Physics 231 2007 Fall Quarter
Introduction to Condensed Matter Physics
ISB 231, MW 2:00-3:45pm
Office hours: MW 1:00-2:00pm or any time by appointment or dropping in

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Course website: http://physics.ucsc.edu/~gweon/teaching/07q4-phys231/

Text: Solid State Physics, by Neil W. Ashcroft and N. David Mermin
References:

Condensed Matter Physics, by M. P. Marder
Concepts in Solids (Lecture Notes in Physics), by P. W. Anderson
Principles of Condensed Matter Physics, by P. M. Chaikin, T. C. Lubensky
Introduction to Solid State Physics, by C. Kittel

Condensed Matter Physics concerns quantum mechanical principles realized in the context of our daily lives. It is a rich discipline that, on one hand, provides foundation knowledge about how high tech devices work and, on the other hand, illuminates myriads of emergent phenomena that seem to be of fundamental interest on many intellectual levels. This course provides a basic introduction to the condensed matter physics, but the rich and complex flavor of the discipline will not be lost. After this course, students should become familiar with bread-and-butter concepts of the condensed matter physics – Bravais lattice, reciprocal lattice, Bloch's theorem, crystal momentum, Brillouin zones, crystal bonding, phonons, Drude theory of metals, electron bands, semi-classical theory of transport, and Landau quasi-particles. A tentative plan for the course is the following.

Week	Lecture #	Date	Topic	Reading
1	1	Oct 1	Crystal Structure	4,5
	2	Oct 3	Crystal Structure	6,7
2	3	Oct 8	Crystal Bonding	19,20
	4	Oct 10	Crystal Dynamics	21,22
3	5	Oct 15	Crystal Dynamics	23,24
	6	Oct 17	Crystal Dynamics	25
4	7	Oct 22	Electrons in Uniform Potential	1
	8	Oct 24	Electrons in Uniform Potential	2,3
5	9	Oct 29	Electrons in Periodic Potential	8,9
	10	Oct 31	Electrons in Periodic Potential	9,10
6	11	Nov 5	Electrons in Periodic Potential	11
	12	Nov 7	Transport Theory	12
7	13	Nov 14	Transport Theory	13,14
8		Nov 19	Mid-term Exam	
	14	Nov 21	Electron-Electron Interaction	17,32
9	15	Nov 26	Electron-Electron Interaction	17,32
	16	Nov 28	Electron-Phonon Interaction	26,34
10	17	Dec 3	Electron-Phonon Interaction	26,34
	18	Dec 5	Catch-Up or Optional Topics	
11		Dec 10 - 13	Final Exam – Presentations	

Active Learning Policy:

Learning comes mostly from discussions, hard thinking and "getting it," not from listening to boring or demanding lectures. Finally, talking about one's knowledge and presenting it really solidify/test it. It is often observed that students' minds wander off from the lecture, especially as the course progresses deep. To make this course more efficient *for learning*, the following active learning policy will be employed. For each lecture, there will be a section of the text assigned to a student for presentation. This presentation will typically occur in the middle portion of the lecture, and about 30 minutes will be allotted for it. This mid-class "guest lecture" will foster a "study group" kind of atmosphere, appropriate for this small and advanced class. There is no need to be nervous about this presentation, as it will not be reflected on grades, unless a particular person gives consistently superb presentations repeatedly.

Grading Policy:

- Homework, 30 %
- Midterm, 30 %
- Final, 30 %
- Quiz, 10 %

Absenteeism:

Absence from class will not affect the grade, as long as it is notified (by email) before class. However, because of the active learning policy above, the guest lecturer cannot be absent, unless it is notified 3 days in advance. For every second absence without prior notification, a global scale-down factor of 0.9 will be accumulated. For example, if 4 or 5 classes are missed without notification, then the total score will be multiplied by 0.81=0.9x0.9, before assigning the grade.

Homework:

Handed out about every two lectures, and due in one week thereafter.
Will accept late homework, but homework score will be multiplied by 0.8 for up to one week late homework, 0.6 for up to two week late homework, and 0.4 afterwards.
No homework will be accepted after Dec 7.

Final Exam:

You will be asked to present a summary of a condensed matter physics topic of your interest. The presentation will consist of a maximum of 10 slides. It is encouraged that you present a subject related to your own research and it is required that you make connections to basic concepts covered during the course. For example, you can present a summary of a "classic paper" or a section of a book chapter in your research subject matter. The quality of presented materials, demonstrated understanding of concepts involved, and the clarity of the presentation will be the basis of the evaluation.