UNIVERSITY OF CALIFORNIA
Department of Materials Science & Engineering

Mat Sci 45 - Properties of Materials
Spring 2021

Instructor Professor Phillip Messersmith
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Course Website: bCourses

Description
This 3-unit course consists of three (3) 50-minute lectures each week. The overall objectives are to provide students with a basic working understanding of materials, in support of a career as a practicing engineer. The course provides broad coverage of the field for non-majors who may not take another course in materials science & engineering, and it serves as the introductory course in the major field, laying the foundation for understanding the relationship between the internal structure of matter and the properties of materials that make them attractive for practical applications. This course will apply basic principles of physics and chemistry to the engineering properties of materials. Primary emphasis will be devoted to the structure-properties-processing relationships of metals, polymers, ceramics, and composites, and principles of materials selection.

Lecture: MWF 12:10-1pm
https://berkeley.zoom.us/j/94169865959?pwd=cEZhQ0kxcm9PVWx0RTRjYlJiRGVUdz09
Meeting ID: 941 6986 5959 Passcode: 369117

Office Hours:
https://berkeley.zoom.us/j/97759995689?pwd=OWYzT0d5NG1NcHdQejRwdnpOVDUzQT09
Meeting ID: 977 5999 5689 Passcode: 334744

	M	T	W	T	F
Messersmith	1:10-2 pm	11-12 am			
Delparastan	2-3 pm		1-2 pm		
Avellan			9-10 am		4-5 pm

Textbook W.D. Callister, Jr. & D.G. Rethwisch, Materials Science and Engineering an Introduction, 10th Edition, Wiley (2020). A recent edition (e.g. 9th Ed.) will probably be fine.

Grading Policy
Homework 15%
Exam I 20%
Exam II 20%
Exam III 20%
Final Exam 25%

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Course Schedule: (SUBJECT TO CHANGE)

Date	Topic	Reading	HW Due
W 1/20	Introduction	Ch. 1	
F 1/22	Structure & Bonding	Ch. 2	
M 1/25	Crystal Structure	Ch. 3, 12.2-4	
W 1/27	Crystal Structure	Ch. 3, 12.2-4	
F 1/29	Crystal Structure	Ch. 3, 12.2-4	HW1
M 2/1	Crystal Structure/X-ray Diffraction	Ch. 3	
W 2/3	Crystal Structure/X-ray Diffraction	Ch. 3	
F 2/5	Crystal Defects	Ch. 4, 12.5	
M 2/8	Crystal Defects	Ch. 4, 12.5	HW2
W 2/10	Diffusion	Ch. 5	
F 2/12	**Exam I**	Ch. 5	
M 2/15	No Lecture: Academic Holiday		
W 2/17	Diffusion	Ch. 5	
F 2/19	Mechanical Properties	Ch. 6	
M 2/22	Mechanical Properties	Ch. 6	HW3
W 2/24	Dislocations/Strengthening Mechanisms	Ch. 7	
F 2/26	Dislocations/Strengthening Mechanisms	Ch. 7	
M 3/1	Fracture/Fatigue	Ch. 8	
W 3/3	Fracture/Fatigue	Ch. 8	HW4
F 3/5	Cooling Curves	Ch. 9, 12.7	
M 3/8	Phase Diagrams	Ch. 9, 12.7	
W 3/10	**Exam 2**		
F 3/12	Phase Diagrams(nonequilibrium)	Ch. 9, 12.7	
M 3/15	Fe-C/Steel Alloys	Ch. 11.2	
W 3/17	Nucleation and Growth	Ch. 10	HW5
F 3/19	Phase Transformations	Ch. 10	
M 3/22-26	Spring Break		
M 3/29	Phase Transformations- TTT/Martensite	Ch. 10	
W 3/31	Shape Memory/Superelasticity	Ch. 10	
F 4/2	Ceramics/Glasses	Ch. 12,13	HW6
M 4/5	Thermal Properties	Ch. 19	
W 4/7	Polymers- Structure and Molecular Weight	Ch. 14,15	
F 4/9	**Exam 3**		
M 4/12	Polymers- Structure and Molecular Weight	Ch. 14,15	
W 4/14	Polymers- Crystalline and Amorphous States	Ch. 14,15	
F 4/16	Polymer Properties	Ch. 14,15	HW7
M 4/19	Smart Polymers	Ch. 14,15	
W 4/21	Polymerization	Ch. 15	
F 4/23	Polymerization	Ch. 15	HW8
M 4/26	Polymerization Demo		
W 4/28	Polymers and the Environment	Ch. 22	
F 4/30	Composites	Ch. 16	HW9
W 5/12	**Final Exam, 3-6pm PST**		

Course Policies

Homework

There will be ~9 problem sets throughout the semester. You will be allowed to drop the lowest grade. Submit homework in either pdf format or as photographs of handwritten work. No word-processing file formats will be accepted. It is strongly suggested to use word-processing software with an appropriate equation-editor. If you choose to hand write your answers and your handwriting is illegible, points will be taken off.

You are allowed to work together with **one** other student to solve homework problems if you wish. If you choose to do this, then the exact same document (with both names on it) must be submitted by both students. Both students will receive the same grade. Homework sets that contain similar solutions that fall outside of these guidelines will lead to additional scrutiny and may be considered academic dishonesty. You may not use solutions to questions that are available from websites, various student organizations that maintain databases from previous years, or those provided to you by your friends. If you do this you are engaging in plagiarism.

