Fall 2019

ME 315-101: Stress Analysis

Fatemeh Ahmadpoor

ME 315: Stress Analysis (Fall 2019)

Instructor:
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Office hours: Tuesday 1:30-3:00 pm.

Course Description
This course provides the theoretical background to stress analysis in mechanical design. Topics include two-dimensional elasticity, transformation of stress and strain, plane stress and plane strain problems, axisymmetric members, buckling criteria and failure theories.

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

Required Materials
Mechanics of Materials, 3rd edition, By Roy R. Craig, JR.

Course Learning Outcomes
Students completing ME 315 should be able to:

- Use Mohr's circle to fully analyze the stress/strain state in a body
- Explain how Mohr's circle is related to the stress transformation equations
- Solve stress /strain eigenvalue problems
- Apply various failure theories needed in the design process
- Explain and describe the relationship between stress and strain tensor
- Define plane stress/ plane strain Explain Airy's Stress function for 2D problems
- Develop equations for and solve axisymmetric problems - plate with hole, point loads on a half-space
- Solve problems involving thick- walled cylinders, shrink-fits, and rotating disks

- Describe the concepts of strain energy, deformation work and explain Betti's reciprocity theorem
- Explain Castigliano's theorems and apply them to problems on beam deflections, and rotations
- Apply Castigliano's theorems to indeterminate structures
- Explain elastic stability related to column buckling
- Solve simple column buckling problems

Course Grading

In-class quizzes and Homework questions: 20% total
Two midterm exams: 40% total
Final exam: 40%

A	Superior
B+	Excellent
B	Very Good
C+	Good
C	Acceptable
D	Minimum
F	Inadequate

Homework sets are assigned weekly and will be posted on Canvas or announced during lectures and are due for submission on the following Tuesday, at 3pm. 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 upload your grades within 24 hours. If you don't upload your grade within 24 hours, it will be considered **zero**. Midterm will be an in-class exam during the regular meeting hour. Tentative dates for two midterm exams are **Oct 2nd** and **Nov 6th** and subjected to changes according to course schedule.

Homework Collaboration Policy

Collaboration and discussion is encouraged on homework. List all students that worked together at the top of each problem. Each student must write up their own solutions. Failure to do this may result in the assignment not receiving credit and possibly more serious consequences.

E-mail communication with the professor and each other is expected to be professional. Any e-mails received by the professor that are not professionally formatted and stated will not be answered. Examples of professional e-mail etiquette can be found at the following links:
http://www.wikihow.com/Write-a-Formal-Email

http://englishlive.ef.com/blog/write-perfect-professional-email-english-5-steps/
https://owl.english.purdue.edu/owl/resource/636/01/

Class Topics

1. Introduction, stress tensor; equilibrium, transformation of stresses, principal stresses.
2. Mohr's circle for stress, Three-dimensional stresses.
3. Normal and shearing strains, strain tensor, compatibility, transformation of strains.
4. Stress-strain relations.
5. Strain energy, St. Venant's principle.
6. Plane stress, plane strain, Airy stress function.
7. Stress & strain in polar coordinates, Stress concentration.
8. Axisymmetrically loaded members, shrink fit, composite cylinders, rotating disks.
9. Theories of failure.
10. Energy methods, Castigliano's theorem, Virtual work.
11. Elastic stability of columns.

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 at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

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.