

North Carolina State University
Department of Mechanical and Aerospace Engineering

MAE 537 Mechanics of Composite Structures

SYLLABUS

Spring 2024

Instructor: Dr. Andrew Lee, Assistant Professor
Schedule: Tue & Thu 3:00 PM - 4:15 PM
Classroom: 2207 Engineering Building 3
Office Hours: Tue 4:30 PM - 5:30 PM on Zoom (ncsu.zoom.us/j/94542952748)
Email: alee29@ncsu.edu
Website: wolfware.ncsu.edu (Moodle)

Course Objectives

- Analyze the mechanical behavior of composite lamina.
- Predict the effective properties of lamina with approaches in micromechanics.
- Find stiffness properties of composite laminates and how they respond to applied loads.
- Determine how composite materials fail and how they respond to environmental effects.
- Model how composite laminates deflect, buckle, and freely vibrate with plate theory.
- Understand the current practices and challenges with manufacturing and testing of composite structures.

Reference Textbook

There is no required textbook. However, the textbooks listed below are recommended for more in depth explanations and supplementary topics.

- *Principles of Composite Material Mechanics*, 4th Edition by R.F. Gibson.
- *Mechanics of Laminated Composite Plates and Shells*, 2nd Edition by J.N. Reddy
- *An Introduction to Composite Materials*, 3rd Edition by T.W. Clyne and D. Hull.

Prerequisite

MAE 316 or MAE 472

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 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 the midterm exam.

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 2:30 PM 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.

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.

Examinations

The midterm exam will be held in class at 2207 Engineering Building 3. It 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 still prohibited. This also means any notes taken on these devices are also prohibited.

The take home final exam is also open book and the use of computers is allowed. It will be administered through Moodle and the completed exam should be submitted on Moodle in PDF format. It must be completed individually and any communication between students is prohibited during the exam.

- Midterm Exam - February 29, 2024 (Thu)
- Take Home Final Exam
 - Start: April 25, 2024 (Thu) 3:30 PM
 - End: April 28, 2024 (Sun) 3:30 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: 30% (Every homework is evenly weighted)
- Midterm Exam: 30%
- Take Home Final Exam: 40%

Grading scale

$96 \leq A+ < 100$	$81 \leq B+ < 85$	$67 \leq C+ < 70$	$57 \leq D+ < 60$	$0 \leq F < 50$
$89 \leq A < 96$	$74 \leq B < 81$	$63 \leq C < 67$	$53 \leq D < 57$	
$85 \leq A- < 89$	$70 \leq B- < 74$	$60 \leq C- < 63$	$50 \leq D- < 53$	

Schedule

Week	Date	Lecture	Topic	HW Assign	HW Due
1	9-Jan		No Lecture		
	11-Jan	1	Introduction and Basic Concepts		
2	16-Jan	2	Lamina Properties and Relations (1/3)		
	18-Jan	3	Lamina Properties and Relations (2/3)		
3	23-Jan	4	Lamina Properties and Relations (3/3)	HW 1	
	25-Jan	5	Micromechanics and Lamina Strength (1/3)		
4	30-Jan	6	Micromechanics and Lamina Strength (2/3)		
	1-Feb	7	Micromechanics and Lamina Strength (3/3)	HW 2	HW 1
5	6-Feb	8	Laminate Properties and Relations (1/3)		
	8-Feb	9	Laminate Properties and Relations (2/3)		
6	13-Feb		Wellness Day (No Lecture)		
	15-Feb	10	Laminate Properties and Relations (3/3)	HW 3	HW 2
7	20-Feb	11	Hygrothermal Effects (1/2)		
	22-Feb	12	Hygrothermal Effects (2/2)		
8	27-Feb		Midterm Exam Review		HW 3
	29-Feb		Midterm Exam		
9	5-Mar	13	Transverse Loads and Deflections (1/2)		
	7-Mar	14	Transverse Loads and Deflections (2/2)	HW 4	
10	12-Mar		Spring Break		
	14-Mar		Spring Break		
11	19-Mar		Midterm Solutions		
	21-Mar	15	Buckling and Free Vibrations (1/3)		HW 4
12	26-Mar	16	Buckling and Free Vibrations (2/3)		
	28-Mar	17	Buckling and Free Vibrations (3/3)		
13	2-Apr	18	Laminate Strength and Failure (1/2)		
	4-Apr	19	Laminate Strength and Failure (2/2)	HW 5	
14	9-Apr	20	Manufacturing, Testing, and Repair (1/3)		
	11-Apr	21	Manufacturing, Testing, and Repair (2/3)		
15	16-Apr	22	Manufacturing, Testing, and Repair (3/3)		
	18-Apr	23	Bistable Composites		HW 5
16	23-Apr		Final Exam Review		
	25-Apr		Take Home Final Exam: Due 28-Apr		

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 instructor will then 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. All lectures will be recorded via Panopto and the link is provided on the course Moodle site.

4. For Engineering Online (EOL) students, the midterm exam will be proctored and administered by the EOL Exam Office. The exam window will be from Feb. 29 at 3 PM to Mar. 2 at 5 PM.
5. 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."

6. 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, see: <https://dro.dasa.ncsu.edu/>