

UNIVERSITY OF CALIFORNIA, DAVIS
Department of Materials Science and Engineering

EMS 268: Materials Characterization
227 OLSON- TTR 2:10-4:00 pm

COURSE OUTLINE – Winter 2020

Instructor: Sabyasachi Sen
3011 Ghausi Hall
email: sbsen@ucdavis.edu
Office hours: M 11:00am – 12:00pm or by appointment
Course webpage: Canvas

Course Description:

This course will introduce the fundamental theoretical framework for various characterization methods used in structural and compositional analysis of engineering materials. Topics will include x-ray, electron, ion, and neutron interactions with materials and techniques will include diffraction, spectroscopy, and microscopy methods.

Textbook: No specific textbook will be required for the class. Readings will be posted on the course Canvas and will consist of sections from various textbooks and journal articles.

Reference books:

- Vitalij K. Pecharsky and Peter Y. Zavalij, *Fundamentals of Powder Diffraction and Structural Characterization of Materials, Second Edition*, Springer, ISBN: 987-0-387-56088-5. *
- Yang Leng, *Materials Characterization, Introduction to Microscopy and Spectroscopic Methods*, Wiley, 2008, ISBN-13: 978-0-470-82298-2. *
- * An electronic copy of these books is available with a UC Davis Kerberos login through the UC Davis Library.

Prerequisites: Graduate standing in Engineering, Physics, or Chemistry, or consent of the instructor.

<u>Grading:</u>	Homework	50%
	Midterm	20%
	Term paper and Oral presentation	30%

Course Policies:

1. Homework is due in class on the specified due date. No late homework will be accepted.
2. Unless you are instructed otherwise, you may discuss homework problems with other students in the class, but submitted work must be your own. The UC Davis Code of Academic Conduct will be strictly enforced. (see <http://sja.ucdavis.edu/files/cac.pdf>)
3. It is expected that students will abide by the UC Davis Principles of Community (see <http://occr.ucdavis.edu/poc/>).

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Tentative List of Topics – Winter 2020

1. Diffraction techniques – X-ray and Neutron
2. Spectroscopic techniques
 - (i) Optical (absorption, fluorescence) Spectroscopy
 - (ii) Vibrational Spectroscopy
 - (iii) X-ray absorption and electron energy loss spectroscopy
 - (iv) Magnetic Resonance spectroscopy
 - (v) X-ray photoelectron spectroscopy
 - (vi) X-ray fluorescence, energy and wavelength dispersive x-ray spectrometry
 - (vii) Secondary ion mass spectrometry, Auger and RBS
3. Microscopy and other techniques
 - (i) TEM – 1 lecture
 - (ii) SEM – 1 lecture
 - (iii) Scanning probe microscopy- 1 lecture

Last two lecture timeslots on 3/10/20 and 3/12/20 will be used for oral presentations by the students.