ENME 361 Vibrations, Controls and Optimization I
Spring 2017 Syllabus

Section Instructors

Section 0101
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Section 0301
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Office Hours: Mon and Wed (11:00 am to 12:00 pm)

Teaching Assistants and Office hours (in TA lounge - 3109 EGR)

Guanjin Wang (gjwang@umd.edu): Mon (9:00 to 10:00 am)
Jonathan Kordell (jkordell@terpmail.umd.edu): Tu (11:00 am to noon)
Tianchen Liu (tianchen@umd.edu): W (2:00 to 3:00 pm), F (11:00 am to noon)

Teaching Fellows and Office Hours (in TA lounge – 3109 EGR)

Patrick Woo (cwoo123@umd.edu): Mon (5:00 to 6:00 pm), Fri (2:00 to 3:00 pm)
Catherine Demmerle (cdemmerl@umd.edu): Mon (3:30 to 4:30 pm), Thurs (3:00 to 4:00 pm)

Class Meeting Times: Tu and Th (9:30 am to 10:45 am): JMP 3201 (0101), MCB 1207 (0301).

Course Prerequisites: ENES 220, ENES 221, and MATH 246.

Textbook: B. Balachandran and E. B. Magrab, *Vibrations*, Second Edition, CENGAGE Learning, Toronto, ON, 2009.

References:

1. Rao, S. S., *Mechanical Vibrations*, 4th Edition, 2004, TA355.R37 2004.
2. Inman, D. J., *Engineering Vibration*, 2nd Edition, 2001, TA355.I519 2001.
3. Kelly, S. G., *Fundamentals of Mechanical Vibrations*, 2nd Edition, 2000, QA935.K38 2000.
4. Seto, W. W., *Schaum's outline of theory and problems of mechanical vibration*, 1964, QA935.S4 1964a.

Course Objective and Topics:

Introduce modeling, analysis, and simulation techniques for the design of vibratory system: identification and prevention of unwanted oscillations or engineering of the desired oscillations in mechanical systems, civil structures, biomechanical systems, and microelectromechanical systems. Major topics include the following:

- Modeling of physical dynamical systems
- Harmonic and transient excitation of single degree-of-freedom systems
- Time-frequency domain equivalence
- Analysis of multiple degree-of-freedom systems

Learning Outcomes:

1. Model vibratory systems: spring, mass, dampers, and their combination.
2. Analyze and interpret the response of mechanical systems to various types of excitation.
3. Predict qualitatively the response of systems based on the spectral content of the excitation.
4. Minimize the effects of transient and harmonic excitations on systems and their support structures.

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Grading:

Final grades will be determined based on the following weight factors:

Homework: 20%
Quiz: 10%
Midterm Exam: 40%
Final Exam: 30%

Your final grade is based on your demonstrated proficiency of the subject, as determined by your grades on the examinations and homework assignments. Questions regarding grading of an exam or homework assignment must be resolved **within ten days** from the time the grade is returned.

Criteria for Homework:

- All homework assignments are due **at the beginning of class on the day specified.**
- Late homework submissions are **not** accepted. Late submissions as well as missed assignments will receive a score of zero.
- Each problem must be completed neatly on a **separate one-sided sheet of paper.** Every homework sheet must be stapled and have a full name and page number.
- **The instructors may decide to base homework grades on only a subset of the assigned problems (that is, there may be homeworks in which only some of the assigned problems will be graded). However, students should complete all the problems since the instructors will not announce which ones will be selected for grading.**
- All homework is to be completed **individually.**
- Use of MATLAB software will be needed for certain assignments.

Grading of Exams

- The exams will be graded & the exam books will be handed back one week after the exam date.
- Solution of the exams will be posted on www.elms.umd.edu one week after the exam date.
- **Questions regarding grading the exams must be resolved within ten days from the time the graded exam is returned**.
- **Make-up exams must be arranged ahead of time with a VALID EXCUSE.**

Academic Honesty

"The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit:
http://www.studenthonorcouncil.umd.edu/whatis.html."

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Lecture No.	Topics	Date	Text Sections
1	Introduction	1/26	1.1
2	Preliminaries from Dynamics	1/31	1.2
3	Modeling of Vibratory Systems	2/2	2.1,2.2,2.3
4	Modeling of Vibratory Systems	2/7	2.4-2.7
5	Single Degree of Freedom System: Governing Equations	2/9	3.1,3.2,3.3
6	Single Degree of Freedom System: Governing Equations	2/14	3.4,3.5
7	Single Degree of Freedom System: Governing Equations	2/16	3.5,3.6
8	Single Degree of Freedom System: Governing Equations	2/21	3.6
	Midterm Review (Chapters 1-3)	2/23	
	Midterm Exam 1 (Chapters 1-3)	2/28	
9	Single Degree of Freedom System: Free Response	3/2	4.1,4.2
10	Single Degree of Freedom System: Free Response	3/7	4.3
11	Single Degree of Freedom System: Free Response	3/9	4.3,4.4
12	Single Degree of Freedom System: Periodic Excitations	3/16	5.1,5.2
	SPRING BREAK		
13	Single Degree of Freedom System: Periodic Excitations	3/28	5.3,5.4
14	Single Degree of Freedom System: Periodic Excitations	3/30	5.4,5.5
15	Single Degree of Freedom System: Periodic Excitations	4/4	5.6,5.7
	Discussion and Review (Chapters 4-5)	4/6	
	Midterm Exam 2 (Chapters 4-5)	4/11	
16	Single Degree of Freedom System: Transient Excitations	4/13	6.1,6.2
17	Single Degree of Freedom System: Transient Excitations	4/18	6.3,6.5
18	Multi Degree of Freedom System: Force/Moment Balance	4/20	7.1,7.2
19	Multi Degree of Freedom System: Force/Moment Balance & Lagrange's Equations	4/25	7.2
20	Multi Degree of Freedom System: Lagrange's Equations	4/27	7.2
21	Multi Degree of Freedom System: Free Oscillations	5/2	7.3
22	Multi Degree of Freedom System: Free Oscillations	5/4	7.3,7.5
23	Multi Degree of Freedom System: Forced Oscillations	5/9	8.1-8.5
	FINAL EXAM REVIEW	5/11	
	FINAL	**5/15 (8 am)**	