



MSE 104 – Materials Characterization | Spring 2015

Instructor: Lane W. Martin
Lecture: 348 HMMB, MWF 12:00-1:00PM

Email: lwmartin@berkeley.edu
Office: 375 Hearst Mining Building
Office Hours: Monday 4:00-5:00PM, Wednesday 4:00-5:00PM, or by appointment only
Course Website: bCourses

Graduate Student Instructors: Chris Barrett (cbarret3@berkeley.edu) (Office hour: Wednesday, 5:00-6:00PM)
Alyssa Maich (maich@berkeley.edu) (Office hour: Monday, 1:00-2:00PM)
Santiago Miret (santiago@berkeley.edu) (Office hour: Thursday, 5:30-6:30PM)

Laboratory Sections: Tuesday 8:00-11:00AM, 2:00-5:00PM
Wednesday 8:00-11:00AM, 2:00-5:00PM
Thursday 2:00-5:00PM
Friday 8:00-11:00AM

Text: *Elements of X-ray Diffraction*, B. D. Cullity and S. R. Stock, 3rd Edition, Prentice Hall: Upper Saddle River, NJ (2001).

References: On reserve at Kresge Engineering Library and course website

Prerequisites: MSE 102 – a basic knowledge of structure, bonding, and crystallography will be assumed.

Description: This 4-unit course consists of three (3) 50-minute lectures each week taught by the head instructor as well as multiple laboratory sessions each week. The course introduces the fundamental theoretical framework for diffraction, spectrometry and imaging methods used in the structural and compositional characterization of engineering materials at the atomic level. The laboratory portion of the course provides intensive hands-on instruction in the most widely practiced x-ray diffraction (XRD) methods for materials evaluation, and an introduction to electron microscopy in both scanning and transmission modes. In addition to these topics we will cover special topics related to modern, advanced materials characterization including (but not limited to) scanning-probe microscopy, synchrotron-based studies, probes of electrical/magnetic/optical properties, etc. Additionally, the course may include local field trips to explore specific unique facilities in and around Berkeley.

Objectives: The long term objective of this course is to provide students with a fundamental understanding, basic working knowledge, and introduction to both fundamental and widely-used materials characterization methods as well as state-of-the-art, novel probes of materials. More specifically, this class will provide students 1) a thorough introduction to the principles and practice of diffraction, 2) practical experience in laboratory methods and reporting, 3) introductory exposure to a range of common characterization methods for the determination of structure and composition of solids, and 4) preliminary coverage of advanced characterization methods. A successful student will learn 1) the theory and practice of X-ray and electron diffraction, 2) basic elements of electron microscopy, 3) basic aspects of optical and other characterization methodologies.



Proposed Class Outline and Schedule

Recall that a course is a flowing and changing thing. The following is a proposed outline and timeline for the semester. This will be subject to changes that will be announced well in advance in class.

Date	Activity	AM Lab	PM Lab	Assignments Due
Jan. 19	No School – Martin Luther King Day			
Jan. 20				
Jan. 21	Lab Orientation in Class Period (Prof. Martin on travel)			
Jan. 22				
Jan. 23	Lecture			
Jan. 26	Lecture			
Jan. 27		Lab 1A	Lab 1A	
Jan. 28	Lecture	Lab 1A	Lab 1A	
Jan. 29			Lab 1A	
Jan. 30	Lecture	Lab 1A		HW 1
Feb. 2	Lecture			
Feb. 3			Lab 1B	
Feb. 4	Lecture		Lab 1B	
Feb. 5			Lab 1B	
Feb. 6	Lecture			HW 2
Feb. 9	Lecture			
Feb. 10		Lab 2A	Lab 2A	
Feb. 11	Lecture	Lab 2A	Lab 2A	
Feb. 12			Lab 2A	
Feb. 13	Lecture	Lab 2A		HW 3
Feb. 16	No School – President's Day			
Feb. 17			Lab 2B	
Feb. 18	Lecture		Lab 2B	
Feb. 19			Lab 2B	
Feb. 20	Lecture			HW 4
Feb. 23	Lecture			
Feb. 24		Lab 3A	Lab 3A	
Feb. 25	Lecture	Lab 3A	Lab 3A	
Feb. 26			Lab 3A	
Feb. 27	Lecture	Lab 3A		Exam 1
Mar. 2	Lecture			
Mar. 3			Lab 3B	
Mar. 4	Lecture		Lab 3B	
Mar. 5			Lab 3B	
Mar. 6	Lecture			HW 5
Mar. 9	Lecture			
Mar. 10		Lab 4A	Lab 4A	
Mar. 11	Lecture	Lab 4A	Lab 4A	
Mar. 12			Lab 4A	
Mar. 13	Lecture	Lab 4A		HW 6
Mar. 16	Lecture			



