

North Carolina State University
Department of Mechanical and Aerospace Engineering

MAE 315-602 Fundamentals of Vibrations

SYLLABUS

Fall 2024

Instructor: Dr. Andrew Lee, Assistant Professor

Schedule: Mon & Wed 11:45 AM - 1:00 PM

Office Hours: Mon & Wed 3:00 PM - 4:00 PM on Zoom (<https://ncsu.zoom.us/j/98462993610>)

Email: alee29@ncsu.edu

Website: wolfware.ncsu.edu (Moodle and Panopto)

Course Description

The introductory course to vibrations. Lectures focus on free and forced vibration of discrete systems and free vibration of continuous systems. Students learn to apply vibration theory to the analysis and design of machines and/or mechanical components.

Reference Textbook

There is no required textbook for this course. However, listed below are optional textbooks that are supplementary to the course material. They serve as useful a resource for additional explanations and example problems.

- *Mechanical Vibrations*, 6th Edition by S.S. Rao.
- *Engineering Vibrations*, 5th Edition by D.J. Inman

Prerequisite

MA 341 and C- or better in MAE 208

Course Notes

Skeleton notes will be posted on Moodle before each lecture. You are expected to print these notes and bring them to class for the discussion of each topic. In class example problems will be worked out by hand. You may take notes on electronic devices, but these devices will be prohibited during exams.

Homework Policy

Homework assignments will be posted on Moodle following the schedule listed in this syllabus. Their due dates are also listed in this syllabus. The submission deadline is always at 11:30 AM and the completed assignments should be submitted on Moodle in PDF format. Late submissions will be accepted up to 24 hours after the deadline, but they will carry a 50% grade

deduction. Homework solutions will be made available after the late homework deadline unless there are any extensions granted to excused students. The lowest homework grade will not be counted towards the final course grade.

Students are allowed discuss the problems with each other, but copying each other's solutions or any solutions outside of this course section is strictly prohibited. Homework submissions must represent your own work and effort.

IMPORTANT: Double check your homework solutions PDF after submitting on Moodle to confirm that the correct file has been uploaded and that it is not corrupt. Students will not be allowed to resubmit their solutions after the late deadline even if they originally completed the assignment on time.

Examinations

There will be two midterm exams and a comprehensive final exam, all held in person. All exams will be open book (i.e. notes, examples, and homework) and calculators are allowed, but devices with internet connectivity (e.g. phones, tablets, and laptops) are prohibited. This means any notes taken on these devices must be printed out.

- Midterm Exam 1 - September 25, 2024 (Wed)
- Midterm Exam 2 - November 4, 2024 (Mon)
- Final Exam - December 9, 2024 (Mon) 12:00 PM - 2:30 PM

Grading Policy

To receive full credit in homework assignments and exam problems, demonstrate how you arrived at your answer by neatly showing your work. Circle or box your final answer(s). For the course grade assignment, the following weights will be applied:

- Homework: 20% (Every homework is weighted the same amount; lowest homework grade is dropped)
- Midterm Exam 1: 25%
- Midterm Exam 2: 25%
- Final Exam: 30%

Grading scale

$97 \leq A+ < 100$	$87 \leq B+ < 90$	$77 \leq C+ < 80$	$67 \leq D+ < 70$	$0 \leq F < 60$
$93 \leq A < 97$	$83 \leq B < 87$	$73 \leq C < 77$	$63 \leq D < 67$	
$90 \leq A- < 93$	$80 \leq B- < 83$	$70 \leq C- < 73$	$60 \leq D- < 63$	

Schedule

Week	Date	Lecture	Topic	HW Assign	HW Due
1	Aug. 19	1	Introduction and Basic Concepts		
	Aug. 21	2	Modeling of Mechanical Systems	1	
2	Aug. 26	3	SDOF Undamped Free Vibration (1/2)		
	Aug. 28	4	SDOF Undamped Free Vibration (2/2)	2	1
3	Sep. 2		Labor Day		
	Sep. 4	5	SDOF Damped Free Vibration (1/2)		2
4	Sep. 9	6	SDOF Damped Free Vibration (2/2)	3	
	Sep. 11	7	SDOF Harmonic Forced Vibration (1/2)		
5	Sep. 16	8	SDOF Harmonic Forced Vibration (2/2)	4	3
	Sep. 18	9	Base Excitation, Impulse, & Numerical Solutions (1/2)		
6	Sep. 23		Midterm Exam 1 Review		4
	Sep. 25		Midterm Exam 1		
7	Sep. 30	10	Base Excitation, Impulse, & Numerical Solutions (2/2)	5	
	Oct. 2		Midterm Exam 1 Solutions		
8	Oct. 7	11	2DOF Free Vibration (1/2)		5
	Oct. 9	12	2DOF Free Vibration (2/2)	6	
9	Oct. 14		Fall Break		
	Oct. 16	13	2DOF Forced Vibration (1/2)		
10	Oct. 21	14	2DOF Forced Vibration (2/2)	7	6
	Oct. 23	15	MDOF Vibration and Lagrange's Equations (1/3)		
11	Oct. 28	16	MDOF Vibration and Lagrange's Equations (2/3)		
	Oct. 30		Midterm Exam 2 Review		7
12	Nov. 4		Midterm Exam 2		
	Nov. 6	17	MDOF Vibration and Lagrange's Equations (3/3)	8	
13	Nov. 11		Midterm Exam 2 Solutions		
	Nov. 13	18	Continuous Vibration: String, Bar, and Shaft (1/2)		
14	Nov. 18	19	Continuous Vibration: String, Bar, and Shaft (2/2)		8
	Nov. 20	20	Continuous Vibration: Beam	9	
15	Nov. 25	21	Introduction to Aeroelasticity		
	Nov. 27		Thanksgiving		
16	Dec. 2		Final Exam Review		9
	Dec. 9		Final Exam: 12 PM to 2:30 PM		

Miscellaneous

1. There will be no makeup examinations or homework extensions unless there is a documented excuse or prior instructor approval.
2. If you believe a grading error was made in the homework, write a short justification of your claim and email the instructor. The grader or instructor will review your claim and you will be notified directly. You will have up to one week after the homework is returned to make any claims.
3. Students are expected to follow university guidance pertaining to the Code of Student Conduct. See <https://studentconduct.dasa.ncsu.edu/code/>

In addition, students are expected to adhere to the university honor Pledge stated here as follows: "I have neither given nor received unauthorized aid on this test or assignment."

4. Online class evaluations will be available for students to complete at the end of the semester.
5. Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantages of available accommodations, students must register with the Disability Resource Office. For more information, please see <https://dro.dasa.ncsu.edu/>