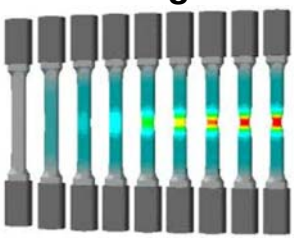
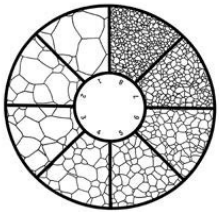
Engineering Materials Fall 2015

Engineering 4L – *Section #58091*





Instructor: Dr. John Heathcote **Lab Times:** Tuesdays, 2:00-4:50pm

Office: Reedley College, FEM-1B (in Math Center, in FEM Building)

Phone: 638-3641 ext. 3215

e-mail: john.heathcote@reedleycollege.edu

Office Hours: Monday, 10 AM-10:50 AM, 12:00-12:50 PM
Tuesday, 12-12:50 PM
Wednesday, 10 AM-10:50 AM, 12:00-12:50 PM

On-Duty in the RC Math Center (FEM-1): Thursday, 12-1 PM
Friday, 10-11 AM

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

Required Text: None (However, the topics of this laboratory course will coincide with the topics covered in ENGR 4 and in its textbook, Materials Science and Engineering, An Introduction, 9th Edition, William D. Callister, Jr., Wiley

Prerequisites: CHEM 1A, PHYS 4A

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.

Grading:		
	60%	Laboratory Exercises and Reports
	20%	Lab Quizzes
	20%	Final Exam

Laboratory Exercises and Reports: This is a laboratory course, so the major portion of the grade will be based upon the performance of labs and the reports that go along with these labs. Labs need to be performed on the week that they are scheduled. There will be one chance to make up a missed lab during the week 17 class period. (Occasionally, a formal lab report will be assigned. This is to help prepare you for lab reports at the university level.)

Lab Quizzes: It is important for students to learn the lab techniques and the required calculations involved in the materials science topics. So, there will be many quizzes to test students' understanding of the material.

Final Exam: During finals week, a comprehensive final exam will be given. This exam may cover both lab techniques and calculation problems.

Grading Scale:	90-100%	A
	80-89%	B
	70-79%	C
	60-69%	D
	<60%	F

Add Date:	Friday, September 4th	Last day to add a course
Drop Date:	Friday, October 16th	Last day to drop this course
Holidays:	Monday, September 7th	Labor Day
	Wednesday, November 11th	Veterans' Day
	Thursday-Friday, November 26th and 27th	Thanksgiving Holiday
Final Exam:	**Thursday**, **December 17th**	2:00-3:50pm

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.

Course Outline: (subject to change)

Lab Dates	Topics
Tuesday, August 18th	Materials Classification and Properties
Tuesday, August 25th	Materials Lab Techniques
Tuesday, September 1st	Unit Cells
Tuesday, September 8th	Crystallography
Tuesday, September 15th	Lab Quiz #1
Tuesday, September 22nd	Tensile Testing - Elastic
Tuesday, September 29th	Tensile Testing – Elastic - Plastic
Tuesday, October 6th	Tensile Testing – Cold Working and Heat Treatments
Tuesday, October 13th	Fracture and Fatigue
Tuesday, October 20th	Lab Quiz #2
Tuesday, October 27th	Phase Dieagrams / Phase Transformations
Tuesday, November 3rd	Iron Carbon Phase Transformations
Tuesday, November 10th	Alloys and Ceramics
Tuesday, November 17th	Polymers
Tuesday, November 24th	Composite Materials
Tuesday, December 1st	Corrosion
Tuesday, December 8th	Electrical Properties / Make Up Lab
Thursday, December 17th	Final Exam

COURSE OUTCOMES:

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

A. operate materials testing equipment and gather and analyze relevant data in order to measure material properties and/or evaluate processing treatments.

B. 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:

A. model various crystal structures found in metals and nonmetals
B. model crystal imperfections and analyze their effect on material properties
C. measure stress-strain behavior for metals, polymers and ceramics
D. investigate ductile and brittle fracture and identify the type of failure from fracture surfaces
E. determine the relative toughness of various materials through impact testing
F. evaluate fatigue behavior of metals
G. analyze equilibrium phase diagrams and predict phases and microstructure present under certain conditions
H. investigate the effect of various materials processing techniques (such as strain hardening, recrystallization, and precipitation hardening) on the structure and properties of metals
I. assess the corrosion resistance of various materials under certain environmental conditions
J. measure the behavior of semiconductor devices

LAB CONTENT:

A. Materials Overview
    1. Classification of Materials
    2. Properties of Materials
    3. Materials Usage
B. Crystal Structures
    1. Modeling
    2. Density and Packing Factor
    3. Crystal Imperfections

C. Mechanical Behavior
    1. Stress Strain Behavior
    2. Elastic vs. Plastic Deformation
    3. Ductile vs. Brittle Fracture
    4. Hardness Testing
    5. Toughness and Impact Testing
    6. Fatigue loading and behavior

D. Phase Diagrams
    1. Interpreting phase diagrams
    2. Experimental determination of phase diagrams
    3. Prediction of phases and microstructures

E. Metallography
    1. Metallurgical Microscopy
    2. Sample Preparation
    3. Grain size measurements and characterization

F. Cold Working and Heat Treatment
    1. Effect of Cold Working on structure and properties
    2. Effect of Heat Treatment on structure and properties
    3. Evaluation of Materials Processing Treatments
        i. Strain Hardening
        ii. Recrystallization
        iii. Precipitation Hardening

G. Corrosion Resistance of various materials

H. Electrical Properties of Materials
    1. Conductivity
    2. Properties of Semiconductor Devices