

ENGR 4L - Engineering Materials Laboratory

Fall 2022
Section #51006

Class:

Face-to-face: Meets on Tuesdays from 2:00-4:50pm in PHY-77

Instructor:

Dr. John Heathcote

Office:

PHY-78

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Office Hours:

Mondays, 11:00-11:50am

Tuesdays, 12:00-1:50pm

Wednesdays, 11:00-11:50am

Fridays, 11:00-11:50am

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

Grading:

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

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.

Final Presentation:

You will research an engineering material of your choice and give a short presentation to the class at the end of the semester.

Late Work Policy:

Please do your best to keep up with this course. You will struggle if you fall behind in the class. However, I do understand that circumstances do come up. I will still accept work after the deadline, but I will work with you if this becomes a problem.

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 26	Last day to add a course
Drop Date:	Friday, October 7	Last day to drop this course
Holidays:	Monday, September 5	Labor Day
	Friday, November 11	Veterans' Day
	Thursday-Friday, November 24-25	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 9 th	Atomic Bonding
Tuesday, August 16 th	Metal Crystal Structures
Tuesday, August 23 rd	Structural Imperfections
Tuesday, August 30 th	Hardness and Diffusion
Tuesday, September 6 th	Tensile Properties of Metals
Tuesday, September 13 th	Steel Heat Treatments
Tuesday, September 20 th	Fatigue and Impact Toughness
Tuesday, September 27 th	Creep
Tuesday, October 4 th	Phase Diagrams
Tuesday, October 11 th	Phase Transformations
Tuesday, October 18 th	Polymers
Tuesday, October 25 th	Ceramic Structures
Tuesday, November 1 st	Electrical Resistivity
Tuesday, November 8 th	Semiconductor Devices
Tuesday, November 15 th	Composites
Tuesday, November 22 nd	Creativity Lab
Tuesday, November 29 th	Final Presentations