PHYS 371 – Solid State Physics I

College of Science – Department of Physics & Astronomy
King Saud University

Course Information

Course Code: PHYS 371
Credit Hours: 3 (3–0–0)
Level: 6
Prerequisite: PHYS 353 (Modern Physics)
Language of Instruction: English

Instructor Information

Instructor: Dr. Saad Al-Omran
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Office Hours: As announced

Course Description

This course introduces the fundamental structural and physical properties of crystalline solids. Topics include crystal structures, reciprocal lattice and diffraction, bonding in solids, lattice vibrations and phonons, thermal properties, free-electron theory, band theory, and an introduction to semiconductors. The course provides a foundation for advanced studies in condensed matter physics and materials science.

Course Objectives

- Explain the basic structural and physical properties of solids.
- Understand the main theories and laws of solid-state physics.
- Analyze crystal structures and reciprocal lattices.
- Describe bonding mechanisms and lattice vibrations.
- Apply solid-state concepts to real materials and applications.

Learning Outcomes

- Identify crystalline and amorphous solids.
- Construct and analyze crystal lattices and unit cells.
- Apply Bragg's law and diffraction concepts.
- Explain phonons and thermal behavior of solids.

- Use free-electron and band theories to explain conductivity.
- Distinguish metals, insulators, and semiconductors.

Course Topics

- Introduction to solid state physics and properties of solids
- Crystal structures: lattices, basis, unit cells, Bravais lattices
- Miller indices and lattice planes
- Reciprocal lattice, X-ray diffraction, Bragg law, Brillouin zones
- Atomic binding and elastic properties
- Lattice vibrations and phonons
- Thermal properties: Einstein and Debye models
- Free electron theory and Fermi–Dirac statistics
- Energy band theory: Bloch theorem and Kronig–Penney model
- Introduction to semiconductors

Assessment Scheme

Midterm Exam I: 20 %
Midterm Exam II: 20 %
Quizzes: 10%
Final Exam: 50%

Textbooks and References

Required:
C. Kittel, Introduction to Solid State Physics, 8th Edition, Wiley

Recommended:
Ashcroft & Mermin, Solid State Physics
Steven H. Simon, The Oxford Solid State Basics
M. Ali Omar, Elementary Solid State Physics