Stony Brook University

<<MECHANICAL ENGINEERING >>

FALL 2021

Important Note: Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. It is your responsibility to check Blackboard for corrections or updates to the syllabus. Any changes will be clearly noted in course announcement or through email.

Part 1: Course Information

Course Title: Introduction to Engineering Mechanics of Composites

Course Catalog # & Section: MEC456 or MEC556

Credit Hours: 3

Prerequisite: MEC 363 or equivalent course (working knowledge of linear matrix algebra and basic coding skills in MATLAB)

Lectures: Mondays 4:25 PM to 7:15 PM (in person)

Classroom: PSYCHOLOGY A 137 WEST CAMPUS

Instructor Name: Kedar Kirane

Instructor Contact Information:

Email: kedar.kirane@stonybrook.edu

Phone: 631-632-8309

Office Hours: Mondays and Wednesdays 1 to 3 pm

Location: 133 Light Engineering

(If necessary, an online zoom meeting can be set up too, by email)

Course Description:

Introduction to the engineering mechanics of fiber reinforced composites. Brief history of the development of fiber composites, their properties, advantages, limitations, and applications. Overview of the different types of composites but with focus on long fiber reinforced composites; particularly, lamina and laminate concepts characteristics and configurations. The course introduces various length-scales at which composites are analyzed (individual fibers/matrix, lamina, and laminates). Topics covered include elastic properties of unidirectional lamina, strength

(and progressive failure) of unidirectional lamina, elastic behavior of multidirectional laminates and strength and progressive failure of multidirectional laminates. Design methodologies and considerations for structural composite materials. The course also introduces the students to various modes of failure in composites, various lamina failure theories, classical laminate theory, and briefly fracture mechanics.

Required Course Textbook and Materials:

- Engineering Mechanics of Composite Materials, Isaac M. Daniel & Ori Ishai. Oxford Press (2006, second edition) ISBN 978-0-19-515097-1

Recommended Readings/Bibliography:

- Autar K. Kaw, "Mechanics of Composite Materials," 2nd ed., Taylor and Francis
- Robert M. Jones, "Mechanics of Composite Materials," Taylor and Francis.

Details of topics covered:

- Introduction - Relevant terminology, advantages & disadvantages of composites, role of constituents (fibers, matrix), synthesis and fabrication techniques, types of composites, degrees of anisotropy
- UD lamina – Elastic constitutive relations, relations between mathematical and elastic constants, plane stress constitutive relation, transformation of elastic parameters, effective elastic properties (fiber volume ratio, rule of mixtures)
- Strength of UD lamina – Failure mechanisms and failure criterion, failure theories (stress, strain, Tsai Hill, Tsai Wu)
- Multi-directional laminates – Macro-mechanical Analysis, Elastic properties, Laminate theory, (Cross-Ply, Moment-Curvature, Basic), Stress and Failure analysis
- Failure and Design of Laminates - Ply Arrangements, Failure Theories, Failure Criterion
- Other topics: Fatigue, Fracture mechanics, Quasi-brittleness, Size Effects, Mechanical testing methods overview, Hygro-thermal effects

Course Delivery Mode and Structure:

This is an in-person course, managed in the Blackboard learning management system (LMS). Students must be mindful of all course expectations, deliverables, and due dates. Many course interactions will utilize internet technologies. See "Technical Requirements" section for more information.

How We Will Communicate:

Course-related questions and other personal/private issues, my preferred method of contact is via email listed at the top of this syllabus. Your Stony Brook University email must be used for all University related communications. You must have an active Stony Brook University e-mail account and access to the Internet. *All instructor correspondence will be sent to your SBU e-mail account.* Please plan on checking your SBU email account regularly for course related messages.

Technical Requirements:

This course uses Blackboard for the facilitation of communications between faculty and students and posting of grades. The Blackboard course site can be accessed at https://blackboard.stonybrook.edu You are responsible for having a reliable computer and Internet connection throughout the term.

The following list details a minimum recommended computer set-up and the software packages you will need to have access to, and be able to use:

- PC with Windows 10
- Macintosh with OS 10.13 or higher
- Latest version of Chrome, Firefox or Explorer; Mac users may use Chrome, Firefox or Safari. (A complete list of supported browsers and operating systems can be found on the My Institution tab of the Blackboard website.)
- Word processing software (Microsoft Word, Pages, etc.)
- Many assignments will require use of MATLAB or Microsoft Excel
- Ability to download and install free software applications and plug-ins (note: you must have administrator access to install applications and plug-ins).
- Adobe Flash player with the latest update is crucial for playing multiple videos throughout the course

Technical Assistance:

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

- submit a help ticket on the web at http://it.stonybrook.edu/services/itsm)
- call (631) 632-9800 (technical support, log-in issues, computer support, wifi, software & hardware)
- call (631) 2-CELT [631-632-2358]

Part 2: Course Learning Objectives and Assessments

Learning Objectives and Activities:

Upon completion of the course, students will be able to:

