Technical Elective: Solid State Physics
Fall 2023

Instructor

Dr. Liwei Geng
Zone 3-322B
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Meeting Time & Location

Monday 13:50-16:25 at RM 3-103

Office Hours

Tuesday & Thursday: 13:00-17:00, or by appointment

TA Information

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Course Catalog Description

This course provides an introduction to solid state physics at the undergraduate student level. The course begins with crystal structure, proceeds to electronic band structure theory, and culminates with ferromagnetism and ferroelectrics. Physical theory and mathematical derivations in solid state materials are introduced as needed.

Course Materials

Required Textbook: "Introduction to Solid State Physics", Charles Kittel, Wiley, 8th edition, 2005.
Lecture slides
Handouts

Copyrights

Prerequisites

Physics for Science and Engineering

Course Objectives

Upon successful completion of this course, students will learn the fundamental theories and mathematical formulations of solid state physics. Lectures will be structured to help student understand the conceptual basis of solid state physics and examples will be given to reinforce those concepts. Homework and exams will be designed to assess the mathematical skills. Projects will be carried out to promote students' creativity and self-learning ability.

Topics Covered

1. Crystal Structure
2. Wave Diffraction & Reciprocal Lattice
3. Crystal Binding & Elastic Constants
4. Phonon I: Crystal Vibration
5. Phonon II: Thermal Properties
6. Free Electron Fermi Gas
7. Energy Bands
8. Ferromagnetism
9. Ferroelectrics

Grading

5%: participation (bonus)
35%: homework
25%: project
40%: final exam

Late Assignment Policy

10% deduction/day

Grade Policy

A: 90 – 100	A−: 85 – 89	B+: 80 – 84	B: 76 – 79	B−: 73 – 75
C+: 70 – 72	C: 66 – 69	C−: 63 – 65	D: 60 – 62	F: < 60

Copyrights

Academic Integrity

All students are expected to adhere to the standards of academic honesty. Any student engaged in cheating, plagiarism, or other acts of academic dishonesty

would be subject to disciplinary action. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include but is not limited to the confiscation of the examination of any individual suspected of violating the University Policy.

Project

Option 1: (Slides, presentation, 1~4 persons per group)

Select an uncovered chapter (chapter 8~22) in the textbook, prepare slides, and present in class followed by a short Q&A section.

Option 2: (Report, 1 person)

Select a topic of contemporary solid state physics, and write a review article. Suitable topics encompass, but are not restricted to, ferroelectric domain wall conduction, current-induced magnetic domain wall motion, high-temperature superconductor, spintronic devices based on magnetic domain walls, all spin logics, Zentropy, phonon softening, electron-phonon interaction, high entropy alloy, high entropy ceramics, etc.