Exams

There will be three 50-minute exams, occurring on **February 12**, **March 10** and **April 9**. The final exam will take place on **Wednesday May 12 from 3-6PM PST.** The final exam will be cumulative – covering all topics from the entire course, but emphasizing the content in lectures after Exam 3.

Late Assignments

Because of the drop policy, no late homework will be accepted except for the following circumstances. These include a medical condition that prevents completion of the assignment, deaths in the family, jury duty, etc. Plan ahead and avoid submitting at the deadline: "My internet service crashed 5 minutes before the deadline so I could not submit my assignment on time" will not be accepted as an excuse.

Re-grading Policy

Re-grade requests must be submitted by email to Professor Messersmith within one week of score posting. Submit a clear and detailed written description of why you think it merits a re-grade, using complete sentences, punctuation and no SMS/social media abbreviations. LOL! THX! Simple fixes such as addition errors will be corrected immediately. Note that a request for a regrade does not guarantee a change in grade, and that re-grading may uncover previously undetected errors on other problems that could change your grade.

Support during Remote Learning

We understand that your specific situation may present challenges to class participation. Please contact the instructors if you would like to discuss these and co-develop strategies for engaging with the course.

- The Student Technology Equity Program (STEP) is available to help access a laptop, Wi-Fi hotspot, and other peripherals (https://technology.berkeley.edu/STEP).
- You will be alerted as to when synchronous sessions are about to be recorded. There is a verbal alert when the instructor/GSI begins the session. If you join subsequently you will not hear the alert but should assume that the session is being recorded. If you prefer not to be recorded, you may turn your video and microphone off.
- Please set your Zoom name to be the name you would like the instructors to call you. You may optionally include your personal pronouns.
- Please set your Zoom picture to an appropriate profile picture of you to foster a sense of community and enhance interactions. If you are not comfortable using an image of yourself, you may use an appropriate picture of an avatar.
- We encourage participating with your video on to foster a sense of community and enhance interactions. However, we understand that some students are not comfortable with video or may not be able to participate by video.

Accommodation Policy

We honor and respect the different learning needs of our students, and are committed to ensuring you have the resources you need to succeed in our class. If you need accommodations for any reason (e.g. religious observance, health concerns, insufficient resources, etc.) please discuss with your instructor or academic advisor how to best support you. We will respect your privacy under state and Federal laws, and you will not be asked to share more than you are comfortable sharing. The disabled student program is a related resource.

Inclusion

We are committed to creating a learning environment welcoming of all students. To do so, we intend to support a diversity of perspectives and experiences and respect each others' identities and backgrounds (including race/ethnicity, nationality, gender identity, socioeconomic class, sexual orientation, language, religion, ability, etc.). To help accomplish this:

- If you feel like your performance in the class is being impacted by a lack of inclusion, please contact the instructors, your ESS advisor, or the departmental Faculty Equity Advisor (list and information at: https://diversity.berkeley.edu/faculty-equity-advisors). An anonymous feedback form is also available at https://engineering.berkeley.edu/about/equity-and-inclusion/feedback/.
- If you have a name and/or set of pronouns that differ from your legal name, designate a preferred name for use in the classroom at: https://registrar.berkeley.edu/academic-records/your-name-records-rosters.
- If you feel like your performance in the class is being impacted by your experiences outside of class (e.g., family matters, current events), please don't hesitate to come and talk with the instructor(s). We want to be resources for you.

- We are all in the process of learning how to respect and include diverse perspectives and identities. Please take care of yourself and those around you as we work through the challenging but important learning process.
- As a participant in this class, recognize that you can be proactive about making other students feel included and respected.

Academic Code of Conduct

Everyone in this class is expected to adhere to Berkeley Honor Code: "As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others."

Ethical conduct is of utmost importance in your education and career. The instructors, the College of Engineering, and U.C. Berkeley are responsible for supporting you by enforcing all students' compliance with the Code of Student Conduct and the policies listed in the CoE Student Guide The Center for Student Conduct is set up to support you when you have been affected by actions that may violate these community rules. This includes an organized and transparent process, student participation in the process, mechanisms for appeals, and other mechanisms to protect fairness.

Academic Honesty

You are encouraged to form study groups and work together to understand course material, but all written work as well as responses to in-class questions should be your own. There are ways to make your work personal and unique even when it seems that there is only one way to correctly answer a question, and the instructors will support you in learning these methods.

This course has a "zero-tolerance" policy concerning cheating and plagiarism. Students are referred to the University of California, Berkeley Student Code of Conduct for complete details on expectations. Special attention should be given to Section V and Appendix II. Cheating and plagiarism will be dealt with according to established campus policy. Students caught cheating will receive a failing grade and a report to the Center for Student Conduct will be filed. The following is a partial list of common cheating/plagiarism situations to avoid:

1. Attempts to "doctor" or manipulate assignments after grading to enhance scores will be considered academic dishonesty and dealt with as described above.
2. Submitting the same work as another student in MAT SCI 45L.
3. Partial or full replication of lab reports from students that have previously taken the course.

- Homework sets that contain similar solutions that fall outside of these guidelines will lead to additional scrutiny and may be considered academic dishonesty. You may not use solutions to questions that are available from websites, various student organizations that maintain databases

from previous years, or those provided to you by your friends. If you do this you are engaging in plagiarism.

- **Re-grading.** Attempts to “doctor” or manipulate answers after grading to enhance scores will be considered academic dishonesty and dealt with as described above.