PY543 - Introduction to Solid State Physics
Spring 2020

Course Information

Class Time: Tuesday and Thursday, 5:00 PM – 6:30 PM.

Class Location: SCI B58

Instructor: **Professor Kevin Smith**.
Office: SCI 357. Phone: 3-6117; E-mail: ksmith@bu.edu;
Office Hours: by appointment.

Discussion Section: Friday 2:30 PM – 3:20 PM, CAS 204A

Text: **Introduction to Solid State Physics,** 8th edition, by Charles Kittel, published by John Wiley. ***Optional:*** Solid State Physics, by Ashcroft and Mermin.

Syllabus: Selections from Kittel. See detailed schedule attached.

Grades: Research Presentation 30%
Final Exam 40%
Homework 30%

Exam Dates: Final Exam: 24 hour Take Home starting Tuesday, May 5th.

Course Prerequisites: PY355 (Methods of Theoretical Physics),
PY408 (Intermediate Mechanics).
PY451, (Quantum Mechanics I)
You **MUST** contact the professor if you have not taken these courses or their equivalent.

Course Description

This is an introductory course that presents the principles and techniques of solid state physics. The course is intended primarily for senior undergraduate and graduate students in physics, although it is also suitable for well-prepared undergraduate and graduate students in engineering and chemistry; such students may take the course with permission of the instructor. T**he most important prerequisites for the course are completion of undergraduate physics courses in mathematical methods and quantum mechanics.** Graduate level mathematics or quantum mechanics are not required. Topics to be covered include electronic band structure of metals and semiconductors, vibrational properties (phonons), magnetism, optical properties of solids, and superconductivity. There will be bi-weekly homework assignments, and a take home final exam. Furthermore, each student will present a 30-minute professional seminar to the class on a topic of current solid state physics experimental research. The presentations will be based on assigned papers from the literature that will be provided towards the middle of the semester, and students will prepare a presentation through literature searches and consultation with the faculty.

There are many books that cover some of the material in this course. The most important is "Solid State Physics" by Ashcroft and Mermin. Those students intending to continue in solid state physics should purchase this book in addition to the required text, since it is a standard reference. However, it is important to understand that if you are experiencing difficulty with a particular topic, the answer to your confusion will almost certainly exist in some text or another. Explore the library, and find a text that works for you.

Administrative Comments

1: **Attendance at lectures is compulsory**

2: Each student will present a 30-minute research seminar based on an assigned paper. Details will be provided during the semester. This will be worth 30% of the final grade.

3: The final exam is a take home exam at the end of the semester. This exam counts for 40% of your final grade.

4: All homework will be distributed by e-mail, as will general course announcements. Your BU account will be used.

5: Office hours for Professors Smith are given on the previous page. Office hours for the TF will be given in class. The TF will be available during office hours and by appointment.

6: **All electronic devices are banned during lectures. This includes cell phones and audio/visual recording or playback devices of ANY kind**.

7: Physics questions will NOT be answered by e-mail. E-mail should be used to set up an appointment to see Professor Smith.

******* VERY IMPORTANT *******

YOU <u>MUST</u> BE AVAILABLE TO TAKE THE FINAL EXAM ON MAY 4 *DO NOT make travel plans that require you to miss the exam since this will result in an automatic fail for the course (F grade).*

Please read the College of Arts and Sciences Academic Conduct Code, which applies to this course.

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PY543: INTRODUCTION TO SOLID STATE PHYSICS - SPRING 2020		
Week	**Date**	**Lecture Topic**
1	Tuesday, 1/21	Introduction
	Thursday, 1/23	Free Electron Fermi Gas
2	Tuesday, 1/28	Free Electron Fermi Gas
	Thursday, 1/30	Reciprocal Lattice
3	Tuesday, 2/4	Reciprocal Lattice
	Thursday, 2/6	Energy Bands
4	Tuesday, 2/11	Energy Bands
	Thursday, 2/13	Energy Bands
5	Tuesday, 2/18	*No class – substitute Monday*
	Thursday, 2/20	Semiconductor Crystals
6	Tuesday, 2/25	Semiconductor Crystals
	Thursday, 2/27	Semiconductor Crystals
7	Tuesday, 3/3	Fermi Surfaces in Metals
	Thursday, 3/5	Fermi Surfaces in Metals
Spring Break		
8	Tuesday, 3/17	Fermi Surfaces in Metals
	Thursday, 3/19	Phonons: Crystal Vibrations
9	Tuesday, 3/24	Phonons: Crystal Vibrations
	Thursday, 3/26	Phonons: Thermal Properties
10	Tuesday, 3/31	Phonons: Thermal Properties
	Thursday, 4/2	Optical Properties and Excitons
11	Tuesday, 4/7	Optical Properties and Excitons
	Thursday, 4/9	Superconductivity
12	Tuesday, 4/14	Superconductivity
	Thursday 4/16	Diamagnetism and Paramagnetism
13	Tuesday, 4/21	Diamagnetism and Paramagnetism
	Thursday, 4/23	Ferromagnetism and Antiferromagnetism
14	Tuesday, 4/28	Ferromagnetism and Antiferromagnetism
	Thursday, 4/30	Research Presentations