

**ME 372
Properties of Materials
Course Outline
Winter 2018**

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Grading

Exam I and II	45%
Final Exam	25%
Homework	10%
Laboratory	20%

Text: "Materials Science and Engineering", Callister, 9th edition, Wiley. (Wileyplus required to submit HW.)

Course Objectives

By the end of the course the successful student will be able to:

- 1) Describe different crystal structures which occur in metals. Calculate linear, planar and volume densities in crystals. (a, e, k)
- 2) Identify imperfections in crystals and explain their effect on material properties. (a, k)
- 3) Calculate diffusion times to satisfy specified design criteria. (a, e, k)
- 4) Describe various mechanical properties and the way they are measured. Use tension test data to calculate mechanical properties. (a, b, d, g, i)
- 5) Describe methods of strengthening in metals. Quantitatively predict effect of cold work on yield and tensile strength. Determine, by experimental techniques, the effect of heat treating on mechanical properties. (a, b, d, g, i)
- 6) Predict if components will or will not fail due to creep or fatigue. (a, e, k)
- 7) Use phase diagrams to determine phases present, composition of phases and fraction of phases. (a, e, k)
- 8) Know how to produce various microstructures in steels and based on microstructures present, calculate mechanical properties in steels. (a, b, d, g, i)

- 9) Describe crystal structures and mechanical properties of ceramics. (a, e, k)
- 10) Identify deformation and strengthening mechanisms in polymers. Describe applications for various polymers. (a, e, k)
- 11) Determine mechanical properties of composites based on matrix/fiber type and fiber orientation. (a, e, k)

Programs Outcomes: are a set of skills that assure the achievement of the program educational objectives. Before graduating, SECS students will demonstrate their skills in the following key areas:

- a. an ability to apply knowledge of mathematics, science, and engineering
- b. an ability to design and conduct experiments, as well as to analyze and interpret data
- c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- d. an ability to function on multi-disciplinary teams
- e. an ability to identify, formulate, and solve engineering problems
- f. an understanding of professional and ethical responsibility
- g. an ability to communicate effectively
- h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- i. a recognition of the need for, and an ability to engage in life-long learning
- j. a knowledge of contemporary issues
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Outline

<u>Date</u>	<u>Read</u>	<u>Homework Due</u>
1/3	Introduction	--
1/8	1.1-1.7, 2.6-2.7, 3.1-3.5	--
1/10	3.6-3.14, 4.1-4.10	3.3, 3.9
1/17	5.1-5.5	3.34a, 3.46a, 3.59, 3.60
1/22	6.1-6.12	4.20, 4.31
1/24	7.1-7.4, 7.8-7.13	5.19, 5.28, 6.6, 6.10
1/29	8.1-8.10	6.18, 6.27, 6.48, 6.53
1/31	8.12-8.14	7.23, 7.D.6
2/5, 2/7	--	8.6, 8.17
2/12	Review	8.34, 8.D.7
2/14	Exam 1	--
2/26	9.1-9.14	--
2/28	9.18-9.20	9.13, 9.23
3/5	10.5-10.9	9.38, 9.58, 9.62
3/7	11.1-11.5	9.81, 10.16, 10.20
3/12	11.7-11.9	10.25, 10.2FE
3/14, 3/19	Oral Presentations	--
3/21	Review	11.10, 11.D.7
3/26	Exam II	--
3/28	12.1-12.2, 12.4-12.5, 12.7-12.11	--
4/2	14.1-14.7, 14.9-14.11	12.4, 12.15, 12.44, 12.50
4/4	15.1-15.4, 15.8-15.17	14.4, 14.21, 14.26
4/9	16.1, 16.5-16.8	15.6, 15.25, 15.31
4/11	--	16.10, 16.14
4/16	Review	--

Lab Schedule

<u>Week</u>	<u>Lab</u>
1/8	Electrical Resistivity
2/5	Tension Test
3/5	Heat Treating of Steel
3/12	Precipitation Hardening
4/2	Stress Relaxation of Polymers
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***Final Exam: Monday, April 23, Noon-3:00 PM**

Note: Additional HW will be assigned and completed during class time.