1. Become familiar with the advantages and limitation of fiber composites in comparison with conventional structural materials
2. Be able to use stress-strain linear elastic constitutive relations in structural analysis, including isotropic, anisotropic, orthotropic, and transverse isotropic relations
3. Understand coordinate transformation of stress, strain, stiffness, and compliance matrices
4. Understand various theoretical methods for predicting effective elastic properties and their relative advantages and limitations
5. Be able to determine the onset of failure in composites using various strength-based failure theories
6. Be able to determine the elastic behavior of multidirectional laminates composed of plies with different orientations
7. Be able to appreciate the shortcomings of strength-based failure theories, and importance of fracture mechanics

CLO Assessment tool for all above CLOs will be homework and exams

Assignments and Expectations:

- Homework assignments will be assigned on blackboard and will have to be submitted in class. Students will work out your solutions on paper, or print typed up document as per their preference

- A group project will also be assigned towards the end of the semester which will involve reviewing a published research article and making a class presentation. (the grade for the project will be counted under homework)

- All exams will be held in person. All exams will be open book and open notes. An exam absence will be scored as a zero, unless a justifiable excuse with appropriate documentation is presented to the instructor in a timely fashion.

Part 3: Course Schedule

****subject to changes****

Please note that this schedule is tentative. Our exact schedule during the semester might differ depending on our progress, weather related class cancellations etc. Updates to this schedule will be posted on blackboard

WEEK	**Date**	**CLASS**		
1	8/23	1	Chapter 1, 2	Intro, basic concepts
2	8/30	2	Chapter 3	Lamina elastic - micromechanics
3	9/6		Labor Day, no class	
4	9/13	3	Chapter 4	Lamina elastic - macromechanics
5	9/20	4	Chapter 4	Lamina elastic - macromechanics
6	9/27	5	Chapter 5	Lamina failure - micromechanics
7	10/4	6	Chapter 5, 6	Lamina failure - macromechanics
8	10/11		Fall break, no class	
9	10/18	7	MIDTERM	
10	10/25	8	Chapter 6	Lamina failure - macromechanics
11	11/1	9	Chapter 6, 7	Lamina failure, Laminate - elastic
12	11/8	10	Chapter 7, 9	Laminate - elastic, laminate failure (FPF)
13	11/15	11	Chapter 9, 8	Laminate failure
14	11/22	12	Chapter 8	Hygrothermal effects
15	11/29	13	--	Project Presentations
16	12/6	14	--	Presentations, HW discussion, Revision
17	12/8*		Final exam	

* (To be confirmed)

Part 4: Grading, Attendance, and Late Work Policies

Assessment & Grading:

Viewing Grades on Blackboard: Points you've earned for graded activities will be posted to the MyGrades screen in the Tools area of Blackboard.

Semester letter grade will be decided based on your relative ranking in the class. An average score will be considered equivalent to a B. Your aggregate score to determine your standing is based on the following categories:

Homework, includes project (about every 2 weeks)	40%
Mid-Term Exam	30%
Final Exam	30%

Letter Grades:
Final grades assigned for this course will be based on the percentage of total points earned and are assigned as follows:

Letter Grade	GPA/Points	Performance
A	4.0	Excellent Work
A-	3.7	Nearly Excellent Work
B+	3.3	Very Good Work
B	3.0	Good Work
B-	2.7	Mostly Good Work
C+	2.3	Above Average Work
C	2.0	Average Work
C-	1.7	Mostly Average Work
D+	1.3	Below Average Work
D	1.0	Poor Work
F	0.0	Failing Work

Attendance and Late Work Policy:

Version with absenteeism penalties: Attendance in this online course is accrued through your timely participation in discussions and completion of assignments.

Late Work Policy: I will accept late work but with a penalty and will be decided on a case to case basis.

Part 5: Course and University Policies

Student Accessibility Support Center Statement

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact the Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631)632-6748.

They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.
https://www.stonybrook.edu/commcms/studentaffairs/sasc/facstaff/syllabus.php

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Student Accessibility Support Center. For procedures and information go to the following website: https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-people-physical-disabilities

- To access mental health services, call Counseling and Psychological Services at 631-632-6720; Counselors are available to speak with 24/7.

- For updated information on the Academic Success and Tutoring Center please check www.stonybrook.edu/tutoring for the most up-to-date information.

- For IT Support: Students can visit the Keep Learning website at
https://sites.google.com/stonybrook.edu/keeplearning
for information on the tools you need for alternative and online learning.

Need help? Report technical issues at https://it.stonybrook.edu/services/itsm
or call 631-632-2358.

For information on Library services and resources please visit the Continuity of Library Operations guide.

Academic Integrity Statement:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Understand When You May Drop This Course:

It is the student's responsibility to understand when they need to consider disenrolling from a course. Refer to the Stony Brook Academic Schedule for dates and deadlines for registration: http://www.stonybrook.edu/commcms/registrar/calendars/academic_calendars

Incomplete Policy:

Under emergency/special circumstances, students may petition for an incomplete grade. Circumstances must be documented and significant enough to merit an Incomplete. If you need to request an incomplete for this course, contact me for approval as far in advance as possible.

