ENGR 4 - Engineering Materials

Fall 2023
Section #51068

Class:
Class meetings on Mondays/Wednesdays, 2:30-3:45pm, PHY-77

Instructor:
Dr. John Heathcote
Office:
PHY-78
Phone:
(559) 494-3000 ext. 3215
Cell Phone:
(559) 643-5469
e-mail:
john.heathcote@reedleycollege.edu

Office Hours:
MWF, 11:00-11:50am
TTh, 1:00-1:50pm

If you cannot make regular office hours, feel free to make an appointment.

Welcome to ENGR 4, an overview of the science and engineering behind materials! This is a wide-ranging course that will cover the structures, properties, processing techniques, and applications of metals, ceramics, polymers, composites and advanced materials. No matter which area of engineering you are pursuing, you will need to understand the materials with which you are working. From this course you will obtain a fundamental understanding of these materials.

Prerequisites: CHEM 1A, PHYS 4A

Catalog Description: This is an introductory course on the properties of engineering materials and their relation to the internal structure of materials. Topics include atomic structure and bonding; crystalline structures; phases and phase diagram; metals; polymers; ceramics; composites; mechanical deformation and fracture; structural control and influence of properties; materials naming and designating systems; and electrical properties.

Textbook: **Foundations of Materials Science and Engineering**, 6th Edition, William Smith and Javad Hashemi, McGraw-Hill

YOU DO NOT NEED TO PURCHASE THIS TEXTBOOK. IT IS AVAILABLE FOR A FREE SEMESTER-LONG CHECKOUT FROM THE REEDLEY COLLEGE LIBRARY. JUST ASK AT THE FRONT DESK.

Grading:

Grading will be based on your percentage of the overall possible points offered during the semester. Points will be earned from chapter assignments, chapter assessments, and exams.

There will be **13 chapter assignments** (all chapters except Chapter 1). Most of these will involve end-of-chapter problems from the textbook, but they may also involve other problems. Each chapter assignment is worth 5 points.

There will be **14 chapter assessments**. The assessments will be timed quizzes or projects. Each chapter assessment will be worth 20 points.

In addition, there will be **three exams** (2 midterms and the final). Each will cover the material from the preceding chapters. Each exam will be worth 100 points.

Retakes: You will be given the opportunity to retake any chapter assessment or exam – one retake per item. I encourage you to learn from any mistakes you make from your first attempt and to improve your performance.

Late Work Policy for Assignments:
You are given a grace period of one class meeting for assignments. For example, if the assignment is due on a Monday, you can still submit it on the following Wednesday without a late deduction. After that date, you will lose points for being late.

Grading Scale:

The overall grade will be based on the overall percentage of possible points that you earn from the chapter assessments and exams. (Based on the plan above, there will be 645 total possible points.)

90-100%	A
80-89.9%	B
70-79.9%	C
60-69.9%	D
<60%	F

Accommodations for Students with Disabilities:
If you have a verified need for an academic accommodation or materials in alternate media (i.e., Braille, large print, electronic text, etc.) per the Americans with Disabilities Act (ADA) or Section 504 of the Rehabilitation Act, please contact me as soon as possible.

Add Date:	Friday, August 25	Last day to add a course
Drop Date:	Friday, October 6	Last day to drop this course
Holidays:	Monday, September 4	Labor Day
	Friday, November 10	Veterans' Day
	Thursday-Friday, November 23-24	Thanksgiving Holiday
Final:	Wednesday, December 6, 2:00-3:50pm	
Final Retake:	Finals week schedule is very flexible. If you need to retake the final exam, I can accommodate you with a schedule for that.	

Student Learning Outcomes:

Upon completion of this course, students will be able to:

1. classify crystal structures and crystal imperfections and determine their effects on material properties.
2. use mechanical behavior data for a given material to predict a material's behavior under a certain load condition.
3. interpret phase diagrams and predict material microstructures created by different heat treatments.
4. identify the properties of the various classes of materials and assess the proper material to be used in certain applications.

Objectives:

In the process of completing this course, students will:

1. define the types of bonds and list their properties.
2. classify the various crystal structures and use crystallographic techniques to describe their features.
3. describe crystalline imperfections and analyze their influence on material behavior.
4. analyze stress-strain curves and calculate materials' reactions to various stress conditions.
5. differentiate elastic and plastic deformation.
6. describe the mechanisms for strengthening materials.
7. calculate failure loads of materials based on fracture and fatigue.
8. calculate materials' reactions under high temperature loading.
9. interpret phase diagrams and solve problems based upon them.
10. use phase diagrams to predict microstructural development in materials under heat treatment.
11. analyze the properties of the various classes of materials.
12. categorize and investigate the variety of materials within each class of materials.
13. outline and apply the electrical and corrosive properties of materials.
14. use reference data regarding the properties, processing, and performance characteristics of materials to recommend appropriate materials to meet engineering design criteria.

Tentative Course Schedule: (subject to change)

	Monday	**Wednesday**
Week 1	Chapter 1 – Introduction	Chapter 2 – Atomic Structure and Bonding
Week 2	Chapter 2 / Chapter 3	Chapter 3 – Crystal and Amorphous Structure
Week 3	Chapter 4 – Crystal Imperfections	Chapter 4
Week 4	Chapter 5 – Thermally Activated Processes / Diffusion	Chapter 5 / Unit Review
Week 5	LABOR DAY HOLIDAY	Chapter 6 – Mechanical Properties of Metals I
Week 6	Chapter 6	Chapter 6
Week 7	**Midterm #1 (Chapters 1-5)**	Chapter 7 – Mechanical Properties of Metals II
Week 8	Chapter 7	Chapter 7
Week 9	Chapter 8 – Phase Diagrams	Chapter 8
Week 10	Chapter 9 – Engineering Alloys	Chapter 9
Week 11	Chapter 10 – Polymeric Materials	Chapter 10
Week 12	Chapter 11 - Ceramics	Chapter 11
Week 13	**Midterm #2 (Chapters 6-10)**	Chapter 14 – Electrical Properties of Materials
Week 14	Chapter 14	Chapter 14
Week 15	Chapter 12 – Composite Materials	Chapter 12
Week 16	Chapter 13 - Corrosion	Chapter 13
Week 17	Prepare for Final	Prepare for Final
Week 18	**Optional Final Time (Chapters 11-14)**	**Official Final Time / Optional Retake**