ME 460/660: Mechanical Vibrations

Fall 2011

1 Instructor

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2 Communication

Please see my home page for contact information. It is the most up to date.

Email will be sent regularly to your university email accounts. This will allow us (me) to contact you regarding the class between lectures/labs. If you would rather have your email forwarded somewhere else, please read how to do that. This information and the answers to most any question you may have regarding the course and computer usage (including old exams, and the syllabus) can be found on the class page or the computer help page.

3 Time and Place

M/W, 6:05-7:45, 144 Russ

4 Office Hours

Tentative: Will change depending on student schedules. By appointment until set. Please try email first to contact me when you have questions outside of office hours. I check my email many times each day, and usually on weekends. You will get a quicker response by email than by any other mode of communication.

5 Text

Inman, D.J., *Engineering Vibration: Third Edition.* - Required
MATLAB Manual - May be useful, but manuals are available in the computer lab, online help is available through the online `help`, `lookfor` and `helpdesk` commands, as well as through the GUI. Also see the course web page for free short manuals. You can also edit any of the vibration toolbox codes for examples on how to code in MATLAB. Just type `edit vtb1_1` in MATLAB to edit the file `vtb1_1.m`.

6 Prerequisites

ME 360, System Dynamics

6.1 Prerequisites by topic

You are expected to know the following. Please review your old course notes and texts from linear systems, dynamics, and differential equations. Require prerequisite knowledge includes:

1. Differential equations,
2. modeling of single and multiple degree of freedom dynamic systems (Newtons law and conservation of energy),
3. transient response,
4. harmonic response,
5. Laplace transforms,
6. linear algebra,
7. kinetic energy of rigid bodies,
8. kinematics,
9. vector dynamics.

If you have not been taught this material in your prerequisite courses, it is vital that you communicate this to me immediately. I will, in turn, immediately pass this information on to the instructor of your prerequisite class (as appropriate), and help you rectify the situation through tutoring.

An inability to perform these tasks with accurately and consistency soon after the start of the course will immediately damage your ability to perform.

7 Course Contents

1. Introduction To Free Vibration And The Free Response (Chapter 1)
2. Response To Harmonic Excitation (Chapter 2)
3. General Forced Response (Chapter 3)
4. Multiple-Degree-Of-Freedom Systems (Chapter 4)
5. Design For Vibration Suppression (Chapter 5)
6. Grad Students Only: Distributed Parameter Systems (Chapter 6)
7. Experimental Vibration Analysis

8 Computer Usage

Programming must be done in MATLAB version 6 or 7 (student or professional version), or one of its free clone (Octave), and you are expected to take advantage of the free Vibration Toolbox (which runs on both). The syntax is not exactly the same as for MATLAB, however it is similar enough and the Vibration Toolbox is ported to run on it. In addition, the price is right (free). Octave does run faster for many calculations. The Engineering Vibration Toolbox will not work on Scilab completely as-is, but the changes that need to be made are small and relatively easy. You will need to use `vnaconvert` on your lab data before leaving the lab so that you can read it into octave. Save the data as vectors and matrices in matlab v4 format. I may be consulted on programming algorithms, but I cannot assist in debugging programs or answering questions on syntax that are readily answered by typing `help "topic"` (no quotes), `lookfor "topic"`, or other manuals. Please RTFM[1] or consult the GTA. Being self reliant is an important skill as an engineer. A tutorial on MATLAB,

[1] Often misunderstood, this stands for "read the *fine* manual"

Unix and Mathematica (the latter is not important to this class) is available on the course resource page. I suggest that you print it out and read it. Other more extensive resources are also available. Syntax issues are sufficiently discussed or displayed in these resources.

It is highly recommended that you learn to use MATLAB on your UNIX account as soon as possible. The Student Edition of the Vibration Toolbox Version 5 is *already installed* on your engineering accounts. This will allow you to use the Engineering Vibration Toolbox from your account on gandalf to aid in learning the material. You are expected to use the toolbox to assist you with homework. You will be required to use parts of it for your lab work. Please refer to the manuals in the computer labs and the hand-out provided in class. Also note that all of your lab data will be available through your UNIX account. If you use MATLAB on your personal computer, *you* will be responsible for installing the Engineering Vibration Toolbox on your computer and obtaining any necessary lab data from your UNIX account.

9 Grading and Performance

The following are my expectations for performance and associated weightings for grades. Guaranteed grades in the course are ($\geq 90 = A, \geq 80 = B, \geq 70 = C, \geq 60 = D, < 59 = F$). The instructor reserves the right to lower any or all of the thresholds.

