Mechanical Engineering
ME 461: Mechanical Vibrations
Section 002
Fall 2019

Part 1: Course Information

Instructor Information

Instructor: Firas A. Khasawneh
Office: 2503 Engineering Building
Office Hours: MWF 2:30-3:30pm
Office Telephone: (517) 432-0471
E-mail: khasawn3@egr.msu.edu
(Please start the subject line with "ME461" followed by a few words describing your question. I usually answer emails daily, except when traveling)

TA: Joshua Tempelman
E-mail: tempelman2@msu.edu
Office hours:
Tue 6:00PM-7:30PM (6:00PM-8:00PM on Tuesday before midterms, and 6:30PM-8:00PM on 10/8)

Thu 2:00PM-3:30PM (no Thu office hours the day after a midterm)
Location for all office hours (see the note below for exceptions): EB 1420
Note:
Thu 10/17 the office hours will held at EB 3112
Thu 12/5 the office hours will be held at EB 3546D

Course Description

Modeling of Systems, Analysis of One DOF Systems, Analysis of Multi DOF Systems, Modal Analysis, and Applications.

Prerequisites

ME 361 and ME 391

Textbook & Course Materials

Engineering Vibration, Daniel J. Inman, Fourth Edition, ISBN: 978-0-13-287169-3, paperback or hardcover.

Recommended Texts & Other Readings

- Zill and Wright, Advanced Engineering Mathematics (OR your ME391 text)
- R.C. Hibbeler, Engineering Mechanics, Dynamics (your ME361 text)

- S. Rao, Mechanical Vibrations
- Schaum's Outline for Mechanical Vibrations
- Balachandran, Vibratinos

Course Requirements

Internet connection (DSL, LAN, or cable connection desirable)

Access to Desire2Learn (D2L)

Access to Crowdmark (for submission of assignments and online grading)

Coding in Python or Matlab for class illustrations and mini-projects

Course Structure
This course will meet three times per week for three lectures.

Section 2
Lectures MWF 11:30-12:20 @ 152 Natural Resources Bldg

The course outline and special materials will be available online through the course management system, and you will need your MSU NetID to login to the course from the D2L homepage (http://d2l.msu.edu).

Technical Assistance

If you need technical assistance at any time during the course or to report a problem you can:

Visit the Desire2Learn Help Site (http://help.d2l.msu.edu/)

Resource Center for Persons with Disabilities (RCPD)

Michigan State University is committed to providing equal opportunity for participation in all programs, services and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at rcpd.msu.edu. Once your eligibility for an accommodation has been determined, you will be issued a verified individual services accommodation ("VISA") form. Please present this form to me at the start of the term and/or two weeks prior to the accommodation date (test, project, etc.). Requests received after this date will be honored whenever possible

Part 2: Course Learning Objectives

Upon successful completion of this course, students can:

1. Mathematically Describe Dynamical Systems
    a. Students can identify the frequency, period and amplitude of an oscillatory signal.
    b. Students can identify the mass, stiffness, and damping elements of a vibration system.
2. Mathematically Model Dynamical Systems
    a. Students can model a vibration system by incorporating the elements of a vibration system into a free-body diagram.
    b. Students can apply Newton's second law to obtain the differential equations of motion.
    c. Students can express a periodic function in terms of a Fourier series.
3. Solve Ordinary Differential Equation Representing Vibration Models
    a. Students can compute and interpret the natural frequency and damping ratio.
    b. Students can determine the free responses of single-degree-of-freedom systems due to initial conditions for damped and undamped systems.
    c. Students can determine the forced responses of single-degree-of-freedom systems under direct excitation, base excitation, and rotating imbalance.
    d. Students can determine the free and forced responses of two-degree-of-freedom systems.
    e. Students can determine the free and forced responses of multiple-degree-of-freedom systems.
    f. Students can compute mode shapes and natural frequencies.
    g. Students can decouple a coupled multi-degree-of-freedom systems by using properties of linear normal modes.
    h. Students can design vibration absorbers.
    i. Students can design for vibration isolation.
4. Understand the underlying principles of common acceleration measurement devices
    a. Students understand the principles of accelerometers and seismometers.
5. Computer Skills
    a. Students can use Python or Matlab for eigenvalue/vector analysis.
    b. Students can use Python or Matlab for linear algebra problems.

