

PHYS*4150 Solid State Physics

W19 Course Outline

Kyle Manchee

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Instructor Information

Instructor: Kyle Manchee

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Office: MACN-330

Lectures: ANNU-306, M-W-F 10:30 - 11:30am

Calendar description

The topics covered in this course include: bonding in solids, thermal and electrical properties of solids, energy bands, imperfections in solids, properties of semiconductors and insulators.

Prerequisites

PHYS*4040 (Quantum Mechanics II), PHYS*4240 (Statistical Physics II)

Objectives

This course deals with crystalline solids and is intended to provide students with basic physical concepts and mathematical tools used to describe solids. The course deals with groups of materials, as in the periodic table, in terms of their structure, electronic, optical, and thermal properties. Specific objectives are:

- To show how crystal symmetry leads to substantial mathematical simplifications when dealing with solids.
- To describe basic experimental measurements, to show typical data sets and to compare these with theory.

Topics included in PHYS*4150

1. Free electron metals: Drude theory (classical), Sommerfeld theory (quantum mechanical)
2. The static crystal lattice: Crystal lattices, the reciprocal lattice, X-ray diffraction
3. Electrons in a static lattice: Bloch's theorem, nearly free electrons (NFE), band structure, Brillouin zones

4. Lattice dynamics: The classical harmonic crystal, the quantum harmonic crystal, measuring phonons - neutron scattering, Raman scattering and Brillouin scattering.
5. Additional topics (if time allows): Semiconductors, superconductivity, quantum Hall effect, magnetism, etc.

Method of evaluation

Assessment	Weight (Scheme 1)	Weight (Scheme 2)	Date
Assignments	30%	30%	TBD
Midterm	30%	35%	TBD (Week 7 or 8)
Final	40%	35%	April 17, 2019

The final grade will be the higher of those calculated using weighting schemes 1 and 2, on an individual basis. The midterm is not scheduled yet, but will take place during week 7 or 8. The final examination has been set for April 17, 2019 from 8:30 - 10:30am (location to be announced). Changes will be announced on CourseLink.

Note that assignments are due at the beginning of class on the stated due date. **Late assignments will not be accepted, and a grade of 0 will be assigned.**

Course texts

- “Solid State Physics”, by N.W. Ashcroft and N.D. Mermin (Holt, Rinehart and Winston, 1976) is our main course text. In Ashcroft and Mermin, we will be mainly covering the first nine chapters and chapters 22 and 23. Other topics will be covered depending on the time available.

Other recommended texts

- “Introduction to Solid State Physics” by C. Kittel (Wiley, 8th Ed., 2005). Several earlier editions can also be used for reference.
- You should feel comfortable consulting other introductory texts and other references. Sometimes several perspectives are required to gain an understanding of a topic. At this point in your academic career you should have a good idea of how you learn as an individual.

CourseLink

All course notes, assignment, and announcements will be posted on the CourseLink website. You are expected to check the site regularly.

Consideration for Illness, Religious Obligations, etc.

If you request academic consideration due to illness of a physical, psychological or emotional nature, or due to compassionate reasons, please contact the lecturer. See the Undergraduate Calendar for details.

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations.

Collaboration

Collaboration and communication are essential for progress and advancement; much of modern society is built upon these skills. Students are encouraged to collaborate and discuss course concepts! However, all material submitted for grading must be each student's own work. Plagiarism is a form of academic misconduct, and will not be tolerated.

A good guideline when it comes to crossing the line from collaboration to academic misconduct is that a student must never look at another student's written work. For students seeking help from their peers, ask conceptual questions as opposed to asking for answers. For student helping their peers, never give the answer explicitly, but explain your reasoning.

You must submit work that is your own, and not a copy of another student's (past or present). Cases of copying and plagiarism will be dealt with severely. The Academic Misconduct Policy is detailed in the Undergraduate Calendar. You are encouraged to cite references and useful discussions. If you are unsure of any of this policy, contact the lecturer in advance.

Getting help

I will hold regular office hours Wednesdays from 1:30 - 3:30pm. Changes to this schedule will be announced in class or on CourseLink. Feel free to email at any time with questions, or to arrange an appointment.