MSE 102 – Bonding, Crystallography and Defects
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Discussion Sections: The discussion sections will be both formal and informal. Sometimes, they will expand on the material covered in class to make concepts more clear. Others will be devoted strictly to your questions. You should view these as mandatory in that material covered in the discussion sections and not necessarily covered in the main lecture is "fair game" for examinations.

Web Site: bcourses.berkeley.edu
The web site will be your primary source of information regarding the course. Lecture notes are posted, as will problem sets, and additional information as needed.

Required Text:

None. Mostly, we will rely on course notes that are posted to the web. This does not mean that you are absolved of any responsibility to do outside reading. You should consult the sources below often for clarification of concepts, and alternate views of presented material.

Recommended Texts:

A single textbook covering the course material is not available. Consequently, I have drawn upon a number of sources (including my own experience) in constructing the course. I find the following references to be extremely helpful. Whenever possible, I will note which of these is particularly strong for which topics to assist you in planning your additional reading.

1) Kelly, Groves and Kidd. "Crystallography and Crystal Defects" (Wiley, 2000).
2) Sands. "Introduction to Crystallography" (Dover, 1990).
3) Borchardt-Ott. "Crystallography" (Springer, 1995).
4) Nye. "Physical Properties of Crystals" (Oxford, 1985).
5) Liboff. "Introductory Quantum Mechanics" (Holden-Day, 1980).
6) Harrison. "Electronic Structure and the Properties of Solids" (Dover, 1989).

Problem Sets:

There will be 10 problem sets assigned. Problem sets will be due, in general, on Thursdays *at the start of class*, and must be submitted electronically. Solutions will be posted to the web after the due date. Late problem sets will not be accepted unless you have made prior arrangements with the Professor. (Exceptions can be made for family emergency/health/religious accommodation reasons.) I will count your best 9 problem sets towards your grade.

Problem sets are meant to enable you to bring you to an understanding of the course material. As such, problem sets turned in should reflect *your* work – the algebra you do, the plotting of the structures, the computer codes should all be yours and only yours. Keep this in mind as you work on problem sets. You can work with others to help understand the material, *but you must develop your own solutions*. Academic honesty and integrity are extremely important. As an engineer or a scientist, your word and actions are your reputation. Academic dishonesty will not be tolerated and result, in a minimum, of a zero on the assignment (that cannot be dropped), and in general, further sanctions.

Grading:

Your grade will reflect four contributions. The problem sets will count as 20% of your grade. There will be two in-class exams that each count as 20% of your grade. The final exam will count as 40% of your grade.

The final grade will be computed by assigning a point value to each component. (For example, your nine best problem sets can contribute a maximum of 20 points.) Your final grade will be determined by a sum of all five components. I will try my best to construct problem sets and exams that are fair, and reflect what I think you need to know.

The course grades may or may not be set by a curved scale. This depends on how well you do, and how well I do. I will try and give you some sense of how things will go after the first midterm. (I view a straight scale as desirable… In science and engineering, there are absolute truths. Bridges fall or they don't. Devices work or they don't. Nature, quite frankly, doesn't care if you know more than your classmates. If you don't know enough, the bridge will fall, the device will fail...)

Syllabus:

The syllabus is posted to the web site. It describes the intellectual flow of the course, and lists important dates (in-class examinations, due dates for problem sets, etc.)
I will endeavor to stick the syllabus as much as is possible. However, I do find that the pace and depth at which topics can be addressed is very much class dependent, and we may find it necessary to adjust the syllabus as we progress.

Goals:

The course description posted on the departmental web site lists three course objectives:

- To identify and describe the types of bonding found inmaterials.
- To develop the language to describe crystal structures and their symmetries.
- To identify and describe different types of defects th at are found in real crystal structures.

In addition, the web site lists desired course outcomes:

- The student should be able to define a lattice and a crystal.
- The student should be able to identify crystalline translational and point symmetries.
- The student should be able to read and interpret the International Tables for Crystallography.
- The student should understand the structure of a stereographic projection, and the stereograms for the 32 crystallographic point groups.
- The student should understand the relationship between symmetry and physical properties.
- The student should be able to construct a reciprocal lattice for a crystal, and relate the structure of the lattice to diffraction from that crystal.
- The student should understand the quantum mechanical origins of bonding, and structure of Schrödinger's equation, and its application to simple problems including the particle in a box, the hydrogen atom and a rudimentary band theory of solids.
- The student should be able to identify the characteristics of metallic, covalent, ionic and van der Waal's bonding.
- The student should be able to identify the different types of defects found typically in crystals.
- The student should begin to understand the importance of defects to materials properties.

Why am telling you this? Well, these objectives and outcomes serve as a type of contract. For my part, I promise to do my best to put you in a position to meet all of the objectives and successfully demonstrate all of the outcomes. Your part is to follow my lead, and attain all of the stated goals. In this respect, the objectives and outcomes serve as a study guide for the course. While we will not always focus explicitly on this list, each of our topics, problem sets and exams will somehow reflect the goals of the course and if you are aware of this, it can help you to focus your study efforts appropriately. By the end of the course you should be able to read through this list and state confidently that you can meet all of the objectives.

One more thing about academic honesty… from the student code of conduct:

GROUNDS FOR DISCIPLINE

The Chancellor may impose discipline for the commission or attempted commission (including aiding or abetting in the commission or attempted commission) of the following types of violations by students (as specified by University Policy 100.00, http://www.ucop.edu/ucophome/coordrev/ucpolicies/), as well as such other violations as may be specified in campus regulations:

102.01 Academic Misconduct

All forms of academic misconduct including but not limited to cheating, fabrication, plagiarism, or facilitating academic dishonesty.

See Appendix II of this Code for further explanation of academic misconduct.

APPENDIX II: ACADEMIC MISCONDUCT

This appendix provides students with a further explanation of different forms of academic misconduct. This list is not exhaustive. Individual departments at the University of California, Berkeley may have differing expectations for students, and therefore students are responsible for clarifying the standards and expectations of their individual departments.

Cheating

Cheating includes fraud, deceit, or dishonesty in an academic assignment, or using or attempting to use materials, or assisting others in using materials that are prohibited or inappropriate in the context of the academic assignment in question.

Plagiarism

Plagiarism includes use of intellectual material produced by another person without acknowledging its source.

False Information and Representation and Fabrication or Alteration of Information

Furnishing false information, failing to identify oneself honestly, fabricating or altering information and presenting it as legitimate, or providing false or misleading information to an instructor or any other University official in an academic context.

Put simply… don't cheat. As I said above, the work you turn in should be your own.