Mar. 17			Lab 4B	
Mar. 18	Lecture		Lab 4B	
Mar. 19			Lab 4B	
Mar. 20	Lecture			HW 7
Mar. 23-27	Spring Break – No Class or Labs			
Mar. 30	Lecture			
Mar. 31		Lab 5A	Lab 5A	
Apr. 1	Lecture	Lab 5A	Lab 5A	
Apr. 2			Lab 5A	
Apr. 3	Lecture	Lab 5A		
Apr. 6	Lecture			
Apr. 7			Lab 5B	
Apr. 8	Lecture		Lab 5B	
Apr. 9			Lab 5B	
Apr. 10	Lecture			HW 8
Apr. 13	Lecture			
Apr. 14		Lab 6A	Lab 6A	
Apr. 15	Lecture	Lab 6A	Lab 6A	
Apr. 16			Lab 6A	
Apr. 17	Lecture	Lab 6A		Exam 2
Apr. 20	Lecture			
Apr. 21			Lab 6B	
Apr. 22	Lecture		Lab 6B	
Apr. 23			Lab 6B	
Apr. 24	Lecture			HW 9
Apr. 27	Lecture			
Apr. 28				
Apr. 29	Lecture			
Apr. 30				
May 1	Lecture			HW 10
May 4-8	Reading Week			
May 13	Final Exam – Group 11 – 3:00-6:00PM			

Grading Policies

Student learning and growth will be assessed based on the following assignments:

- **Homework (20% of total grade, 2% for each assignment)**
 - There will be ~10 problem sets throughout the semester.
 - Homeworks may be completed in groups of 2 students or you may choose to work independently.
 - No more than 2 people may work together, but each individual student must turn in an individual version of each homework.
 - Homework pairs must clearly indicate which other student (if any) they worked with on the homework. This will be accomplished by providing the full name (first and last) of your partner below your name at the top of your assignment.
 - Similarities and correlation of solutions within the homework pair are expected, but verbatim copying of one another solutions is not allowed. If you work out how to do the problem together, then write-up your final solutions separately.



- Strong correlation between the solutions of different pairs' homeworks will lead to additional scrutiny from the graders and instructor. Cases of academic dishonesty (i.e., cheating, copying, etc.) will receive an automatic zero for that assignment.
 - Homeworks are to be turned-in online via bCourses by the start of class (12:10PM) on each of the noted due dates.
 - Homeworks must be turned-in in .pdf format; submissions must be converted to pdf to preserve formatting, which is common professional engineering practice. No raw word-processing file formats will be accepted. It is strongly suggested that homeworks be completed in a work-processing software with an appropriate equation-editor add-on as opposed to scanned versions of hand-written homeworks.
 - No late homeworks will be accepted.
 - A few words on the homeworks, solutions, and honesty:
 - The topmost objective of your homework assignments is to guide your self-learning.
 - Some of the questions may be available from various student organizations that maintain databases of previous year's solutions. If you choose to adopt or modify the solutions presented in any of the "Instructor's Manuals" available on line, or an instructor's previously distributed solutions to any of the problems assigned this semester, you **MUST** give a full citation of such resources; otherwise you are engaging in plagiarism. Such academic dishonesty yields **NO** points and risks a report to the Center for Student Conduct.
- **In-class Participation (5% of total grade)**
 - Classes such as this are greatly improved by active discussion and participation.
 - If you have a question you can rest assured that at least 50% of the rest of the class also has that question – so ask it!
 - If you didn't know, some subject matter is not only dry for you as the student, but for the instructor as well. Questions break-up the pattern and can lead to unexpected and entertaining stories and examples. Please ask questions
- **Exams (25% of total grade, 12.5% for each exam)**
 - There will be **two (2) 50 minute, in-class exams, occurring on Feb. 27, 2015 and the other on April 10, 2014.**
 - There will be **no makeup exams.** If you have a valid reason for missing an exam (e.g., doctor's excuse, death in the family, school-sponsored activity, etc.) I will work with you to reach an acceptable time to take the exam. Cases will be dealt with on a case-by-case process.
- **Laboratory Time and Laboratory Reports (30% to total grade, 5% for each report)**
 - There are 6 laboratory sections for MSE 104 each week (as noted in the table below).
 - There are **2 MiniFlex X-ray diffractometer stations available** in the lab. To offer a reasonable learning experience, there should be no more than 3 students per MiniFlex station, allowing a **total of 6 students conducting each lab exercise.** We will offer the same lab exercise twice, to 6 students during Week "A" and another 6 students during Week "B," thereby accommodating 12 students per lab section.

