

VIBRATIONS

EML4220 Section 13422

Class Periods: Period 4 (10:40 AM - 11:30 AM)

Location: TUR 2306

Academic Term: Fall 2021

This syllabus may be modified during the semester. If this happens, students will be notified, and the revised syllabus will be posted on the course web site.

Instructor:

Name: Youping Chen

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Office Phone Number: (352)3928494

Office Hours: MWF, 5-6pm, zoom

Supervised Teaching Student:

- "Sun, Jiaqi" <sunjiaqi@ufl.edu>

Course Description

Free and forced vibrations, single and multiple degree of freedom systems, and applications to mechanical systems. Credits: 3.

Course Pre-Requisites / Co-Requisites

Prereq: EGM 3344, EGM 3401, EGM 3520 and MAP 2302 with minimum grades of C.

Course Objectives

This course stresses fundamental engineering science and mathematical principles required for understanding of vibrations. Students will (a) learn the concepts needed for understanding and analysis of the dynamic behavior of vibrating systems, and (b) will develop skills for designing vibrating systems with desired properties that enhance vibration when it is wanted and reduce vibration when it is unwanted. Upon completion of this course, students will be able to

- 1) Generate simplified mechanics models for vibrating systems
- 2) Derive the equations of motion of single- and multiple-degree-of-freedom systems using mechanics principles
- 3) Solve the equations using mathematical methods of ordinary differential equations and linear algebra
- 4) Analysis of the mathematical solutions to find natural frequencies of the systems and to predict the dynamic responses of the systems to external excitations
- 5) Design mechanical systems with prescribed vibratory performance

Materials and Supply Fees

None

Professional Component (ABET):

EML 4220 supports several program outcomes enumerated in the Mission Statement of the Department of Mechanical and Aerospace Engineering. Specific ME program outcomes supported by this course include: (1) Apply knowledge of calculus based physics (ME Program Outcome M1); (2) Use knowledge of advanced mathematics through differential equations and Linear algebra (ME Program Outcome M2 and M3). (4) Being able to work professionally in the mechanical systems area (ME Program Outcome M4). Mathematical Sciences (40%), Physical Sciences (20%), Engineering Sciences (40%)

Course Title, Prefix, and Number

Course Instructor and Academic Term

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Relation to Program Outcomes (ABET):

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of mechanics and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Low
3. An ability to communicate effectively with a range of audiences	Low
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Low
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Low
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Low
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Low

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

- Title: [Engineering Vibration](#)
- Author: [Daniel J. Inman](#)
- Publication date and edition: [2014 3rd or 4th Edition](#)
- ISBN number

(if course notes derived from various published sources are used, provide information above for each source)
(if course notes are developed by the instructor, so state)

Recommended Materials

- Title (will be posted on the course web site)
- Author
- Publication date and edition
- ISBN number

Tentative Course Schedule (this may be modified in time)

	Week	Date	Topic
1	1	Aug. 23	Introduction to the course
2		Aug. 25	Chapter 1, Free Vibration (8-9 lectures)
3		Aug. 27	Free Vibration step 3 & 4
4	2	Aug. 30	Free Vibration examples
5		Sep. 1	Free Vibration, Viscous damping
6		Sep. 3	Free Vibration, Viscous damping examples HW1 due
7	3	Sep. 8	Free Vibration, Stiffness
8		Sep. 10	Free Vibration, Application of vibrations to instruments and measurements
9	4	Sep. 13	Free Vibration, Stability
10		Sep. 15	Chapter 1 & HW 1 review HW2 due
11		Sep. 18	HW 2 and Practice exam review
12	5	Sep. 20	Exam 1
13		Sep. 22	Exam1 review/ Chapter 2, Response to harmonic excitation (6-7 lectures)
14		Sep. 24	Response to harmonic excitation
	6	Sep. 27	Career Fair/No class
15		Sep. 30	Response to harmonic excitation of damped system
16		Oct. 1	Response to harmonic excitation of damped system, base excitation
17	7	Oct. 4	Harmonic excitation of damped system, base excitation, rotating balance
18		Oct. 6	Measurement devices/accelerometer/seismometer HW3 due
19	8	Oct. 11	Review of chapter 3 and HW3
20		Oct. 13	Practice exam review
21		Oct. 15	Exam 2
22	9	Oct. 18	Exam2 review/ Chapter 3, General force response, impulse response (6 lectures)
23		Oct. 20	General force response, impulse and step response
24		Oct. 22	General force response, step and ramp response
25	10	Oct. 25	General force response, periodic forces and Fourier theory
26		Oct. 27	General force response, arbitrary periodic force examples
27		Oct. 29	Fourier transform, stability HW4 due
28	11	Nov. 1	Laplace transform, shock spectrum
29		Nov. 3	Review of HW3
30		Nov. 5	Review of Chapter 3, Practice exam review,
31	12	Nov. 8	Exam 3
32		Nov. 10	Exam 3 review / Chapter 4 MDOF systems
33		Nov. 12	2DOF Eigenvalues and natural frequencies
34	13	Nov. 15	2DOF Modal analysis
35		Nov. 17	More than 2DOF
36		Nov. 19	Mode summation method
37	14	Nov. 22	Rigid body motion and modal analysis/systems with viscous damping
38		Nov. 23	Resonance, Modal analysis of forced response
39	15	Nov. 29	Examples HW5 due
40		Dec. 1	Vibration design
41		Dec. 3	Review of Chapter 4 and HW 5
42	16	Dec. 6	Review of Practice Exam
		Dec. 8 or Dec. 17 7:30 am	Exam 4

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy, Class Expectations, and Make-Up Policy

Class attendance (in person or online) is expected, but not required. Participation is, however, required. If you must miss a lecture for any reason, you should obtain the lecture notes from another student or watch the recorded lecture if available. Students will be held responsible for knowledge of all scheduling and policy announcements made in class or on course website. Make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (5)	100 each	20%
Participation	100	5%
Exam 1	100	20%
Exam 2	100	15%
Exam 3	100	15%
Exam 4	100	25%
		100%

- Late homework will be deducted 20% per day.
- Solutions will be posted on class web site

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

Honorlock:

Consistent with University of Florida policy, Honorlock will be used for the exams. Please see the following link: <https://distance.ufl.edu/proctoring/> for more information.

More information on UF grading policy may be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Use of Live Zoom (HyFlex)

In light of the challenge of the pandemic, the instructor may live stream to those who are sick or just quarantining. Associated recordings may be made. Regarding associated details, the instructor will update the class throughout the semester.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any

condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate Program Coordinator: advising@mae.ufl.edu
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

COVID-19

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.
- Consistent with UF policy: "If a student is absent from classes or examinations because of illness, they should contact their instructors."

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.