

Solid State Physics – I (3PGP1)

Unit I: Crystal lattice

Primitive cell – Unit cell – Crystallographic system – Bravais lattice – Directions – Planes – Miller indices – Simple Crystal structures – NaCl, hcp, CsCl, Diamond, ZnS – Lattice vacancies and interstitial atoms – (Schottky and Frenkel defects) – Edge dislocation and screw dislocation – Burger's vector

Unit II: Diffraction and bonding

Bragg law – Photographic techniques, Laue, powder and oscillation methods – Reciprocal lattice vectors – Diffraction condition – Brillouin zones, SC, BCC, FCC – Atomic form factor – Structure factor – Ionic bonding, Madelung constant, calculation of Madelung constant, lattice energy – Covalent crystals – Metal crystals – Hydrogen bonded crystals

Unit III: Lattice vibrations

Dispersion relation – Monoatomic lattice – Diatomic lattice – Phonon momentum – Heat capacity – Einsteins model, Debye model

Unit IV: Optical processes

Frenkel exciton – Mott exciton – Exciton condensation into electron hole drop (EHD) – Raman effect in crystals

Unit V: Superconductivity

Meissner effect – Thermal properties – Energy gap – Type I and type II superconductors – London equations – Thermodynamics of superconductivity – DC and AC Josephson tunneling

Books for reference:

1. Solid state physics, C.Kittel, Vth Edn., 1976, 9th Reprint 1989, Wiley Eastern Ltd.

Unit I: Pages 21-27

Unit II: Pages 39-44, 47-63

Unit III: Pages 86-97

Unit IV: Pages 107-116

Unit V: Pages 332-337, 340-347, 390-394

2. Solid state physics, S.O. Pillai, New Age International P Ltd., 2005

Unit I: Pages 90-92, 101-117, 125-133

Unit IV: Pages 334-352

Unit VI: Pages 366-379, 382, 383, 390-394
