ENGR 4L - Engineering Materials Laboratory

Fall 2021

Section #51449

Class:

Face-to-face: Meets on Tuesdays from 2:00-4:50pm in PHY-70

Instructor:

Dr. John Heathcote

Office:

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Phone:

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Office Hours:

MW 9:00-9:50am
TThF 10:00-10:50am

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

Course Communication Policy:

Outside of our weekly class meetings, communication will take place through our Canvas site. I will send Canvas messages regularly to keep you updated on the progression of the class and any important announcements. You will need to read these to stay informed about the class.

Please contact me with any questions or concerns you have about this class. Contact me through a Canvas message. I will reply within 24 hours on weekdays. I may be able to respond on weekends as well, but it is not guaranteed. (If I do not respond within 24 hours, please resend your message.)

Prerequisites:

CHEM 1A, PHYS 4A

Corequisite:

ENGR 4 (previously or concurrently)

Introduction:

Welcome to the Engineering Materials Laboratory! This is a fun, hands-on companion course to the ENGR 4 lecture course. You will have the opportunity to perform lab experiments that will bring the textbook material to life. While doing so, you will also work on developing your technical writing skills in your laboratory reports.

Catalog Description:
This is a laboratory course in which students investigate the structure, properties, and performance of engineering materials, with topics including crystal structures, metallography, cold working and heat treatment, mechanical behavior, ductile and brittle failure, toughness, fatigue, corrosion, and properties of semiconductor devices.

Required Text:
None (However, the topics of this laboratory course will coincide with the topics covered in ENGR 4 and in its Zybooks textbook, based on Callister, William D. and Rethwisch, David G., **Fundamentals of Materials Science and Engineering, An Integrated Approach**, 5th Edition, Wiley, 2015.)

Grading:
Grading will be based upon the total points earned by students through the semester. Activities that will earn points will include lab worksheets and formal lab reports.

Grading Scale:
Grades will be determined from the percentage of points earned by a student from the total possible points.

90-100%	A
80-89.9%	B
70-79.9%	C
60-69.9%	D
0-59.9%	F

Laboratory Worksheets and Reports:
You will perform laboratory activities and then report your results. These results may be reported as completed worksheets or as formal lab reports.

Late Work Policy:
Please do your best to keep up with this course. You will not receive full credit for tasks completed after the due date. Assignments will be accepted after the deadline. However, your grade will drop by 5% for each day that you are late.

HOWEVER, I do understand that circumstances do come up. If you have a good reason to ask for an extension for a task, please communicate that to me as early as possible. Depending on the situation, I will consider an extension for you.

Attendance and Drop Policy:
A student who do not attend the first class meeting will be considered a “No Show” for the class and will be dropped. Students who are absent for two weeks (not necessarily in a row) will be dropped from the class.

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.

Cheating and/or plagiarism:

Cheating and/or plagiarism will not be tolerated. A student will receive no credit for the assignment if in the opinion of the instructor the individual has cheated. Further problems with cheating or plagiarism may cause a report to the Dean of Students.

Add Date:	Friday, August 27	Last day to add a course
Drop Date:	Friday, October 8	Last day to drop this course
Holidays:	Monday, September 6	Labor Day
	Thursday, November 11	Veterans' Day
	Thursday-Friday, November 25-26	Thanksgiving Holiday

Student Learning Outcomes:

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

1. measure material properties and/or evaluate processing treatments using standard materials testing equipment and techniques.
2. write laboratory reports that communicate the collection, analysis, and interpretation of experimental data according to professional engineering standards.

Course Objectives:

In the process of completing this course, students will:

1. model various crystal structures found in metals and nonmetals
2. model crystal imperfections and analyze their effect on material properties
3. measure stress-strain behavior for metals, polymers and ceramics
4. investigate ductile and brittle fracture and identify the type of failure from fracture surfaces
5. determine the relative toughness of various materials through impact testing
6. evaluate fatigue behavior of metals
7. analyze equilibrium phase diagrams and predict phases and microstructure present under certain conditions
8. investigate the effect of various materials processing techniques (such as strain hardening, recrystallization, and precipitation hardening) on the structure and properties of metals
9. assess the corrosion resistance of various materials under certain environmental conditions
10. measure the behavior of semiconductor devices

Course Outline: (subject to change)

Lab Dates	Topics
Tuesday, August 10th	Creativity Lab
Tuesday, August 17th	Atomic Bonding and Metal Crystal Structures
Tuesday, August 24th	Metal and Ceramic Crystal Structures
Tuesday, August 31st	Polymer Structures
Tuesday, September 7th	Structural Imperfections
Tuesday, September 14th	Hardness and Diffusion
Tuesday, September 21st	Tensile Properties of Metals
Tuesday, September 28th	Mechanical Properties of Polymers
Tuesday, October 5th	Steel Heat Treatments
Tuesday, October 12th	Fatigue and Impact Toughness
Tuesday, October 19th	Creep
Tuesday, October 26th	Phase Diagrams
Tuesday, November 2nd	Phase Transformations
Tuesday, November 9th	Electrical Resistivity
Tuesday, November 16th	Semiconductor Devices
Tuesday, November 23rd	Composites
Tuesday, November 30th	Corrosion