ME 315, Stress Analysis

Kupfrian Hall, Room 117
Mondays, 6:00-8:50 pm

Instructor

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Office hours: By appointment, in person or Online, via Zoom

Prerequisites

ME 215 – Engineering Materials and Processes; Mech 237 – Strength of Materials; Math 222 – Differential Equations

Textbook/References

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

1. Mechanics of Materials, 3rd edition, By Roy R. Craig, JR.
2. Advanced Mechanics of Material and Applied Elasticity, 5th edition, by Ansel C. Ugural and Saul K. Fenster (Pearson)
3. Elasticity: Theory, Applications and Numerics, M.H. Sadd
   This book is available online on NJIT library website.

Course Description

This course provides an introduction to the mechanics of solids and the fundamentals of the theory of linear elasticity.

Course Learning Outcomes

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

- Understand the concepts of stress and strain tensors.
- Describe the stress-strain relationship in an isotropic, linear-elastic solid.
- Analyze the stress/strain states in structural members.
- Analyze general stress/strain states using transformation equations and Mohr's circle.
- Define the plane stress/strain concept and understand the underlying assumptions.

- Solve plane stress/plane strain problems.
- Understand the concepts of strain energy and external work.
- Solve linear elasticity problems using energy methods.
- Understand the concepts of stable, unstable, and neutral equilibrium.
- Solve column buckling problems through stability analysis.

Class Schedule and Topics

Jan 27	Review of Basic Concept and Formulation- Stress Tensor
Feb 3	Displacement and Strain- Hooke's law
Feb 10	Transformation, Mohr's circle and Principle Stresses
Feb 17	Problem Session
Feb 24	Mid-term Exam 1
March 3	Equilibrium and Compatibility
March 10	Plane Problems and Airy Stress Function
Mar 17	Spring Break
March 24	Problem Session
March 31	Midterm Exam 2
Apr 7	Strain Energy and Failure Theories
Apr 14	Castigliano's theorem and applications
Apr 21	Buckling of Columns
Apr 28	Problem Session
May 5	Last day of class— problem session

Course Grading Policy

- Homework sets 40%
  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 then you must submit your grades within 48 hours. If you don't submit your grade within 48 hours, it will be considered *zero*.
- Midterm exam I 20%
  The tentative date for the exam is **Feb 17th**. This date is subject to change according to the course schedule.
- Midterm exam II 20%
  The tentative date for the exam is **March 31st**. This date is subject to change according to the course schedule.
- Final exam 20%

- In-class activities and pop quizzes: bonus credit up to 10 points
  In-class quizzes will not be announced in advance and student participation is not mandatory.

In the event of absence, there will not be any makeup exam.

The solutions to the homework problems, midterm exam I, midterm exam II, final exam and pop quizzes should be uploaded to 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	D
90-100	85-89	80-84	75-79	70-74	60-69

Table 1: Letter grade scaling

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found here[1]. Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

Generative AI

This course expects students to work without generative artificial intelligence (AI) assistance in order to better develop their skills in this content area. As such, student use of generative AI (e.g., ChatGPT) is not permitted throughout this course under any circumstance.

Student Absences for Religious Observance

NJIT is committed to supporting students observing religious holidays. Students must notify the instructor in writing of any conflicts between course requirements and religious observances. Students expecting to miss classes or exams due to religious observances must submit a written list of dates to their instructors, ideally by the end of the second week of class, but no later than four weeks before the anticipated absence. Academically reasonable accommodation will be provided, allowing students to complete missed assignments, exams, quizzes, or other coursework within the academic term. This policy applies only to absences for religious observances. For other excused absences, students should refer to the policies from the Dean of Students. For any questions or additional guidance, please review the policy (https://www.njit.edu/registrar/njit-policy-student-absences-religious-observances) or contact the Office of Inclusive Excellence at inclussiveexcellence@njit.edu.

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