

# MASC 551

## Mechanical Behavior of Engineering Materials

Fall Term 2022

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

Lectures: Professor:

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### 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 Material”s Meyers and  
Chawla, Prentice Hall, 1998

“Introduction to Dislocations” D. Hull and D.J. Bacon 5<sup>th</sup> ed.  
Butterworth

### Introductory Books:

"Materials Science and Engineering"

5<sup>th</sup> 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%
Student Presentations	10%
Final Exam	30%

## MASC 551 MECHANICAL PROPERTIES OF ENGINEERING MATERIALS

<u>WEEK</u>	<u>DATE</u>	<u>LECTURE TOPICS</u>
1	8/23 8/25	Introduction Elasticity I
2	8/30 9/1	Elasticity II Elasticity III
3	9/6 9/8	Basic Plasticity True Stress and Strain
4	9/13 9/15	Midterm #1 Work hardening
5	9/20 9/22	Dislocations Intro. Dislocations: Schmid's Law
6	9/27 9/29	Dislocations: Theoret. Shear Strength Dislocations: Burgers Vector
7	10/4 10/6	Dislocations: Stress Fields (video) Dislocation: Dynamics (video)

8	10/11 10/13	Midterm #2 Fall Recess
9	10/18 10/20	Partial Dislocations and Stacking Faults Cross-slip, Climb, Kinks, Jogs
10	10/26 10/28	Strengthening by Solutes Grain Size Strengthening
11	11/1 11/3	Dislocation Video Heat Treatment of Steels
12	11/8 11/10	Polymers (V) Midterm #3
13	11/15 11/17	Strain-Rate Sensitivity and Creep Brittle and Ductile Fracture
14	11/22 11/24	Ceramics and Glasses Holiday
15	11/29 12/1	Student Presentations Student Presentations
16	12/6	FINAL EXAM