MAE 213 Solid Mechanics

Spring 2016

Classes: TTh 4:30-5:45, PSH151

Recitation: Friday, weekly, attendance taken

Class Website: ASU Blackboard System Log on: https://myasucourses.asu.edu or http://my.asu.edu

Instructor: Yongming Liu

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TAs: Jayesh Zope (jzope@asu.edu); AKSHAY MURKUTE (Akshay.Murkute@asu.edu); Karthikrajan Venkatesan (kvenka10@asu.edu);

Office Hours: Monday 1~4 , ERC 476 (Akshay)
Wednesday 1-4, ERC 476 (Jayesh)
TTh: 1-4, ERC 419 (Liu)
or by appointment (e-mail to Liu)

Text: Hibbeler, Russell C. *Mechanics of Materials,* 9th edition. Prentice Hall, 2014. ISBN-13: 978-0-13-340932-1.

Course Description: Equilibrium, method of sections, definition of stress and strain, and stress-strain-temperature relations. Applications to force transmission and deformations in axial, torsional and bending deformation of bars. Combined loadings.

Pre-requisites: CEE 210, CEE 211 or MAE 212 with C or better; MAT 274 (or 275) with C or better

Prerequisite competencies

- Free-body diagrams
- statics of rigid bodies in 2-D
- Vector calculus operations

Course Outcomes:

The following are Core Outcomes for this course. Outcomes are statements describing what you should be able to do at the time of completion of the course.

Core Outcome.	ABET (a-k)	Level of Mastery
• Students will understand the definitions of stress and strain, and basic mechanical properties of materials such as elasticity, yielding stress, Young's modulus and Poisson's ratio	a	Knowledge
• Students will apply concepts of strain and stress to the analysis of statically-determinate and indeterminate bars under axial loading	a, e	Comprehension
• Students will apply concepts of strain and stress to the analysis of statically-determinate and indeterminate shafts in torsion	a, e	Comprehension
• Students will analyze the shear, moment distribution, and calculate stress in beams under bending	e	Comprehension
• Students will predict deflection in beams under bending, and analyze statically indeterminate beams	e	Comprehension

General Topics:

1. Review of Statics
2. Stress. (Ch. 1)
3. Strain. (Ch. 2)
4. Mechanical Properties of Materials. (Ch. 3)
5. Axial Load. (Ch. 4)
6. Torsion. (Ch. 5)
7. Bending. (Ch. 6)
8. Deflections of Beams and Shafts. (Ch. 12)

Homework:

There will be approximately a total of 10 homework assignments. Homework is expected to be turned in in class (before the lecture) on the due date. **Unless there are extraordinary circumstances late homework assignments will not be accepted**.

You are encouraged to work together on the homework, but **copying is unacceptable**. For information about the ASU Academic Integrity Policy, please check online. https://provost.asu.edu/academicintegrity

Exams:

Four exams (3 midterms + 1 final). Closed book, closed notes. Formula sheets provided. Midterms of one hour and fifteen minutes, while one hour and fifty minutes for the final.

Tentative midterm dates: **2/11** (Thursday), **3/17** (Thursday), **4/14** (Thursday)

Final review: **04/28** (Thursday)

Final exam: comprehensive, May 5 (Thursday), 2:30 - 4:20 PM， PSH151

Grading:	Recitation attendance	3%
	Homework	15%
	Midterm #1	17%
	Midterm #2	17%
	Midterm #3	17%
	Final	31%

Tentative cut-off lines:

A+: 95 and above
A: 87.5 - 95
B: 77.5 - 87.5
C: 67.5 - 77.5
D: 55.0 - 67.5
E: otherwise

Other Notes:

Cheating on homework and tests is **unacceptable**. You **CAN NOT** use the online service (e.g., chegg.com or other sites) for solution manuals without the authorization of the instructor. See the ASU Academic Integrity Policy at https://provost.asu.edu/academicintegrity for more details.

Cheating on the homework would result in a **ZERO** for the homework portion of the total grade; cheating on tests would result in an **E** for this class.

You have **a week** to contact the instructor regarding the grading of a specific homework assignment/test (from the day the graded hw/test is returned). After the period, no **grading inquiry** will be responded. Please check the Blackboard frequently to ensure your grades are listed correctly.

After the final exam, no request for a grade-upgrade consideration is responded. It is your responsibility to **EARN** the grade you need.

Detailed course topics:

- Review of statics
- Statics of internal reactions and distributed loads
  - Moment equation: cross-product and inspection method
  - Method of sections
  - Distributed loading
  - Area moments of inertia
- Tension, compression and shear
  - Normal stress and strain
  - Elasticity, Young's modulus, Poisson's ratio and yield stress
  - Shear stress and strain
  - Design for axial loads and direct shear

- Axially loaded members
    - Axial load diagrams
    - Stress-strain relationships
    - Elongations and displacements
    - Trusses
    - Statistically indeterminate structures under axial loads
- Torsion
    - Torsion moment diagrams
    - Torsional deformation of a circular bar and angle of twist
    - Circular bars of linearly elastic materials, non-uniform torsion
    - Stresses and strains in pure shear
    - Relation between moduli of elasticity (G and E)
    - Statistically indeterminate structures under axial loads
- Shear forces and bending moments
    - Loads, shear forces and bending moments
    - Shear force and bending moment diagrams
- Stresses in beams
    - Pure bending
    - Longitudinal strains in beams
    - Normal stresses in beams
- Deflection of beams
    - Integration of curvature equations
    - Method of superposition
- Statically indeterminate beams

The syllabus is prepared by Dr. Liu on 01/11/2016.