performance. The final grade distribution is as follows:

Homework	30%
Midterm Exam	30%
Final Exam	40%

Homework:

Homework assignments and corresponding due dates are listed in the attached course schedule. Please note that homework assignments will be collected at the BEGINNING of class on the day they are due. Late homework will not be accepted.

Beware of over-dependence on other people for help with homework. Proper use (full participation) of study groups is highly encouraged; however, improper use of study groups is a form of academic misconduct and will be dealt with seriously (see section on Academic Integrity below).

Standards for Presentation:

Similar to what is expected in engineering practice, complete, professional, and correct presentations are expected on homework and exams. The presentations will be subject to critical review. It is possible to have correct solutions on homework and exam problems but receive less than full credit due to lack of clarity or un-professional presentation. The work leading to the solutions must be presented appropriately and clearly.

Note: A sample of proper work presentation is provided in this packet.

Attendance:

All students enrolled in this course are required to attend all lectures. Unavoidable absences should be discussed with the instructor in advance.

Academic Integrity:

In keeping with the University of Arkansas' academic integrity policy, academic misconduct in all forms is unacceptable and may result in a failing grade and further action by the Office of Academic Integrity and Student Conduct (OAISC). Academic misconduct includes, but is not limited to, plagiarism, fabrication or falsification, and cheating (including taking credit for work completed by others).

Five Keys to Success:

1. Read the assigned material before each class
2. Bring thoughtful questions to class or prepare for class as if you will be explaining the concepts to others
3. Take notes during class discussions and during reading assignments
4. Synthesize and summarize what you learn each week in a course journal
5. Begin your assignments the day they are assigned (rather than the day they are due) and turn in your work on time

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Tentative CVEG 5323 Course Schedule – Spring, 2014
(Subject to change by instructor)

Day	Date	Lecture	Topic / Discussion	Reading Assignment	HW Set
PART I: Single Degree-of-Freedom Systems					
M	1/12	1	Introduction to Vibration	1.1-1.5	
W	1/14	2	Lumped Parameter Models: Springs, Masses, and Dampers	1.6-1.9	
F	1/16	3	Harmonic motion	1.10-1.11	
W	1/21	4	Free Vibration of Un-damped Translational Systems	2.1-2.2	
F	1/23	5	Free Vibration of Un-damped Translational Systems Cont.	--	
M	1/26	6	Rayleigh's Method; Intro to Viscous Damping	2.5-2.6	
W	1/28	7	Free Vibration with Viscous Damping	--	
F	1/30	8	Free Vibration with Viscous Damping Cont.	--	
M	2/2	9	Harmonic Excitation, Beating, and Resonance	3.1-3.3	
W	2/4	10	Un-damped Harmonic Excitation	--	
F	2/6	11	Harmonic Excitation with Viscous Damping	3.4-3.5	
M	2/9	12	Harmonic Excitation with Viscous Damping Cont.	--	
W	2/11	13	Harmonic Base Excitation	3.6-3.7	
F	2/13	14	Introduction to Forced Vibration	4.1	
M	2/16	15	Periodic Forcing	4.2	
W	2/18	16	Numerical Integration of Periodic Functions	4.3-4.4	
F	2/20	17	The Convolution Integral	4.5	
M	2/23	18	The Response Spectrum	4.6	
W	2/25	19	Numerical Integration of Non-Periodic Functions	4.8-4.9	
F	2/27	20	Exam Review	--	
M	3/2	21	**Midterm Exam (2-hour time limit)**	--	
W	3/4	22	Debrief Exam	--	
PART II: Two Degree-of-Freedom Systems					
F	3/6	23	Free Vibration of Two Degree-of-Freedom Systems	5.1-5.4	
M	3/9	24	Free Vibration of Two Degree-of-Freedom Systems Cont.	--	
W	3/11	25	Coordinate Coupling and Principal Coordinates	5.5	
PART III: Multi-Degree-of-Freedom Systems					
F	3/14	26	Equations of Motion	6.1-6.3	
M	3/16	27	Influence Coefficients	6.4	
W	3/18	28	Lagrange's Equations	6.5-6.7	
F	3/21	29	The Eigenvalue Problem	6.8-6.11	
M	3/30	30	Semi-definite Systems	5.7, 6.12	
------- SPRING BREAK (MAR 23-27) -------					
W	4/1	31	Free Vibration using Modal Analysis	6.13	
F	4/3	32	Free Vibration using Modal Analysis Cont.	--	
M	4/6	33	Forced Vibration using Modal Analysis	6.14	
W	4/8	34	Forced Vibration using Modal Analysis Cont.	--	
F	4/10	35	Viscous Damping	6.15	
M	4/13	36	Viscous Damping Cont.	--	

W	4/15	37	Dunkerley's Approximations	7.1-7.2	
F	4/17	38	Rayleigh's Approximations	7.3	
PART IV: Continuous Systems					
M	4/20	39	Transverse Vibration of a String	8.1-8.2	
W	4/22	40	Longitudinal Vibration of a Rod	8.3	
F	4/24	41	Torsional Vibration of a Shaft	8.4	
M	4/27	42	Transverse Vibration of Bernoulli-Euler Beams	8.5	
W	4/29	43	Review for Final	--	
FINAL EXAM (Comprehensive)					