PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

Paper – 3: SOLID STATE PHYSICS

Offered to : M.Sc.(PHYSICS)	Course Code : 22PH2T3
Course Type : Core	Course : Solid State Physics
Year of Introduction : 2004	Year of offering : 2022
Year of Revision : 2022	Percentage of Revision : Nil
Semester : II	Credits : 4
Hours Taught: 60 hrs. per Semester	Max.Time: 3 Hours

Course Description:

In solid state physics the student studies how the large-scale properties of solid materials result from their atomic-scale properties and forms a theoretical basis of materials science.

Course Objectives:

1.To understand the basic theory of structure and composition of the solid.

2. To understand the properties of the crystalline materials.

3. To learn the concepts of reciprocal lattice and Brillouin zone schemes.

4. To understand the effect of magnetic and electric field on the crystalline materials.

5. To enhance the ability of students to understand electron and band theories.

CourseOutcomes: Attheendof thiscoursethestudentsshouldbeableto:

CO1: Understand the basic concepts of translation vectors, lattices, symmetry operations, lattice types and simple crystal structures.

CO2: Understand the experimental diffraction methods, reciprocal lattice and Brillouin zones

CO3: Understand the properties of the free electron gas.

CO4: Understand the concepts of Fermi levels and quantization of orbits in magnetic fields.

CO5: Understand the concepts of band gap and various electronics models in solids.

CO - PO MATRIX								
	CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
22PH2T3	CO1	H					L	M
	CO2	H					L	M
	CO3	H			M		L	M
	CO4	H			M		L	M
	CO5	H			M		L	M

Syllabus		
Unit	**Learning Units**	**Lecture Hours**
I	**Introduction to crystallography** Periodic array of atoms- Lattice translation vectors, Basis and the Crystal Structure, Primitive Lattice cell, Fundamental types of lattices-Two Dimensional lattice types, three Dimensional lattice types- Index system for crystal planes- simple crystal structures; sodium chloride- cesium chloride – Hexagonal Close Packed Structure -Diamond Structure- Zinc Sulfide structure	12
II	**Crystal Diffraction and Reciprocal Lattice** Bragg's law, scattered wave amplitude-Reciprocal Lattice vectors-Diffraction conditions-Laue Equations, Brillouin Zones - Reciprocal lattice to SC lattice, BCC lattice and FCC lattices, properties of reciprocal lattice, geometrical structure factor- BCC lattice and FCC lattices, atomic form factor.	12
III	**Free Electron Fermi Gas** Energy levels in one-dimension, Free electron gas in 3 dimensions, Heat capacity of the electron gas- Experimental heat capacity of metals, electrical conductivity and Ohms law – experimental electrical resistivity of metals, Motion in Magnetic Fields, Hall effect, thermal conductivity of metals - Ratio of thermal to electrical conductivity- Widemann Franz ratio.	12
IV	**Fermi Surfaces of Metals** Reduced zone scheme - periodic Zone schemes- Construction of Fermi surfaces- Electron orbits, hole orbits and open orbits, Experimental methods in	12

	Fermi surface studies – Quantization of orbits in a magnetic field, De-Hass-van Alphen Effect, extremal orbits, Fermi surface of Copper. Fermi surface of gold, Magnetic breakdown.	
V	**Band Theory of Solids** Failure of free electron theory of metals, Nearly free electron model-Origin of the energy gap- The Bloch theorem- Kronig-Penney Model, wave equation of electron in a periodic potential distinction between metals, insulators and intrinsic semiconductors, Effective mass of electron-Crystal momentum of an electron-Approximate solution near a zone boundary.	12

Text and Reference Books:

1.Solid State Physics, A.J. DEKKER (Macmillan).

2. Introduction to Solid State Physics, CHARLES KITTEL (John Wiley & Sons).

3. Introduction to Solid State Physics, ARUN KUMAR (PHI).

4. Elements of Solid State Physics, J.P. SRIVASTAVA (PHI).

5. Solid State Physics, GUPTA and KUMAR (K.Nath& Co.)

6. Solid State Physic and electronics R.K.PURI & V.K BABBAR (S.CHAND)