	MSE 104 Lab	M	Tu	W	Th	F
Week A	8:00-11:00AM		105A	104A		107A
	2:00-5:00PM		101A	102A	103A	
Week B	8:00-11:00AM					
	2:00-5:00PM		101B	102B	103B	

- Reports must be completed following the guidelines outlined in the **Laboratory Guide** (available online).
- Laboratory reports are to be submitted electronically through bspace and are due 1 week from the end of your laboratory.



- Example if you are in laboratory section 105A, your report will be online by 11:00AM on the next Tuesday (week B).
- **Final Examination (20% of total grade)**
 - The final examination will be cumulative – covering all topics from the entire course.
 - The exam will take place on **May 13, 2015 from 3:00-6:00PM.**
 - There will be **no makeup exams**. If you have a valid reason for missing an exam (e.g., doctor's excuse, death in the family, school-sponsored activity, etc.) I will work with you to reach an acceptable time to take the exam. Cases will be dealt with on a case-by-case process.

Late Assignments

- **No late assignments will be accepted unless prior arrangements are made with the instructor for valid excuses.**
 - Valid excuses include, but are not limited to, deaths in the family, jury duty, hospitalization for illness, etc.
 - Non-valid excuses include, but are not limited to, oversleeping, "my printer didn't work," "I wasn't here when you assigned it," etc.
- If you have concerns I am happy to discuss with you about your specific situation and clarify any questions you have.

Re-grading Policy

- Re-grading of exams, reports, and homeworks is a timely and serious undertaking. The Instructor takes the academic integrity of this course and your work very seriously. In turn, you will be asked to take a similar stance on these materials. In order to assure only valid cases come before the class staff, the following policies will be in place. Failure to adhere to these policies will mean that your requests will go unheeded:
 - Students are required to type up a written request for re-grading. This request should include the following information:
 - Student Name and ID
 - Assignment or Exam in question
 - Problem number in question
 - A written description, using complete sentences, outlining the suspected mis-grading. This includes a detailed description of what you have done and why you think it merits a re-grade.
 - Re-grade request along with the original assignment/exam will first go to the Instructor for consideration. At this point the Instructor can reject re-grade requests that do not meet the above standards. Compliant requests will then go to the appropriate grader or GSI who will consider the request.
 - Simple fixes such as addition errors will be rectified immediately.
 - More extensive requests will go to the appropriate grader or GSI who will then consult with the Instructor with one of two outcomes: 1) a complete re-grade of the entire assignment or 2) rejection of the appeal. Note that complete re-grading may under other errors on other problems that could lower or increase your grade further.
 - The results of this re-grading will be final and binding.
 - Attempts to "doctor" or manipulate assignments after grading to enhance scores will be dealt with under the auspices of the Academic Code of Conduct.

Academic Code of Conduct

- This course will execute a "zero-tolerance" policy concerning cheating and plagiarism.



- Students are referred to the University of California, Berkeley Student Code for complete details on the Student Code. Special attention should be given to Section V and Appendix II of (<http://sa.berkeley.edu/code-of-conduct>).
- Cheating and plagiarism will be dealt with according to established campus policy. Students caught cheating will receive a failing grade.