

E Mch 315: MECHANICAL RESPONSE OF ENGINEERING MATERIALS

Mechanical response measures and design theories for engineering materials; elastic and plastic response as affected by stress, strain, time, temperature.

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Class Hours: T/Th 9:05-9:55 pm 119 EES Building

Office Hours: T/Th 10:00-11:00 am 149 Research West

Angel homepage <https://cms.psu.edu>

Teaching Assistants:**Tutoring hours and locations:**

Prerequisite: E MCH 213 or 210H or 210

Text:

“Mechanical Response of Engineering Materials, 7th Edition by R. Queeney and A. Segall, Kendall/Hunt”.

Your expectations for this course should be to develop a deeper understanding of engineering mechanics, especially as it applies to various materials: thereby building on the knowledge and practice needed in the engineering profession. Specifically, by the end of the semester you should be able to:

- Analyze stress and strain conditions found in various components and determine their principal values;
- Analyze failures and make life-cycle predictions;
- Determine time-dependence(life) to be expected for success of a design (i.e., avoid failure);
- Select appropriate materials for safe applications based on their properties and dominant engineering attributes.

Course Information:

There is no-such thing as a stupid question; if you have a question or don't understand, please ask!

Assigned readings (see attached course schedule) should be done before coming to class.

1. **Examinations:** There will be two in-class examinations (25 % of your grade for each exam) during the semester on the exam dates listed in the attached schedule. There will also be a **comprehensive** final during finals week (see Section 3). Students should plan to bring a functioning calculator, a ruler, and a card or piece of paper or card no larger than 3 inches by 5 inches: the card is intended as an aid to the student, and may have formulas, etc., written on it. Hold on to the card(s) as they may be used in the next exam(s) along with a new one. Calculators cannot be shared. Absolutely no formulas will be given at the examination - it is the student's responsibility to be fully prepared.
2. **Conflict examinations:** These will be provided **ONLY** when a conflict arises due to a regularly-scheduled University activity, such as a varsity athletic team or choir event coinciding with the examination. All requests for conflict exams must be made well in advance of the actual scheduled exam. Legitimate medical/family emergencies will only be considered with valid proof. Conflict examination papers are the property of the department and will not be permanently returned to the taker.

3. **Final Examination:** a **comprehensive** final examination (30 % of your grade) will be given during the regular finals period, at the time specified by scheduling. Students needing a conflict examination must apply for one in the usual way, not casually arranging same with the course instructor. Again, students should plan to bring a functioning calculator, ruler, and up to 4 formula cards no larger than 3 inches by 5 inches. Formulas will not be given at the exam, and proctors will only address questions relevant to the exam readability.
4. **Homework:** Homework problems are assigned after each lecture. In addition to the textbook problems, there will be Quizzes assign to each homework. Quizzes will be distributed in class. Keeping up with the assigned homework is essential to understanding the concepts presented in class and doing well on the exams. Homework will be collected periodically as shown on the following pages and selected problems will be graded (20% of your final grade). About a week before each exam, detailed solutions for the homework problems will be available on the ANGEL site.
5. **Class Notes:** Class notes and supplementary materials can be downloaded from the ANGEL site prior to the lecture.

Here is information on how to get lecture notes and class materials from ANGEL:

- 1) Go to the basic Angel homepage <https://cms.psu.edu>
- 2) Log on in the middle of the page using your Penn State ID and Password
- 3) Click onto My Profile>My Courses>Fall 2008>E MCH 315, Section 002
- 4) Check out the Syllabus under the Syllabus tab and the lecture notes are under the Lessons tab along with supplemental materials.

Note to students with disabilities: Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services, ODS located in room 116 Boucke Building at 814-863-1807(V/TTY). For further information regarding ODS, please visit their web site at www.equity.psu.edu/ods/ Instructors should be notified as early in the semester as possible regarding the need for reasonable academic adjustments.

Period	Date	Topic	Reading	Problems
1	8/25	Introduction		
2	8/27	Tensile Properties	Chapter 4	4-1,2
3	9/1	Elastic Behavior of Materials	Chapters 3 and 4	4-5,6
4	9/3	Thermoelastic	Chapters 3	3-4, 5, 6
		Homework 1 due (Topics 1-3 + Quiz 1)		
5	9/8	True Stress and Strain	Chapter 6	6-1, 3
6	9/10	Parabolic Strain Hardening Rule	Chapter 6	6-2, 4, 5
7	9/15	Stress; Transformations in a Plane	Chapter 2	2-1, 2, 3
		Homework 2 due (Topics 4-6 + Quiz 2)	Sections 2.1-2.8	
8	9/17	3-D Stress Transformations	Chapter 2	2-5, 6, 7
			Sections 2.1-2.8	
9	9/22	Strain; Transformations in a Plane	Chapter 1	1-1
10	9/24	Strain; Transformations in a Plane	Chapter 1	1-5 (i & ii)
11	9/29	review		
		Homework 3 due (Topics 7-10 + Quiz 3)		
12	10/1	EXAMINATION 1 (in class)	Topics 1-10	
13	10/6	Yielding: Maximum Shear Stress Theory and Distortion Energy Theory	Chapter 5	5-3,4a, 5
14	10/8	Yielding: Maximum Shear Stress Theory and Distortion Energy Theory	Chapter 5	5-4b, 5
15	10/13	Yielding: Maximum Shear Stress Theory and Distortion Energy Theory	Chapter 5	5-6
16	10/15	Viscoelastic Response	Chapter 9	9-1, 2, 3
		Homework 4 due (Topics 13-15 + Quiz 4)		
17	10/20	Viscoelastic Models	Chapter 9	9-4, 5
18	10/22	Viscoelastic	Chapter 9	9-6, 8
19	10/27	Creep in Structural Materials	Chapter 10	10-1, 3
20	10/29	Creep	Chapter 10	10-4
21	11/3	Creep	Chapter 10	10-5, 6
		Homework 5 due (Topics 16-20 + Quiz 5)		

<u>Period</u>	<u>Date</u>	<u>Topic</u>	<u>Reading</u>	<u>Problems</u>
22	11/5	Stress concentrations	Chapter 2	2-10, 11
23	11/10	Fracture of Brittle Materials	Chapter 7	7-1, 3
24	11/12	Analysis of Cracked Structures	Chapter 7	7-4, 5
25	11/17	<i>Review</i>		
		Homework 6 due (Topics 21-24 + Quiz 6)		
26	11/19	EXAMINATION 2 (in class)	Topics	
27	12/1	Fatigue and Structural Endurance	Chapter 8	8-1, 2, 3
28	12/3	Fatigue	Chapter 8	8-4, 5
29	12/8	Fatigue	Chapter 8	8-7, 8
30	12/10	<i>Review</i>		
		Homework 7 due (Topics 27-29 + Quiz 7)		
		COMPREHENSIVE FINAL DURING EXAM WEEK		