Mat E 272 (F 2001), TR 2:10-3:00 p.m., 117 MacKay

http://mse.iastate.edu/mate272/

Materials Science and Engineering Department (Dept. Office: 3053 Gilman)

Principles of Materials Science and Engineering (2-0) Cr. 2. F.S. Introduction to the structure of metals, polymers and ceramics. Crystal structure and imperfections in metals. Diffusion, mechanical properties, and failure mechanisms. Phase equilibrium diagrams and heat treatment principles for steels, cast irons, and aluminum alloys. Corrosion and electrical properties. Engineering applications.

Prerequisites: None required, although completion of a high school or college chemistry course is helpful.

Instructor: Bruce Cook 253 Spedding
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Office Hours: (in 253 Spedding): Tue & Thurs 3:30 - 5:00, Fri 11:00 - 12:00
other times arranged as needed

Text: W.D. Callister, Jr., Materials Science and Engineering an Introduction, 5th edition

Grading: Grade weighting:
The 10 homework assignments together count 30%
The midterm exam counts 30%
The final exam counts 40%

Course Objectives: The objectives of **MatE 272** are to give the student the ability to:

(1) predict **physical properties** of a material based on the type of bonding present (covalent, ionic, metallic, and/or van der Waals) and the presence of any of the several types of defects common in condensed matter

(2) use knowledge of the **crystal structure** (primarily BCC & FCC) of a metal to make general predictions about the metal's ability to plastically deform

(3) calculate the extent of **diffusion**-driven composition changes based upon composition, time, and temperature

(4) predict the **microstructure** of a material comprised of two constituents (e.g. Fe and C or ZrO_2 and CaO) given the binary phase diagram and thermal history of the material

(5) use a steel's **time-temperature-transformation** diagram to specify a suitable heat treatment to produce any of the major microstructures in steel (pearlite, bainite, martensite, or tempered martensite)

(6) specify an appropriate heat treatment to precipitation harden a binary alloy given the **phase diagram** for that alloy

(7) recognize the basic causes of metallic aqueous **corrosion** and **oxidation** and design simple systems to minimize corrosion damage

(8) use knowledge of the **electronic structure** of materials to make general predictions about the material's ability to conduct electricity

Milestone Schedule: (Revised 10/24/01)

Week No.	Dates	Topic	Homework* Due Dates	Reading from Callister
1	Aug 28 & 30	Intro & Atomic Bonding		Chap. 1, 2
2	Sep 4 & 6	Crystal Structures		pp. 30-53 (except HCP planes/dir'ns), 58-59
3	Sep 11 & 13	Crystal Defects	# 1: Tu 9/11	Chap. 4
4	Sep 18 & 20	Diffusion	# 2: Tu 9/18	Chap. 5
5	Sep 25 & 27	Mechanical Properties of Metals		Chap. 6
6	Oct 2 & 4	Dislocations/Strengthening	# 3: Tu 10/2	Chap. 7
7	Oct 9 & 11	Review (Oct 9) **Midterm Exam** (Oct 11)		
8	Oct 16 & 18	Fracture Fundamentals	#4: Tu 10/16	Chap. 8 (exclude Sec. 8.10)
9	Oct 23 & 25	Fatigue & Creep (10/23) Phase Diagrams-I (10/25)	#5: Tu 10/23	Chap. 9.1-12
10	Oct 30, Nov 1	Phase Diagrams-II (10/30) Phase Transformations (11/1)		Chap. 9.13-15, Chap. 10.1-5
11	Nov 6 & 8	Steels, Cast Iron	#6_7: Tu 11/6	Chap. 10.6-9, Chap. 11
12	Nov 13 & 15	Ppt. Hardening, Nonferrous Alloys	#8: Tu 11/13	Chap. 12
		THANKSGIVING BREAK		
13	Nov 27 & 29	Ceramic Materials	#9: 11/27 (wk 12 mat'l)	Chap. 13, Chap. 14.1-5, 14.9, 14.15-18
14	Dec 4 & 6	Polymers (12/4), Electrical Properties-I (12/6)		Chap 15 (exclude 15.8-9) Chap. 16.1-10, Chap. 19.1-14
15	Dec 11 & 13	Corrosion (12/11), Review (12/13)	#10: Tu 12/11	Chap. 18
16	Fri , Dec 21, 9:45 – 11:45	**Final Exam**		

* Late homework is reduced in score 10% for each day late, unless excused by instructor.

Contribution of the Course to Meeting the ABET Professional Component: Mat E 272 is one of the engineering topics courses, consisting of engineering sciences and engineering design appropriate to the student's field of study