



Course description:

This course is intended to provide an introduction to the physics of solids. This course covers the following topics: crystal structure, the crystal binding, lattice vibrations (phonons), thermal properties of solids, free electron Fermi gas.

Aims of the course:

- provide the student with a clear and logical presentation of the basic concepts and Principles of solid state physics.
- Strengthen an understanding of the concepts and principles through a broad range of the interesting real world applications.
- Demonstrate and apply knowledge of the crystalline lattice.
- Solve problems concerning the definition of the Bravais lattice.
- Understand and apply the definition of the reciprocal lattice.

Intended Learning Outcomes: (ILOs)

Acknowledge and Understanding

A1. Concepts and Theories: Use the principles of solid state physics.

A2. Contemporary Trends, Problems and Research: Comprehend the meaning of crystal structure and dynamic (lattice vibrations) arrangements of atoms. Highlighting the concepts of relationships between structure and physical (optical, electrical and magnetic), thermal, and mechanical properties of inorganic materials.

A3. Professional Responsibility: Use computer, graphical and algebraic tools to analyze crystal structure.

B. Subject-specific skills

B1. Problem solving skills: Apply some theories and mathematical tools to solve problems in solid state physics. These problems can be given as assignments, short exams and group projects. Student can gain valuable skills such as mathematical and software programs (Excel and Mathematica online program).

B2. Modeling and Design: Design models of multiple crystals

B3. Application of Method and Tools: Use the special mathematical techniques such as (Fourier series).

C. Critical-Thinking Skills

C1. Analytic skills: Concepts of relationships between structure and thermal, optical, magnetic, electrical, and mechanical properties of inorganic materials.

C2. Strategic Thinking: Formulate plans designed to achieve maximum useful of the special techniques that the student uses to solve the solid state problems.

C3. Creative thinking and innovation: Strengthen an understanding of the concepts and principles through a broad range of the interesting applications to the real world.

D. General and Transferable Skills (other skills relevant to employability and personal development)



D1. Communication:

Students will be able to communicate with teacher, ask questions, solve problems, and use computers. Students ask questions during the lecture, work in groups, and communicate with each other and with me electronically, and periodically visit the sites I recommended.

D2. Teamwork and Leadership:

- I encourage the student to attend lectures regularly by giving bonus marks for attendance, give students tasks, and ask questions about previous lectures.
- Mutual respect is between the lecturer and students and among students themselves. I deal with them as young mature people, responsible for their actions and schedules.
- I apply educational standards and behavioral control when they work in groups, I can assess the response of students as a whole and the team spirit and good character.
- I enable students to communicate with me discuss any needs they have related to the course, and I welcome students' comments when they face challenging problems.

Course structures:

Week	Credit Hours	ILOs	Topics	Teaching Procedure	Assessment methods
1,2,3	3	A1,B1,C3	Crystal structure	Lecture discussion Oral inquiry	Class participation Homework: Text exercises (1.1,1.2,1.3) page 25 quizzes
4,5	3	A2,B2	Wave diffraction and reciprocal lattice	lecture	Class participation Homework: Text exercises (2.1, 2.4, 2.5 , 2.7) page 49 & 50 quizzes
6,7	3	A1.B1,C3	Crystal binding	Lecturing discussion	Class participation Homework: Text exercises (3.1, 3.2, 3.3 , 3.5 , 3.7) page 78&79 quizzes
8,9	3	A1.A2.B2	Phonon1: crystal vibration	Lecturing Discussion, Oral inquiry	Class participation Homework: Text exercises (4.1, 4.2, 4.4 , 3.6) page 96&97&98 quizzes
10,11	3	A1.B2.C1	Phonon2: thermal properties	Lecturing Discussion, Oral inquiry	Class participation Homework: Text exercises (5.1) page 123 quizzes
12,13	3	A1,B3	Free electron Fermi gas	Lecturing Discussion, Oral inquiry	Class participation Homework: Text exercises



					(6.1, 6.2, 6.3 , 6.5 , 6.6) page 153&155 quizzes
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References:

A. Main Textbook:

Introduction to Solid State Physics, C. Kittel, 8th edition (Wiley)

B. Supplementary Textbook(s):

Solid State Physics, J.R. Hook and H.E. Hall, (Wiley)

Assessment Methods:

Methods	Grade	Date
Fist Exam	20%	TD
Second Exam	20%	TD
Activities	10%	TD
Final Exam	50%	TD