Course Materials and Copyright Statement:

Course material accessed from Blackboard, Zoom sessions, Homework Assignments, Exams, Lecture videos or a Stony Brook Course website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor and/or the copyright holder. Duplication of materials protected by copyright, without permission of the copyright holder is a violation of the Federal copyright law, as well as a violation of Stony Brook's Academic Integrity.

All federal and state copyright interests are reserved for all original material presented in this course through any medium, including lecture, electronic transmission or print. Individuals may not sell, be paid or receive anything of value for class notes made during this course from any person or entity without the express written permission of (author). In addition to legal sanctions, violation of these copyright prohibitions may result in University disciplinary action.

Allowed Calculators:

Only the following calculators will be permitted to be used on all midterm and final exams in the Department of Mechanical Engineering. There will be no exceptions! This list of calculators is identical to that allowed for the National Council for Examiners for Engineering and Surveying (NCEES) Fundamentals of Engineering (FE) exam that many of you will take in your senior year, as well as Professional Engineering (PE exam) that you may take.
Casio: All fx-115 models. Any Casio calculator must contain fx-115 in its model name.
Hewlett Packard: The HP 33s and HP 35s models, but no others.
Texas Instruments: All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.
For detailed information, follow https://ncees.org/exams/calculator-policy/

Make up exams:

The class policy on make-up exams is consistent with university policy on Student Participation in University Sponsored Events, the policy on Final Exams and the New York State Education Law regarding Equivalent Opportunity and Religious Absences.

Online Communication Guidelines and Learning Resources:

Maintain Professional Conduct: The classroom is a professional environment where academic debate and learning take place. I will make every effort to make this environment safe for you to share your opinions, ideas, and beliefs. In return, you are expected to respect the opinions, ideas, and beliefs of other students—both in the face-to-face classroom and online communication. Students have the right and privilege to learn in the class, free from harassment and disruption. The course follows the standards set in the Student Code of Conduct, and students are subject to disciplinary action for violation of that code. If your behavior does not follow the course etiquette standards stated below, the grade you receive for a posting may suffer. I reserve the right to remove any discussion messages that display inappropriate language or content.

Online communication etiquette:

- Offensive language or rudeness will not be tolerated. Discuss ideas, not the person.
- Avoid cluttering your messages with excessive emphasis (stars, arrows, exclamations).
- If you are responding to a message, include the relevant part of the original message in your reply, or make sure to refer to the original's contents to avoid confusion.
- Be specific and clear, especially when asking questions.
- Use standard punctuation and capitalization. Using all UPPERCASE characters gives the appearance of shouting and makes the message less legible.
- Remember that not all readers have English as their native language, so make allowances for possible misunderstandings and unintended discourtesies.

Student Learning Resources:

- Academic and Transfer Advising Services: Have questions about choosing the right course? Contact an advisor today. Phone: (631) 632-7082 (option 2); email: advising@stonybrook.edu; website: http://www.stonybrook.edu/commcms/advising/
- Amazon @ Stony Brook: Order your books before classes begin. Phone: (631) 632-9828; email: Bookstore_Liaison@stonybrook.ed; website: http://www.stonybrook.edu/commcms/bookstore/
- Bursar: For help with billing and payment. Phone: (631) 632-9316; email: bursar@stonybrook.edu; website: http://www.stonybrook.edu/bursar/
- Career Center The Career Center's mission is to support the academic mission of Stony Brook University by educating students about the career decision-making process, helping them plan and attain their career goals, and assisting with their smooth transition to the workplace or further education. Phone: (631) 632-6810; email: sbucareercenter@stonybrook.edu; Website: http://www.stonybrook.edu/career-center/
- Counseling and Psychological Services: CAPS staff are available by phone, day or night. http://studentaffairs.stonybrook.edu/caps/
- Disability Support Services: Students in need of special accommodations should contact DSS. Phone: (631) 632-6748; email: dss@stonybrook.edu; http://www.stonybrook.edu/commcms/studentaffairs/dss/
- Library: Access to online databases, electronic journals, eBooks, and more!
    - **Library Instruction Website -** http://library.stonybrook.edu/workshops-this-week-citation-skills-worldcat-and-endnote-the-hsc/
    - **SBU Library Research Guides and Tutorials** http://library.stonybrook.edu/research/research-basics/
- Registrar: Having a registration issue? Let them know. Phone: (631) 632-6175; email: registrar_office@stonybrook.edu; http://www.stonybrook.edu/commcms/registrar/
- Writing Center: Students are able to schedule face-to-face and online appointments. https://www.stonybrook.edu/writingcenter/
- **Support for Online Learning** http://www.stonybrook.edu/commcms/onlineed/student.html
- Ombuds Office The Stony Brook University Ombuds Office provides an alternative channel for confidential, impartial, independent and informal dispute resolution services for the entire University community. We provide a safe place to voice your concerns and explore options for productive conflict management and resolution. The Ombuds Office is a source of confidential advice and information about University policies and procedures and helps individuals and groups address university-related conflicts and concerns. http://www.stonybrook.edu/ombuds/