



Stevens Institute of Technology

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Syllabus

PEP503WS: Introduction to Solid State Physics

Overview

This course provides a description of simple physical model which account for electrical conductivity and thermal properties of solids. It discusses basic crystal structures, X-ray diffraction and dispersion curves for phonons and electrons in reciprocal space. It treats energy bands, Fermi surfaces, metals, insulators, semiconductors, superconductivity and ferromagnetism.

The course is suitable for upper-level undergraduate students in science and engineering.

Prerequisites

PEP 242, PEP 331 or equivalent. Cross-listed with EE 503WS and MT 503WS.

Learning Goals

After taking this course, the student will be able to:

- Appreciate the fundamental processes affecting electrical conductivity and thermal properties of solids
- Understand the physical processes responsible for electron and phonon transport in solids
- Appreciate the differences between metals, semiconductors, and insulators
- Understand the physical processes responsible for superconductivity and ferromagnetism

Pedagogy

The course will employ lectures, online class discussion, e-mail exchange, homework assignments, and tests. Students will do weekly assignments, a mid-term exam plus a final exam.

Required Text(s)

Elementary Solid State Physics, by M. Ali Omar, Addison Wesley - ISBN – 0-201-60773-6

Required Readings

Readings will be assigned for each week. These will be found on the course website.

Assignments

The course will emphasize homework, a midterm exam, and a final exam with equal weight.

1. Homework – Homework must be completed by the required date and submitted via e-mail or the web-interface to the professor in (Word format or PDF format.).
2. A mid-term exam must be completed in a timely manner
3. A final exam must be completed when due.

The assignments and their weights are as shown below:

1. Class Participation	0%
2. Homework	33%
3. Mid-term	33%
4. Final exam	34%
TOTAL	100%

Course Schedule (Sample)

Week	Subject	Assignment Due
1	Crystal Structures and Interatomic Forces	Beginning of the following week
2	X-Ray, Neutron, and Electron Diffraction in Crystals	Beginning of the following week
3	Lattice Vibrations: Specific Heat: Models of Einstein and Debye	Beginning of the following week
4	Lattice Waves and Optical Properties	Beginning of the following week
5	The Free Electron Model	Beginning of the following week
6	Energy Bands in Solids, Band Models	Beginning of the following week
7	Metals, Insulators, and Semiconductors; Electron Dynamics	Beginning of the following week
8	Electron	Beginning of the following week
9	Theory of Semiconductors	Beginning of the following week
10	Semiconductor Devices	Beginning of the following week
11	Dielectric and Optical Properties of Solids	Beginning of the following week
12	Magnetism and	Beginning of the following week

Week	Subject	Assignment Due
	Magnetic Resonances	
12	Superconductivity	Beginning of the following week
13	Overall Review	Beginning of the following week
14	Final Exam Preparation	Final exam due via email.