Part 3: Tentative Course Outline/Schedule

A tentative schedule of the week by week course outline will be posted to D2L.

Important Dates:

- Open add period ends on 9/4/19
- End of tuition refund period for spring semester courses: 9/23/19
- Middle of semester and Last date to drop with no grade reported: 8:00 pm, 10/16/19
    - For drop after this date, students need to see their Associate Dean's office.

Part 4: Grading Policy

Graded Course Activities

The table below describes the graded course activities including points and activity description. The first column includes the points possible, and the second column includes a description for each activity.

Points	***Description***
60	Semester exams – graded using ad-hoc point rubrics (for short problems) and the topic rubrics provided on D2L. There will be three (3) semester exams, each one worth 25 points. The contribution of the lowest exam will be reduced by 15 points, and the score from all exams will contribute a total of 60 points toward the final grade. I will provide a formula sheet and any needed tables.
25	Final exam – The final is comprehensive with a specific focus on: (a) Material that was not tested on semester exams, i.e., final material. (b) Material that was part of semester exams but that was not tested. (c) Material that was tested on semester exams, but for which the class average was too low. The above is provided for guidance only—I would strongly caution against selective studying for the final since all the topics we will have covered are fair game. I will provide a formula sheet and any needed tables. These will also be posted prior to the finals week.
10	Mini-projects: Two mini-projects will be performed in groups of 4-6 students. The report can contain a mix of analytical derivations, experimental work, and coding exercises. A typeset report with a cover page stating the contribution of each member is required (a template will be posted on D2L). You will have weeks to complete each mini-project.
5	Five points total will be awarded for homework and/or in-class exercises: Homework – Only a small subset of the assigned problems will be graded, but the solutions to all HW problems will be posted after the deadline. You should use these assignments to better understand the course concepts and problem solution strategies. Your lowest homework score will be dropped from the final grade calculation. **No late submissions and no make-ups.** In-class exercises – graded using an exercise-specific rubric, to be provided. Some of these exercises may involve group-based analysis, design and discussion. Your lowest exercise score will be dropped. **No late submissions and no make-ups.**
100	Total Points Possible

Course Grades

The table below describes the course grade that will be assigned based on the points earned in the course (as described in the above table). Boundary cases are rare and they are handled on case-by-case basis at the instructor's discretion. Factors that can influence the outcome of boundary cases include:

* Trend of grades (up, down or stagnant?)
* HW performance (one missing is OK)
* Class maturity (disruptive? Or collaborative?)
* Office hours attendance
* Class attendance (if info is available)

Points Earned	*Course Grade*
90.0 – 100	4.0
85.0 – 89.9	3.5
80.0 – 84.9	3.0
75.0 – 79.9	2.5
70.0 – 74.9	2.0
65.0 – 69.9	1.5
60.0 – 64.9	1.0
< 60.0	0.0

Exam Schedule
Exam 1: Wed 9/25/19
Exam 2: Wed 10/30/19
Exam 3: Wed 11/20/19
Final: Wednesday, Dec 11 2019 7:45am - 9:45am in 152 Natural Resources Bldg

Regrade requests

Errors, oversights, and misinterpretations may occur. If there is an error in your grade (e.g., the total number of points incorrectly added) or you feel that the grade you received is not commensurate for your solution then you may submit a regrade request.

For HW and mini-projects, you must return the assignment with an attached written request detailing why you think your grade should be reconsidered. This regrade request should occur within 7 days after the graded assignment in question has been returned to the class.

