

Course name	Physics 156, Applications of Solid State Physics
Meeting place, time	Crown 201, TuTh 10:00AM-11:45AM
Instructor	G.-H. (Sam) Gweon
Office hours	Tu 12-2PM, W 1-2PM
Where to find instructor	ISB 249, gweon@ucsc.edu, http://griffin.ucsc.edu
CCR	Hee-Sun Lee, heesun.lee@berkeley.edu
Textbook	<i>Semiconductor Device Fundamentals</i> Robert F. Pierret
References	<i>Solid State Electronic Devices</i> Ben G. Streeman <i>Introduction to Solid State Physics</i> Charles Kittel
Course website	http://griffin.ucsc.edu/teaching/current

Course objectives Gain working understanding of the fundamental quantum mechanical principles governing the semiconductor physics. Gain practical understanding of physical principles behind the building blocks of modern devices such as diodes, transistors and solar cells. Also, use and learn computer technology for learning and computation (Matlab, Python, Mathematica). Learn about other topics (lasers, magnets, superconductors), as time permits.

How you can achieve them. Work hard (read, listen, ask, think hard). Believe that *you are the one*.

Prerequisite 101A/B, or equivalent. Some modern physics knowledge with the mastery of the introductory physics courses. Math: basic multi-var calculus.

Evaluation Roughly, homework (30 %), midterm (30 %), final (30 %), quiz (10 %). Homework will be out every Thursdays, and will be due in one week. Late homework will not be accepted (but see next). Every Thursday, except for the first two Thursdays, there will be in-class quiz.

CCR and homework The acronym “CCR” used above stands for the Concord consortium representative. The Concord consortium is a non-profit NSF-funded organization that develops web-based teaching materials for science education. Some of their web activities designed for higher education will be included as (basic) part of some homework sets. The goal here is to help you grasp relevant basic quantum mechanical concepts better. Therefore, this activity, while required, will be a very “light” part of homework, as far as the grading is concerned. For the Concord consortium to measure the effectiveness of this activity, you will be administered a short pre-test and a post-test, at the beginning and the ending, respectively, of this course. Please sign up at the Concord consortium website for this.

Emergency If highly unusual personal circumstances arise to prevent you from participating in core course activities (homework, quiz, exam), you should communicate with me as soon as you can, so that you will get the best consideration for makeup opportunities.

Get all help you can get. Make the most use of my office hours. Make friends with classmates and talk to them! The evaluation in this course will be absolute, and so help your friend and yourself understand things better by having good discussions. If your classmate asks you something, by all means give an earnest answer. You will not only help your friend, but you will help yourself by thinking again, clearing up confusion, and solidifying knowledge in the process. By the same token, don't be shy to ask your classmate a question. You may be actually helping her/him! Last but not least, please first help yourself by reading the book. I think the textbook is excellent for reading, which is why I selected it.

However . . . you should never help, or be helped by, your friends during an exam or a quiz. You should never copy your friend's homework solution. Likewise, you should never engage in other activities that breach the academic integrity. To ensure fairness, I will be monitoring possible activities breaching the academic integrity. If confirmed to be involved in such an activity, you will fail this course.

Lecture plan This is a rough plan for lectures.

Lecture will be based on the textbook, but may deviate (significantly) from it sometimes.

L	W	D	Subject	Materials (for reading)
1	1	3-29	Introduction, Solid, Crystal, Lattice	1.1-1.2
2	1	3-31	Quantum mechanics, Atoms, Molecules, Bands	2.1-2.2, Appendix A
3	2	4-5	Charge Carriers in Semiconductors	2.2-2.4
4	2	4-7	Charge Carriers in Semiconductors	2.5
5	3	4-12	Drift and Diffusion	3.1, 3.2
6	3	4-14	Interaction with Light, Lifetime	3.3
7	4	4-19	Equations of State	3.4, 3.5
8	4	4-21	Electrostatics of p-n Junction	5.1
9	5	4-26	Electrostatics of p-n Junction	5.2
10	5	4-28	– Midterm –	
11	6	5-3	I-V curve of p-n Junction	6.1
12	6	5-5	I-V curve of p-n Junction	6.2
13	7	5-10	Small-signal, p-n Junction	7.1-7.3
14	7	5-12	Transient response, p-n Junction	8.1-8.2
15	8	5-17	BJT Fundamentals	10.1-10.5
16	8	5-19	BJT Analysis	11.1
17	9	5-24	MS contacts, Schottky Diodes	14.1-14.3
18	9	5-26	Selected Topics in MOSFET	16, 17
19	10	5-31	– Other Topics, Catch-up, or Review –	
19	10	6-2	– Other Topics, Catch-up, or Review –	
		6-9	– Final exam (12:00-3:00 PM) –	