

Core Elective-A (Theory)

Condensed Matter Physics-II

Mark-100

Unit-I

Magnetism:

Landau diamagnetism and Pauli paramagnetism, Weiss theory of ferromagnetism, Curie law for susceptibility, Heisenberg model- condition for ferro and anti ferromagnetic order, spin waves and magnons, Bloch $T^{3/2}$ Law, Antiferro magnetic order, Neel temperature. Diluted magnetic Semiconductors.

Ferroelectricity:

Ferroelectric crystals, classification of Ferroelectric crystals, Polarisation catastrophe, Soft optical phonons, Landau theory of phase transition-second and first order transition, Multiferroics-Elementary concept

UNIT-II

Electronic and lattice defects:

Lattice defects, Frenkel and Schottky defects, Line defects, Edge and screw dislocations- Burger's Vector, Planar (stacking) Faults- twin planes and grain boundaries Color centers- mechanism of coloration of a solid, F-center, other color centers.

Excitons: Loosely bound, tightly bound, Excitonic Waves, Electron-hole droplets.

Exotic Solids

Amorphous materials, Quasi-crystals, Nano structured materials- Classification based on spatial extension (0-D, 1-D, 2-D). 0-D nanostructures- quantum dots, Widening of band gap in quantum dots, 1-D nano structures- Quantum wells- superlattices.

Unit-III

Electron-phonon interaction, Second quantized form of Hamiltonian for electrons and phonons interaction, electron-electron attractive interaction due to virtual phonon exchange, Cooper pairs and BCS Hamiltonian, Solution of BCS Hamiltonian- spin analog method.

Josephson effect: Microscopic quantum mechanical effect, Dc Josephson effect, Effect of electric field Ac/Inverse Ac Josephson effect, Effect of magnetic field, SQUID.

Books:

1. M. Tinkham: Group Theory and Quantum Mechanics
2. M. Sachs: Solid State Theory
3. A.O.E. Animalu: Intermediate Quantum Theory of Crystalline Solids
4. N.W. Ashcroft and N.D. Mermin: Solid State Physics
5. J.M. Ziman: Principles of the Theory of Solids
6. C. Kittel: Introduction to Solid State Physics