



Mechanical and Aerospace Engineering 20

Introduction to Materials Science and Engineering

Department of Mechanical and Aerospace Engineering
Jacobs School of Engineering
University of California, San Diego

Fall 2021 Syllabus

COURSE DESCRIPTION

The structure of materials: metals, ceramics, glasses, semiconductors, superconductors, and polymers to produce desired, useful properties. Atomic structures. Defects in materials, phase diagrams, microstructural control. Mechanical and electrical properties are discussed. Time temperature transformation diagrams. Diffusion. **Prerequisites:** PHYS 2A or 4A, CHEM 6A or CHEM 6AH, and MATH 20C.

GENERAL COURSE INFORMATION

Instructor:	Dr. Olivia A. Graeve
E-mail:	professorgraeve@ucsd.edu
Course web site:	http://graeve.ucsd.edu/MAE20.html
In-person class times:	Tuesdays and Thursdays, 11:00 AM – 12:20 PM
Classroom:	CENTR 105
Virtual class times:	Fridays, 11:00 – 11:50 AM; the Oct. 22 meeting will take place on Oct. 23
Connection:	Zoom meeting ID: 957 4747 3275 Password: 852242
Office hours:	Friday, September 24, 12:00 – 1:00 PM Friday, October 1, 12:00 – 1:00 PM Friday, October 8, 12:00 – 1:00 PM Friday, October 15, 12:00 – 1:00 PM Saturday, October 23, 12:00 – 1:00 PM Friday, October 29, 1:00 – 2:00 PM Friday, November 6, 12:00 – 1:00 PM Friday, November 12, 12:00 – 1:00 PM Friday, November 19, 12:00 – 1:00 PM Friday, December 3, 12:00 – 1:00 PM
Off. hrs. connection:	Zoom meeting ID: 920 5848 1313 Password: 936820

REQUIRED TEXT

Title: Introduction to Materials Science for Engineers 8/e

Author: J.F. Shackelford

ISBN: 9780133826654

This book is available in eBook format through the bookstore.

TOPICS

- Ionic, covalent and metallic bonding
- Crystal and molecular structures
- Defects in materials
- Diffusion in solids
- Thermal properties of materials
- Electromagnetic properties of materials
- Recovery, recrystallization and grain growth
- Phase diagrams, stability and transformations
- Corrosion in metals and degradation in ceramics and polymers
- Recyclability/disposability and lifecycle of materials

COURSE OBJECTIVES

All students who participate in MAE 20 should come away with:

- Knowledge of how materials have shaped technology development with an emphasis on present-day technologies.
- A recognition of the necessity of materials selection in their own engineering discipline and a description of some ways that materials properties determine performance in applications in their own discipline.
- A recognition of the practice of materials engineering and an identification of some ways that process choices influence structure and properties.
- An identification of various types of materials that would be appropriate for use in engineering applications, including biomedical, communication, electronics, transportation, recreation and construction.

EXAMINATIONS

There will be two midterm examinations and one final examination.

GRADING Students will be graded using the following breakdown:

Midterm examinations	60% (30% each)
Final examination	40%
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TOTAL	100%

MAE 20 STUDENT HONOR CODE

I have read the honor code below and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code:

I will not:

- give information or receive information from another person during an exam,
- use more reference material during an exam than is allowed by the instructor,
- plagiarize information from books, journals, or the Internet, and
- alter an exam after it has been graded and return it to the instructor for regrading.

HOMEWORK AND EXAMINATION SOLUTIONS

Solutions to all homework and examination solutions will be posted electronically on the following web site: <http://graeve.ucsd.edu/MAE20.html>

E-MAIL ETIQUETTE

Email is a very public means of information exchange, which should be treated with respect. As such, I expect that all students will write and respond to emails in a respectful manner.

An example of an appropriate email is:

September 23, 2021

Dear Dr. Graeve:

Could you please inform me of the reading assignment for this week?

Thank you,

John Doe

An example of an inappropriate email is:

Hey you what is the homewrk this week

This email has misspellings, inappropriate punctuation, no salutation, no signature, no date, and is extremely disrespectful.

Note: Do not write emails that you would not want your mother or your lawyer to read. Assume, at all times, that everyone in the world will read any email you write.