9.1 Attendance

1. Attendance at lectures is optional and you are not assigned a specific grade for attendance. However, lack of attendance followed by poor performance or asking for material missed for no good reason will be reflected in your professionalism grade. If you miss class, you are responsible for obtaining missed material, including assignments, from another student. I will not repeat with you material covered in class if you do not attend.

2. Attendance in labs is mandatory. If you miss a lab, you must make it up. You must receive a passing grade for each lab assignment in order to complete the class. See the section on labs.

3. Bonus points may be awarded for participation (see Professionalism).

9.2 Professionalism (5%)

Professionalism is a measure of your behavior regarding expected practice as an engineer. This includes aspects such as attendance, note taking, consistency of performance, tenacity in problem solution, leadership, legibility and organization of problem solutions, clarity of communication, etc. For details on expected behavior, please consult *The Unwritten Rules of Engineering* by W.J. King, with revision by J.G. Skakoon. This book is available at the library. However, for your own professional development, I highly recommend that you own a personal copy. If you read an older edition of the book (prior to Skakoon), please be attentive to the fact that some of the comments, for example those regarding polishing shoes, are considered rather quaint today. Appearance is not quite as important today is it was then.

9.3 Homework (10%)

Homework problems will be posted on the course web page. Homework problems are collected every Wednesday in class, and you have no less than one week to do them after they are posted. Each homework problem is worth 1 point. Your final homework score is your average score of all homework problems assigned. You are encouraged to work together in small groups, but keep in mind that homework is assigned in order to help you learn and keep up with the course material. Homework may not be turned in late, but it is strongly encouraged that you complete late assignments for your own benefit. Please see me if you need help with the homework. You are also encouraged to do additional problems out of the text for practice on your own. The only way to learn the skills taught in this course is to apply them. Homework grades will be curved to a class average of 0.8 points per problem completed or above.

9.4 Exams (65%)

There will be two tests and a final exam graded on a near-straight scale ($\geq 90 = A, \geq 80 = B, \geq 70 = C, \geq 60 = D, < 59 = F$). I adjust for the difficulty of exams by scaling recorded scores. Cut-offs for each letter-grade will be reported when tests are returned. The final exam will count as two tests and will be comprehensive. The midterm grades plus the final exam grade (counted twice) yield four grades, one of which may be dropped. Tests will be returned as soon as possible. Solutions will be discussed during the lecture following the exam if time permits, otherwise solutions will be posted. All grading discrepancies must be brought up in writing no later than one week after the exam is returned. A simple note describing your contentions will do. All work must be done on the provided exam book using pencil or black ink. The provided formula sheet should be brought to the exam. No modifications to the sheet are allowed.

9.5 Labs (20%)

Labs will be performed in 010 Russ. Four labs will be assigned during the lab sessions. See the lab handouts (also posted on the web) for more details. Chapter 8 of the textbook is a useful resource on experimental techniques. Also see my Extra-Notes on-line. Please read the appropriate sections of the text before coming to the lab. All labs must be completed to receive a passing grade in the course. Lab reports will be worth a combined total of 20%. You will be tested on exams regarding your experience and learning in the lab.

9.6 Graduate Work (20%)

Graduate students will be expected to perform additional homework assignments. You will be responsible for them on the final exam. Graduate students may also be assigned topics beyond those in chapter 6. Undergraduates who perform the graduate work may use these points as bonus points. Note: it is not possible to "wing it," go without studying, and get partial credit.

9.7 Problem Solutions

All problem solutions, whether on homework or exams, should be neat and orderly. They should begin with a brief problem statement and figure (Elaborate drawings are not expected). A free-body-diagram is REQUIRED if Newton's law is applied. If Newton's law is applied, and no free-body diagram is given, no partial credit will be given. A brief description of each major step taken is necessary (as I do when giving lecture notes). Incomprehensible solutions will not receive partial credit. All work must be done on 8.5 in. by 11 in. paper using pencil or black ink.

Cheating

Don't. I helped write the university rules, and I will pursue them when warranted.

Cheating is defined as: Copying the solution of a problem from any source (including the solution manual). Using any source other than specified during a quiz or exam to solve the problem. Taking credit for work that was copied from another source is plagiarism and considered cheating.

10 Important Dates

October 3	Class time	Midterm
October 27	Class time	Midterm
November 16	8-10 PM	Final Exam

Please see my calendar for verification of dates.