ME 620, Mechanics of Materials

Location: Faculty Memorial Hall Room 207
Time: Mondays, 10:00 AM - 12:50 PM

Instructor

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Office hours: by appointment

Prerequisites

ME315 Stress Analysis or an equivalent, ME616 Matrix Methods in Mechanical Engineering, and Courses on Engineering Mathematics

Textbook/References

For this class, a complete set of lecture notes will be provided and uploaded on Canvas.
Recommended resources:

1. Elasticity: Theory, Applications and Numerics, M.H. Sadd
   This book is available online on NJIT library website.
2. Lecture Notes on The Mechanics of Elastic Solids. Volume I: A Brief Review of Some Mathematical Preliminaries by Professor Rohan Abeyaratne.
   These notes are available online here.

Course Learning Outcomes

At the conclusion of this course, the students will be able to:

- Apply the tensor and vector algebra to calculate the stress and strain in a body in all directions, their maximum and minimum values and their corresponding directions.
- Describe and apply Hooke's law in 3D using the tensor form.
- Derive equilibrium equations for a deformable body under body/external forces
- Identify and apply boundary conditions and solution strategies to solve 2D problems in elasticity

Course Grading Policy

- Homework sets 60%
  Homework sets are assigned weekly and will be posted on Canvas or announced during lectures and are due for submission in about a week after. You must upload your solutions on Canvas

by the due date. Submission by other means will not be accepted. Students should upload a single PDF document per assignment. Homework sets will be self-graded. You will receive the solutions after the due date and must submit your grades within 48 hours. If you don't submit your grade within 48 hours, it will be considered *zero*.

- Final project 40%
  The final project will be in the form of a self-study of an advanced topic relevant to the mechanics of materials. Students should first consult the professor to:
  - choose a topic by March 18th (3% of your total grade). You need to reach out to the professor earlier. This is not the date to reach out to the professor. Your final project topic should be fixed by this date.
  - study the relevant references and discuss their learning progress with the professor at least once by April 1st (3% of your total grade).
  - and finally give a short talk (about 20 minutes), in the form of a tutorial to share their knowledge with the rest of the class (30% of your total grade).
  - In addition, each student must participate actively in the discussions during others' presentations (4% of your total grade).
- In-class activities and pop quizzes: bonus credit up to 20 points
  In-class quizzes will not be announced in advance and student participation is not mandatory.

The solutions to the homework problems, exam, and pop quizzes should all be uploaded on Canvas. Submissions by other means are not acceptable. The students are expected to have an electronic device, such as a smartphone, tablet, or laptop to be able to take pictures of their solutions and upload them on Canvas during the class.

A	B+	B	C+	C	F
90-100	82-89	74-81	66-73	60-65	<60

Table 1: Letter grade scaling

Class Topics

- Mathematical preliminaries: scalar, vector, matrix and tensor definition, index notation, coordinate transformation, principal values and directions, vector and tensor algebra
- Deformation, displacement and strain
- Stress and equilibrium
- Material behavior, linear elastic solids
- Formulations and solution strategies
- Strain energy and related principles
- Two-dimensional formulation

- Two-dimensional problem solution
- Extension, torsion and bending of elastic cylinders

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[1] https://www5.njit.edu/policies/sites/policies/files/NJIT-University-Policy-on-Academic-Integrity.pdf