For exams, no regrade requests will be accepted until exactly one week after the graded exam has been returned. To submit a regrade request, you must: 1) review the posted exam solution, and 2) attach a written request explaining why I should reconsider your grade. You must hand me your exam with the attached request either before or after the class one week after the exams are returned. Note that by submitting a regrade request you understand that your whole work can be re-evaluated and not only the problems you requested. You may appeal a section score if your solution was incorrect due to a minor error, as defined in the rubric.

Late Work and Make-Ups Policy

For homework assignments and in-class exercises, no late submissions will be accepted and no make-up assignments will be provided. To account for unforeseen circumstances, your lowest homework score and lowest in-class exercise score will be dropped.

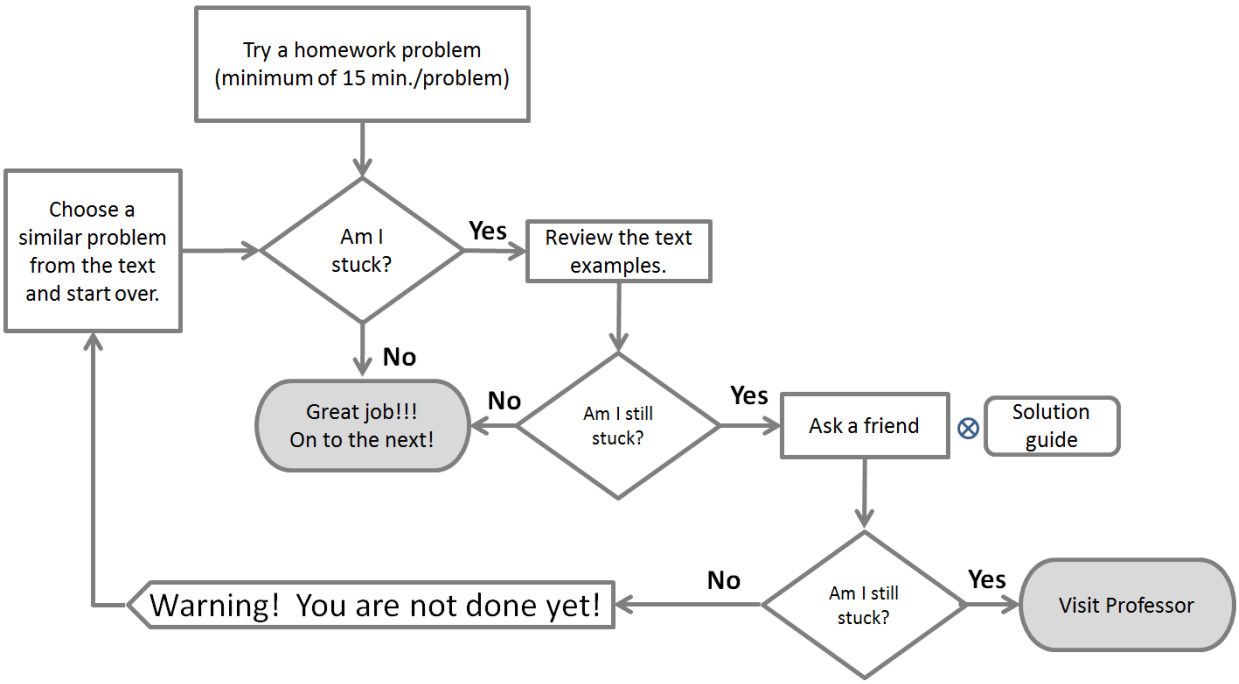
Make-up exams will be given only in the case of documented emergencies. Early exams will not be given.

Viewing Grades

Grades will be posted in D2L.

Methods

Learning to solve problems in engineering is hard. Please use the following process to optimize your results.



Part 5: Course Policies

Inform Your Instructor of Any Accommodations Needed

From the Resource Center for Persons with Disabilities (RCPD): Michigan State University is committed to providing equal opportunity for participation in all programs, services and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at rcpd.msu.edu. Once your eligibility for an accommodation has been determined, you will be issued a Verified Individual Services Accommodation ("VISA") form. Please present this form to me at the start of the term and/or two weeks prior to the accommodation date (test, project, etc.). Requests received after this date may not be honored.

