Core Electives –A

MPYE-305 Condensed matter Physics-I Mark-100

UNIT –I

Lattice vibration:

Born openheimer Approximation, Hamiltonian for lattice vibration in the harmonic Approximation, Normal modes of system and quantization of lattice vibrations-phonons.

Electron phonon interaction, Second quantized form of Hamiltonian for electrons and phonons in interaction.

Energy Bands:

Wave equation for an electron in a periodic potential, Bloch functions, Brillouin zones E-K diagram under free electron approximation, Nearly free electron approximation-Diffraction of electrons by lattice planes and opening of gap in E-K diagram. Effective mass of electrons in crystals, Holes, Tight binding approximation,

Unit-II

Fermi surface

Construction of Fermi surface, Experimental methods of study of Fermi surface, Cyclotron resonance, de Hass van Alphen effect .

Electron Interaction:

Pertrubation formulation, Dielectric function of an interacting electron Gas(Lindhard's expression), static screening, screened impurity, Kohn effect, Friedel oscillations and sum rule, dielectric constant of semiconductor,plasma oscillation.

UNIT-III

Transport properties:

The Boltzmann equation, Electrical conductivity,General transport coefficients,Thermalconductivity,thermoelectric effect, Hall effect, Elementary ideas about Quantum hall effect, magnetoresistance, Elementary ideas about giant magnetoresistance and colossal magnetoresistance,

Books:

1. D. Pines: Elementary Excitations in Solids S. Raimes: Many Electron Theory
2. O. Madelung: Introduction to Solid State Theory
3. N.H. March and M. Parrinello: Collective E ects in Solids and Liquids
4. H. Ibach and H. Luth: Solid State Physics: An Introduction to Theory and Experiments J.M. Ziman: Principles of the Theory of Solids
5. C. Kittel: Quantum Theory of Solids