

MEC 541 Elasticity
Spring 2020

Instructor: Prof. Lifeng Wang
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Lecture: Thurs 4:00PM - 6:50PM at CHEMISTRY 126

Office Hours: Wed and Thurs 10:00AM – 11:30AM, or by appointment

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 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.

Grading:

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

Homework: 30%

Midterm Exam (Week 9): 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).	

Exams:

All exams are open book and closed notes.

Make-up exams must be arranged prior to the exams. Make-up exam policy is consistent with university policy on:

1. Student Participation in University Sponsored Events

http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/participation_univspnsored_activities.php

2. University policy on Final Exams:

http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/records_registration/final_examinations.php

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

http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/equivopportunity_religiousabsences.php

Homework:

1. Homework will be assigned weekly and collected every Thursday in class.
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 recess (No class)	
9	Mid-term Exam (In class)	

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	Three-Dimensional Problems	Lecture notes
15	Review	Lecture notes
16	Final Exam	

Usage of Blackboard:

Students are required to use Blackboard, where important announcements, slides, homework, assignments, and supplementary materials of the course are posted.

<http://blackboard.stonybrook.edu>

Use your NetID and password to login. You can also call the Blackboard Support Team at: 631-632-2777 or e-mail: blackboard@stonybrook.edu for further information.

Important Copyright Notice: The materials in this course available online through Blackboard or other online channels are for the exclusive use of registered students currently enrolled in this course, and may not be retained or further distributed. In addition to legal sanctions, violation of these copyright prohibitions may result in University disciplinary action.

Various University Policies and Statements:

Disability Support Services (DSS) Statement: If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are 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 Disability Support Services. For procedures and information go to the following website: <http://www.stonybrook.edu/ehs/fire/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 are 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/uaa/academicjudiciary/>

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 Judicial Affairs 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.