Important Dates

See the MSU Academic Calendar for important dates:
http://www.reg.msu.edu/ROInfo/Calendar/Academic.asp

Labor Day: Monday, 9/2. University closed.

Design Day: Friday 12/6, in the Engineering Building

Final Exam: Wednesday, Dec 11 2019 7:45am - 9:45am in 152 Natural Resources Bldg

Honors Options

If you wish to do an honors option in this course, please discuss with your instructor in the first two weeks of the semester.

Commercialized Lecture Notes

Commercialization of lecture notes and university-provided course materials is not permitted in this course. This means that it is not allowable to post any of the course materials on-line, including but not limited to exam solutions, example problem solutions, and course notes or other materials provided by the instructor.

Complete Assignments

Assignments for this course will be submitted electronically through Crowdmark or D2L unless otherwise instructed**.**

Office Hours

I am happy to meet with students during office hours to clarify course issues and concepts. It is expected that students will give forethought to their questions prior to attending office hours. Don't be embarrassed to visit with a "simple" or "easy" question, often the answers to simple questions provide the most insight.

Homework

Homework will be assigned for each portion of the course, approximately every one or two weeks. Homework solutions will be submitted to Crowdmark (or D2L, as specified). Copying solutions from any source is expressly forbidden in this course.

On homework assignments, having group discussions about concepts and providing small "hints" to one another are allowable and encouraged. Looking at or making use of in any way an existing solution from any source (e.g., another person, a solution manual, a solution found online, etc.) is not allowed.

Your goal must be to learn how to independently solve these problems, and struggling with the problem concepts and the solution steps is a crucial part of the learning process. Despite the allowable collaborations, students are expected to submit final solutions that were worked out independently.

Examinations

All exams are closed book and closed notes. A formula sheet will be provided. You may bring a calculator (see below). Make-up exams will not be given.

No phones, headphones (unless disconnected headphones are approved by a VISA form), tablets, computers, smart watches or any other electronic device other than a calculator may be used or present during the exams.

Calculators

A calculator may be used on the exams. However, calculators may not be shared. Only independent, non-networked calculators may be used on exams. Students should have an extra set of batteries for their calculator in their bag; extra time will not be provided if there is a calculator failure.

Class Attendance

Absence from class can cause serious confusion. Students are expected to attend lectures, which are the standard forum for class communication. *Students are expected to prepare for class by reading the text material prior to class and examining the sample problems in the text.* Class absence is not an excuse for being unaware of course announcements or course materials. If a class is missed, lecture notes should be obtained from a peer in the class. The instructor is not responsible for providing lecture notes due to a student's absence.

Electronics

Cellphones and computers can be distracting to yourself and other students. Unless you receive prior permission to use them, they should remain silently in your bag during all lecture and laboratory sessions. Headphones may never be worn in class.

Communication

Email and other communications should comply with professional standards of corporate best practice. This includes using proper salutations, grammar, formatting, and logical flow. Use informative subject lines like "ME461-002 question: HW 3 problem 2".

Ethics and Academic Integrity

Engineers must adhere to a rigorous code of professional ethics and maintain the highest level of personal and professional integrity. Unethical conduct in this class includes, but is not limited to, copying from any source on exams, supplying information to others on exams, copying homework or laboratory exercises from any source, supplying unauthorized assistance to others on homework or laboratory exercises.

Students bear due responsibility for ensuring the security of their examination work, homework solutions and projects. There is a professional duty to report unethical conduct by others, including peers. If you have any questions, your instructor is available to discuss issues of professional expectations and ethics.

Any form of academic dishonesty (cheating) will result in a grade of 0.0 on the related assignment and may result in a grade of 0.0 in the course and the filing of an academic dishonesty report to the Associate Dean of Engineering. In extreme cases, a recommendation for expulsion will be filed.

The Associate Students of Michigan State University (ASMSU) has proudly launched the following Spartan Code of Honor academic pledge:

> **As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honest in my work, foster honesty in my peers, and take pride in knowing that honor is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do.**