

**DEPARTMENT OF PHYSICS  
ANDHRA UNIVERSITY**

**M.Sc. Physics**

**III Semester (w.e.f 2009-10 batch)**

**P301: SOLID STATE PHYSICS.**

2009-10

SEP-5 325

**UNIT-I: CRYSTAL STRUCTURE:**

Periodic array of atoms—Lattice translation vectors and lattices, symmetry operations. The 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 and diamond structures.

**UNIT-II: CRYSTAL DIFFRACTION AND RECIPROCAL LATTICE:**

Bragg's law, Experimental diffraction methods-- Laue method and powder method, Derivation of scattered wave amplitude, indexing pattern of cubic crystals and non-cubic crystals (analytical methods). Geometrical Structure Factor, Determination of number of atoms in a cell and position of atoms. Reciprocal lattice, Brillouin Zone, Reciprocal lattice to bcc and fcc Lattices.

**UNIT-III: PHONONS AND LATTICE VIBRATIONS:**

Vibrations of monoatomic lattices, First Brillouin Zone, Group velocity, Long wave length, Lattice with two atoms per primitive cell, Quantization of Lattice Vibrations-Phonon momentum.

**FREE ELECTRON FERMI GAS:**

Energy levels and density of orbitals in one dimension, Free electron gas in 3 dimensions, Heat capacity of the electron gas, Experimental heat capacity of metals, Motion in Magnetic Fields- Hall effect, Ratio of thermal to electrical conductivity.

**UNIT-IV: THE BAND THEORY OF SOLIDS:**

Nearly free electron model, Origin of the energy gap, The Bloch Theorem, Kronig-Penny Model, wave equation of electron in a periodic potential, Crystal momentum of an electron-Approximate solution near a zone boundary, Number of orbitals in a band--metals and isolators. The distinction between metals, insulators and semiconductors

**FERMI SURFACES OF METALS:**

Reduced zone scheme. Periodic Zone schemes. Construction of Fermi surfaces. Electron orbits, hole orbits and open orbits. Experimental methods in Fermi surface studies-- Quantization of orbits in a magnetic field, De-Hass-van Alphen Effect, extremal orbits, Fermi surface of Copper.

**TEXT BOOKS:**

1. Introduction to Solid State Physics, C.Kittel, 5<sup>th</sup> edition,
2. Solid State Physics, A.J.DEKKER.

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