DISABILITIES ACCOMMODATIONS

All students with disabilities who wish to request accommodations should contact the Office for Students with Disabilities. All information disclosed to this office by students will remain confidential, but the office will provide documentation that supports accommodations within the classroom (*e.g.*, examination accommodations, notes, *etc.*). Please keep in mind that many accommodations require early planning, so requests should be made as soon as possible.

IDEA ENGINEERING STUDENT CENTER

The IDEA Engineering Student Center, located just to the right of the lobby of Jacobs Hall, is a hub for student engagement, academic enrichment, personal/professional development, leadership, community involvement, and a respectful learning environment for all. The Center offers a variety of programs, listed in the IDEA Center Facebook page at <http://www.facebook.com/ucsdidea/> (you are welcome to Like this page!) and the Center web site at <http://idea.ucsd.edu/>.

PUBLIC HEALTH EXPECTATIONS AND BEST PRACTICES

Public health is a collective effort. Keeping the UC San Diego community healthy takes all of us following campus safety requirements to help prevent infection. You are also expected to follow university public health requirements and pursue personal protection practices to protect yourself and the others around you. These include:

Participating in the university's daily screening process

Everyone must complete a daily symptom screener at:

<https://returntolearn.ucsd.edu/return-to-campus/testing-and-screening/student-screening-and-testing/index.html#daily-screening>

Participating in the university's testing program

All students are required to participate in the COVID-19 testing program as required by their vaccination status at:

<https://returntolearn.ucsd.edu/return-to-campus/testing-and-screening/student-screening-and-testing/index.html#covid-testing>

Wear a well-fitting mask that covers your nose and mouth at all times

Everyone is required to wear masks indoors regardless of vaccination status. If you see someone not wearing a mask, or wearing it incorrectly, kindly ask them to mask up. Details can be found at:

<https://returntolearn.ucsd.edu/return-to-campus/safety-requirements/index.html>

Monitor potential exposures and comply with contact tracing efforts

Look out for the daily updates and potential exposure list that the university sends out with building information and the dates of exposure.

Stay home if you are feeling ill

If you are not feeling well, complete the symptom screener and if needed, get tested for COVID-19. Do not come to campus unless given the all-clear.

LECTURE SCHEDULE

Date	Topic	Sections
Thur, September 23	Six Materials That Changed Your World Metallic Structures	1.3, 3.1, 3.2
Fri, September 24	<i>Problem solving session</i>	
Tue, September 28	Ceramic, Semiconductor and Polymeric Structures	3.3, 3.4, 3.5
Thur, September 30	Lattice Geometry and X-Ray Diffraction	3.6, 3.7
Fri, October 1	<i>Problem solving session</i>	
Tue, October 5	Chemical Imperfections and Point Defects	4.1, 4.2
Thur, October 7	Higher-dimensional Defects	4.3, 4.4, 4.5
Fri, October 8	<i>Problem solving session</i>	
Tue, October 12	Diffusion I	5.1, 5.2
Thur, October 14	Diffusion II	5.3, 5.4, 5.5
Fri, October 15	<i>Problem solving session</i>	
Tue, October 19	Thermal Behavior of Materials	7.1, 7.2, 7.3
Thur, October 21	Electronic Properties of Materials I	13.1, 13.2, 13.3
Sat, October 23	<i>Problem solving session</i>	
Tue, October 26	Electronic Properties of Materials II	13.4, 13.5
Thur, October 28	Materials for the 21st Century	
Fri, October 29	<i>Problem solving session</i>	
Tue, November 2	Optical Properties of Materials	14.1
Thur, November 4	Magnetic Properties of Materials	14.2
Fri, November 5	<i>Problem solving session</i>	
Tue, November 9	Phase Diagrams	9.1, 9.2
Fri, November 12	<i>Problem solving session</i>	

Tue, November 16	The Lever Rule and Microstructural Development	9.3, 9.4
Thur, November 18	Kinetic Processes	10.1, 10.2
Fri, November 19	<i>Problem solving session</i>	
Tue, November 23	Microstructure Control	10.3, 10.4, 10.5
Tue, November 30	Materials for the 21st Century	
Thur, December 2	Environmental Degradation of Materials	15.4
Fri, December 3	<i>Problem solving session</i>	
Sat, December 11 11:30 AM – 2:30 PM	Final examination	