

MEC 541 Elasticity
Spring 2024

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Lecture: Thurs 4:00PM - 6:50PM, Frey Hall 216

Office Hours: Wednesday & Thursday 10:00AM – 11:30PM

Course Learning Objectives:

The course will provide a basic treatment of the formulation of linear elasticity theory and its application to problems of stress and displacement analysis. The objective is to provide students with the ability to solve linear elasticity problems. The fundamental field equations will be developed including strain energy concepts. Applications will involve the solution to problems of engineering interest including two-dimensional problems of plane strain and plane stress, fracture mechanics, torsion, bending and stress concentration, and three-dimensional solutions.

Pre-requisite:

Mechanics of Materials/Strength of Materials, Mechanics of Solids.

Textbook:

Elasticity by J. R. Barber, Springer, 2010 (Third Edition).

References:

- Mechanics of Solids and Materials, by R.J Asaro and V. A. Lubarda, Cambridge, 2006.
- Elasticity: Theory, Applications & Numerics, by M. H. Sadd, Elsevier, 2014.

How We Will Communicate:

Course-related questions and other personal/private issues, the 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. To log in to Stony Brook Google Mail, go to <http://www.stonybrook.edu/mycloud> and sign in with your NetID and password.

We are using Brightspace, a digital learning environment, for this course. To learn more and for SUNY Online helpdesk information, visit: <https://brightspace.stonybrook.edu>. If you would like,

you can add a link to Brightspace in your Blackboard “My Courses” list to easily move between the LMS’s during this transition. Information can be found:

<https://it.stonybrook.edu/help/kb/adding-brightspace-course-to-bb-course-list>.

Technical Assistance:

DoIT provides technical assistance to all students. If you require assistance with hardware or using any supported applications, available support options include:

- Visit one of DoIT’s [Tech Stations](#)
- Access [self-help materials](#)
- Submit a ticket online at service.stonybrook.edu
- [Chat live](#) with a student consultant
- Call 631-632-9800 for assistance (2-9800 from on campus)

If you need assistance with Brightspace, you can access resources from the Brightspace Resources link on Stony Brook Brightspace homepage (<https://brightspace.stonybrook.edu>) or contact the SUNY helpdesk via phone/ticket/live chat at: <https://online.suny.edu/help/>

Need a laptop? You can borrow a laptop from the Melville LIbrary SINC Site. Details can be found at: <https://it.stonybrook.edu/services/student-laptop-loaner-program>

Grading:

Your grade in this course will be assessed by homework and exams.

Homework: 30%

Midterm Exam (Week 11): 30%

Final Exam (Finals week): 40%

Grading Scale:

A (100-92)	A- (91-89)	B+ (88-86)	B (85-82)
B- (81-79)	C+ (78-75)	C (74-70)	C- (69-66)
D+ (65-63)	D (62-60)	F (< 59).	

Homework:

1. Homework will be assigned weekly and collected every Thursday through Brightspace.
2. Late homework will not be accepted.
3. All homework assignments are individual, unless otherwise specified.
4. Homework problems should be neat, professional, and well organized.

Tentative Course Outline:

Week	Content	Reading
1	Introduction, Review of tensor notation, coordinate transformations, principal values and directions, calculus of tensors.	Lecture notes, Ch. 1
2	Deformation, Displacements and Strains, Compatibility Equations, Force, Stress and Equilibrium.	Lecture notes, Ch. 2
3	Material Behavior, Generalized Hooke's Law, General Solution Strategies, Simple Boundary Value Problems	Lecture notes
4	Two-Dimensional Formulation: Plane Strain, Plane Stress, Generalized Plane Stress, Anti-Plane Strain. Derivation of Airy stress function.	Lecture notes, Ch. 3, 4
5	2D problems in rectangular coordinates. Cartesian Coordinate Solutions Using Polynomials, Fourier series and transform solutions	Lecture notes, Ch. 5, 7
6	2D problems in polar coordinates.	Lecture notes, Ch. 8
7	Calculation of Displacements, Curved beam problems	Lecture notes, Ch. 9, 10
8	Spring Break (No class)	
9	Mid-term Exam	
10	Wedge Problems: Half plane problems, Contact Problems, Punch/Indentation Problem	Lecture notes, Ch. 11, 12
11	Torsion of a prismatic bar: Prandtl stress function, multiply-connected cross-section, thin-walled cross-section. Shear of a prismatic bar.	Lecture notes, Ch. 16, 17
12	Complex variable formulation: Holomorphic functions, Harmonic functions, Biharmonic functions, In-plane deformations, stresses, Airy stress.	Lecture notes, Ch. 18, 19
13	Viscoelasticity: Polymer, Creep, Stress relaxation, Dynamic loading, Spring-Dashpot Model, Standard Linear Solid, Laplace transformation, Viscoelastic Stress Analysis	Lecture notes, Handouts
14	Review	
	Final Exam (TBA)	

Exams:

The Midterm exam will be given in class during the lecture hours while the final exam will be given during the final exam week.

The exams are open books and open notes.

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.

1. Student Participation in University Sponsored Events

https://www.stonybrook.edu/sb/bulletin/current/policiesandregulations/policies_expectations/participation_univponsored_activities.php

2. University policy on Final Exams:

https://www.stonybrook.edu/sb/bulletin/current/policiesandregulations/records_registration/final_examinations.php

3. New York State Education Law regarding Equivalent Opportunity and Religious Absences

https://www.stonybrook.edu/sb/bulletin/current/policiesandregulations/policies_expectations/equivalentopportunity_religiousabsences.php.

Course and University Policies

Students are expected to attend every class, report for examinations and submit major graded coursework as scheduled. If a student is unable to attend lecture(s), report for any exams or complete major graded coursework as scheduled due to extenuating circumstances, the student must contact the instructor as soon as possible. Students may be requested to provide documentation to support their absence and/or may be referred to the Student Support Team or Dean's office for assistance. Students will be provided reasonable accommodation for missed exams, assignments, or projects due to significant illness, tragedy or other personal emergencies. In the instance of missed lectures or labs, the student is responsible for reviewing posted slides and/or recorded lectures.

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, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodation is necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: <https://ehs.stonybrook.edu//programs/fire-safety/emergency-evacuation/evacuation-guide-disabilities> and search Fire Safety and Evacuation and Disabilities.

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 Professions, 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 Student Conduct and 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.

Course Materials and Copyright Statement:

Course material accessed from Bb, SB Connect, SB Capture 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 and [Student Conduct Codes](#).

Calculator Policy:

Effective Spring, 2009 only the following calculators are being 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 the Professional Engineering (PE) exam that you may take several years from now. The sooner you become comfortable on one of these calculators, the better.

NCEES Allowed calculators as of Nov 2011:

- 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.

The NCEES policy on calculators can be found here: http://www.ncees.org/Exams/Exam-day_policies/Calculator_policy.php

Subject to Change Notice:

All material, assignments, and deadlines are subject to change with prior notice. It is your responsibility to stay in touch with your instructor, review the course site regularly, or communicate with other students, to adjust as needed if assignments or due dates change.

Syllabus Disclaimer:

The instructor views the course syllabus as an educational understanding between the instructor and students. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. The instructor reserves the right to make changes to the syllabus as deemed necessary. Students will be notified in a timely manner of any syllabus changes via email or in the course site Announcements. Please remember to check your SBU email and the course site Announcements often.