

MASC 551

Mechanical Behavior of Engineering Materials

Fall Term 2021

Lectures: OHE 132 or online T-Th 9:30-11:20

Lectures: Professors:

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Office Hours: T-Th 1-2 PM (Prefer Appt.)

TA: to be announced

Supplemental Texts:

“Mechanical Metallurgy”, G.E. Dieter

“Mechanical Behavior of Materials”, T.H. Courtney

“Deformation and Fracture of Engineering Materials”, R.W.
Herzberg

“Mechanical Behavior of Materials”, McClintock and Argon

“Fracture of Structural Materials”, Tetelman and McEvily

“Mechanical Behavior of Materials” Meyers and
Chawla, Prentice Hall, 1998

“Introduction to Dislocations” D. Hull and D.J. Bacon 5th ed.
Butterworth

Introductory Books:

"Materials Science and Engineering"

5th ed. William D. Callister

"Principles of Engineering Materials", Barrett, Nix
and Tetelman

Objectives:

This course focuses on the mechanical properties of materials. The lectures will emphasize stress and strain relationships how the macroscopic mechanical behavior is related to the structure and microstructure of the material. This course will discuss elementary dislocation theory and relate this to basic strengthening mechanisms. Physical and chemical mechanisms that alter the mechanical properties will be discussed. Crystalline metals and ceramics will be emphasized but polymers and non-crystalline materials will be discussed as well. Fatigue and fracture will also be discussed in terms of fundamental mechanisms.

Grading:

Mid-terms (3)	60%
Final Exam	40%

MASC 551 MECHANICAL PROPERTIES OF ENGINEERING MATERIALS

<u>WEEK</u>	<u>DATE</u>	<u>LECTURE TOPICS</u>
1	8/24 8/26	Introduction Elasticity I
2	8/31 9/2	Elasticity II Elasticity III
3	9/7 9/9	Basic Plasticity True Stress and Strain
4	9/14 9/16	Work Hardening Midterm #1
5	9/21 9/23	Dislocations Intro. Dislocations: Schmid's Law
6	9/28 9/30	Dislocations: Theoret. Shear Strength Dislocations: Burgers Vector
7	10/5 10/7	Dislocations: Stress fields Dislocation: Dynamics

8	10/12 10/14	Partial Dislocations No Class
9	10/19 10/21	Midterm #2 Cross-slip, Climb Kinks, Jogs
10	10/26 10/28	Strengthening by Solutes Grain Size Strengthening
11	11/2 11/4	Strengthening by Precipitates Heat Treatment of Steels I
12	11/9 11/11	Heat Treatment of Steels II Brittle and Ductile Fracture
13	11/16 11/18	Strain-Rate Sensitivity and Creep Midterm #3
14	11/23 11/25	Polymers No Class
15	11/30 12/2	Ceramics and Glasses Manufacturing
16	12/9 (11-1PM)	FINAL EXAM