Syllabus

MS 132 Diffraction and Structure

Instructor

Brent Fultz (138-78, x2170, Room 239 Keck) btf@caltech.edu

Teaching Assistant

TBA @caltech.edu

Prerequisites

This is a core course for first-year graduate students in Materials Science or Applied Physics, but others are welcome, including second year graduate students and junior and senior undergraduates.

Familiarity with very basic crystallography (directions, and Miller indices for planes). Concept of a unit cell and basis vectors. Wave mechanics, with some exposure to quantum mechanics. Some exposure to Fourier transforms would be very helpful, although some of this is done in the class itself.

Content

The course will follow the book, approximately linearly. It is available for electronic checkout from the Caltech library. The following link to the springer ebook website should work for anyone on the Caltech network/VPN:

https://link.springer.com/book/10.1007/978-3-642-29761-8

It is my understanding that Springer offers a low-cost ($ 25 ?) paperback version to students at Caltech, but I do not know the procedure for ordering it. Earlier editions (2nd and 3rd) contain the main content, but problems and chapters are different. All assignments and reading requirements will reference the Fourth Edition. Please use the Fourth Edition.

The coverage is approximately one chapter per week, at least until Chapter 8. This is near the end of the term, and topics will then be selected from Chapters 8-13.

Required Text

B. Fultz and J.M. Howe, Transmission Electron Microscopy and Diffractometry of Materials, Fourth edition (Springer, 2013).

Other Books

B. E. Warren, X-Ray Diffraction, Dover

J. M. Cowley, Diffraction Physics, North Holland

D. B. Williams and C. B. Carter, Transmission Electron Microscopy (4 Vols), Plenum

J. Edington, Practical Electron Microscopy in Materials Science (4 Vols), Philips Electronic Instruments

Grading

15% Participation and moodle questions. (Please come to class, even if it is early in the day.)
40% Homework (do not look at old assignments, late problem sets will receive 1/3 credit, students may collaborate on any written work).

45% Final Exam. Format to be determined, but likely 3 hour take-home with open book.

In 2019 the class time will be arranged as a partially-flipped classroom

Tentative Class Format (times in minutes)

(* before class) To help you follow what is going on, I expect you to do a little reading before coming to class, and answer a question on the moodle site the day before the classtime. The reading is assigned from the textbook, so you need the textbook to identify the pages and sections to read. Parts of the pre-recorded lecture may also be assigned. This problem will be graded, but **almost any reasonable answer will receive full credit**.

(10) Some students will be selected to read (or write on the board) their answers to the pre-class question. (I will give you a hardcopy to read, to jog your memory.)

(40) Fultz will describe some of the concepts and approaches to be taken. (This is a lecture.)

(20) Students work in groups of three to solve homework problems or derivations. Small, erasable white boards are provided. One group may be asked to present the solution to the rest of the class, and the TA may take a photo of the white board for posting on the moodle site.

(20) Fultz may give a mini-lecture or lead a discussion.