

# Syllabus for PHYS 340-Solid State Physics, Spring '08

## Basic information:

•Prerequisites: a passing grade in PHYS 212. If you don't meet this requirement, please talk to me right away.

•Instructor: Yumi Ijiri  
Wright 216  
Phone: 775-6484  
Email: yumi.ijiri@oberlin.edu  
with course information available on Blackboard.

•Class hours and location: MWF 10-10:50 am in Wright 209.

•Problem session: An optional problem session will be held at a time and place to be determined, probably on Monday.

•Office hours: to be determined based on schedules. Also feel free to just stop by- Tuesday and Thursday mornings are the best.

•Textbook: The required textbook for this course is *Solid State Physics*, Second Edition by Hook and Hall. It is a British text, and not the usual choice, so we're doing a bit of an experiment--at least with a cheaper, paperback book. The standard undergraduate text is *Intro to Solid State Physics* by Kittel, which almost no one likes!! I've placed a number of other physics books, with their own pros and cons, (by Ashcroft and Mermin, Blakemore, Christman, and Dalven, etc.) on reserve in the Science Library for you to refer to as well. As you gather from this, class will be particularly important to flesh out things, expand beyond or in different ways from the text.

## Description:

In this course, we will investigate the structural and physical properties of materials by developing a better understanding of crystal structure, band theory, and scattering. Particular attention will be paid to studying the electrical and magnetic behavior of solids.

*Objectives:* The objectives of the course are three-fold: 1) to increase your understanding/knowledge about solid state physics or more broadly the physics of materials 2) to improve your problem solving ability and 3) to develop skills in working from primary and secondary literature. As you will see, this course will draw on your knowledge from many of your previous classes!

*Format:* The components for the course (lectures, problem sets, exams, and presentations) are described in more detail below.

**Lectures:** In lecture, we will go over the material, using demonstrations and examples taken from the current research literature. Please ask lots of questions! This class will draw on lots of different parts of physics: some things from mechanics, E&M, a little thermo, some things related to quantum mechanics, etc, etc... It's a chance to see physics all put together.

**Problem sets:** Homework assignments will be due on Wednesday at class. The problem session is designed to help you with any hurdles you may have encountered along the way. I encourage you to work with other members of the class, but the solutions you had in should represent your own understanding of the material. Make sure to write and sign the Honor Code pledge: "I affirm that I have adhered to the Honor Code in this assignment," and cite any sources you used or collaborators in your work. Failure to do this may constitute an Honor Code violation, particularly if you have verbatim copied from a source without attribution, i.e. an act of plagiarism. I will drop your lowest homework score.

**Exams:** There will be two take-home exams for the class, the first due Wednesday, March 19<sup>th</sup> at class and the second due at 7 pm Wednesday, May 14th. The exams (1 1/2 hours) will be limited open book/notes and cover the first and second half of the course respectively.

**Presentations and reports:** Twice during the semester, you will be asked to choose an article from the recent literature concerning solid state physics. I will give you a variety of suggestions if you can't think of anything! You will give an in-class presentation (~10-15 min in length) describing what was discovered, at a level that your classmates can understand. You will also write a short paper (~ 3 pages in length) summarizing and explaining the main features of the work. If you prefer to do a different type of presentation (say make a computer model of crystal structures, or explain data you've taken from a summer REU), you may but please consult me in advance. At any rate, the requirements of an oral presentation and paper will remain. The presentation dates are Mar. 19/21 and May 7/9, and the reports are due Apr. 2 and May 9. Remember to write and sign the Honor Code and cite sources appropriately.

**Grading:** Grading for the course will be based as follows: 35% on the problem sets, 35% on the two exams, 25% on the in-class presentations and accompanying papers, and 5% on class participation.

**Other issues:** If you have any special needs, I encourage you to speak with me as soon as possible. In particular, if you have a learning disability, it may take some time to work with Jane Boomer in Student Academic Services to assure that the necessary paper work is in place in order for accommodations to be made.

*Schedule:* a tentative schedule for the course is listed below.

<b>Week</b>	<b>Topic</b>	<b>Notes</b>
Feb. 4,6,8	Ch. 1: Crystal structure	
Feb. 11,13,15	Ch. 2: Crystal dynamics	Prob. set #1 due Feb. 13
Feb. 18,20,22	Ch. 2/3: Heat transport, electrons in metals	Prob. set #2 due Feb. 20
Feb. 25,27,29	Ch. 3/4: Electron transport, energy bands	Prob. set #3 due Feb. 27
Mar. 3,5,7	Ch. 4/5: Effective mass/semiconductors	Prob. set #4 due Mar. 5
Mar. 10,12,14	Ch. 5/6: Semiconductors and devices	Prob. set #5 due Mar. 12
Mar. 17,19,21	Ch. 6:devices/In-class presentations	Take home exam due Mon. 19 <sup>th</sup> , presentations 19,21
	SPRING BREAK	
Mar.31, Apr. 2,4	Ch. 7: Dia- and paramagnetism	Paper due Apr. 2
Apr. 7,9,11	Ch. 8: Ferro- and antiferromagnetism	Prob. set #6 due Apr. 9
Apr. 14,16,18	Ch. 8/10: Ferro/Superconductivity	Prob. set #7 due Apr. 16
Apr. 21,23,25	Ch. 10/11: Superconducting devices/Waves in crystals	Prob. set #8 due Apr. 23
Apr. 28,30,May 2	Ch. 11/Ch. 12: Waves/Scattering	Prob. set #9 due Apr. 30
May 5,7,9	??/In-class presentations	Presentations May 7,9, Paper due May 9
May 14	Wed. <b>May 14<sup>th</sup></b> , 7 pm-hand in take-home exam	