Mechanics of Materials

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	Thursday, 4:00-5:30	More 229

Course Objectives

This course is directed towards undergraduate engineering students who have already taken a course in Engineering Statics (e.g., AA 210 or equivalent).

Our primary goals this quarter are to develop a working knowledge of the fundamental concepts and problem-solving techniques associated with stress, strain, and simple constitutive theory. We will study applications involving axial loading, pressure vessels, torsion, and bending, including introductory-level statically indeterminate systems.

Upon completion of the course, each student should:

- Be able to demonstrate a working knowledge of the fundamental concepts and problem-solving techniques associated with stress, strain, simple constitutive theory.
- have accumulated significant practice in solving a variety of application problems.
- have gained experience in generating and presenting suitable solutions to open-ended problems involving course concepts in combination with other general considerations.
- be able to carry on technical discussions involving the concepts in the course.
- be able to solve well-posed problems with reasonable speed and accuracy, and should begin to demonstrate mastery of the general concepts.
- have gained experience in addressing engineering problems in the context of working groups.

Course Outline

Introduction

- Course objectives and logistics
- 1-D solid mechanics: equilibrium, kinematics, and constitutive relations
- 1-D solid mechanics application: axial loading

Stress

- What is stress?
- Stress characterization

- Analysis of stress states: transformation
- Principal stresses
- Simple stress examples
- Mohr's circle
- Pressure Vessels
- Other examples and applications

Strain

- Characterizing strain in 2D and 3D
- Strain analysis
- Strain examples

Constitutive Relations

- Introduction to constitutive relations
- Linear elasticity (Hooke's law) and material constants
- Applications of linear stress-strain relations
- Strain gauge analysis
- General constitutive behavior
- Strain energy (as time permits)

1st Midterm Exam

- Failure theories
- Applications of failure criteria

Torsion

- Calculating stresses
- Calculating deformations (twist)

Beams

- Introduction to beams
- Moment and shear diagrams
- Bending stresses
- Beam deflections
- Example applications

2nd Midterm Exam

- More examples
- Shear stresses in beams
- Shear stress examples

Indeterminate Analysis

- Statically indeterminate systems
- Illustration for axial load and torsion

Summary/wrap-up

Course Administration

Reading Assignments and Quizzes

Reading assignments will be given ahead of time for certain class sessions. It is expected from everyone that you will have read the assigned text before we discuss the topic in class. The goal is to optimize your learning by helping you prepare for class, and hence achieve a more effective transfer of knowledge during lecture sections. The instructor will announce reading assignments during class. They will also be posted on the class website.

Homework Assignments

Homework is an important part of this class. You are encouraged to work with each other to understand concepts, and to check numerical and procedural accuracy of your solutions. However, unless otherwise instructed, each of you needs to submit your own solution.

In practice, it is important to communicate your ideas and designs clearly, because mis-communication can lead to faulty construction, products, lawsuits and injury. In this class, all homework solutions should be completed as follows:

- A neat sketch showing the problem geometry and key features. It is not necessary to rewrite the full problem statement.
- Assignments should be completed on engineering paper.
- The heading on each page should include your name, the date, an identification of the homework set and of the particular problem number. The page number and total number of pages should be shorn in the right-hand corner.
- Document your solutions neatly so that another engineer (such as the grader) can understand your assumptions and procedures.
- underline important intermediate results, and box final answers.

Homework assignments will be given once a week and will be posted on the class website. Typically, homework assignments will be assigned on Mondays (or the previous Friday) and due on Friday by noon. Assignments can be submitted in lecture to the instructor or to one of the TAs during office hours. For most problems, you will be able to check your answers online. Your homework score will be based on the problem approach, answer and solution presentation.

It is the students responsibility to read and understand all comments regarding the reading and homework assignments on the class website. Please use the on-line discussion forums before emailing the instructor or the TA's.

Required Text

Hibbeler, R.C., *Mechanics of Materials*, 8th Edition, Pearson Prentice Hall, 2011.

Grading

Lab sections	10%
Homework assignments	20%
Midterm #1	20%
Midterm #2	20%
Final Exam	30%

25% deduction per weekday for late homework.

Lab attendance is mandatory to pass the class. You may miss one lab section with no penalty. If there are appropriate circumstances which will cause you to miss more than one, please contact me in advance, and we will schedule a make-up project.

Important Dates

Martin Luther King, Jr. Day	Monday, January 17th
President's Day	Monday, February 21st
Last Day of Instruction	Friday, March 11th
Final Exam	Wednesday, March 16th, 8:30-10:20 AM.

Academic Integrity

Regardless of your particular area of interest, you are on your way to becoming a professional, whose work can affect the safety and financial security of others. It is expected that each student understands the rules and policies regarding academic integrity as outlined by the University of Washington. For homework assignments and reading quizzes, students are encouraged read to work in groups. However, make sure the work you turn in is understood and is your own.

In addition to other disciplinary actions taken by other university officials, cheating on homework or exams will result in a voided score for all those involved.

Special Situations

If you are a student athlete or a student who has special requirements for taking tests, homework, etc., please see the instructor ASAP to discuss your schedule or special needs.