

## BS (4 Years) for Affiliated Colleges



Code	Subject Title	Cr. Hrs	Semester
PHY-421	SOLID STATE PHYSICS-II	3	VII
Year	Discipline		
4	Physics		

### Course Outlines:

Optical Processes and Excitons: Optical reflectance, Kramer-Kronig relations, example, conductivity of collisionless electron gas, electron interband transitions, excitations, Frenkel excitons Alkali halides, molecular crystals, weakly bound (Mott-Wannier) excitons, exciton condensation into electron-hole drops (EHD), Raman effect in crystals, electron spectroscopy with X-rays, energy loss of fast particles in a solid, summary.

#### Superconductivity:

Experimental survey, occurrence of superconductivity, destruction of superconductivity by magnetic fields, Meissner effect, heat capacity, energy gap, microwave and infrared properties isotope effect, theoretical survey, thermodynamics of the superconducting transition, London equation coherence length, BCS theory of superconductivity, BCS ground state, flux quantization in a superconducting ring, duration of persistent currents, type II superconductors, Vortex stat, estimation of  $H_{c1}$  and  $H_{c2}$ , Single particle tunneling, Dc Josephson effect, Ac Josephson effect, Macroscopic quantum interference, high-temperature superconductors, critical fields and critical currents, Hall number, fullerenes, summary,

Dielectrics and Ferroelectrics: Maxwell equations, polarization, macroscopic electric field, depolarization field,  $E_1$ , local electric field at an atom, Lorentz field,  $E_2$ , field of dipoles inside cavity,  $E_3$ , dielectric constant and polarizability, electronic polarizability, structural phase transitions, ferroelectric crystals, classification of ferroelectric crystals, displacive transitions, soft optical phonons, Landau theory of the phase transition, second-order transition, first-order transition, antiferroelectricity, ferroelectric domains, piezoelectricity, ferroelasticity, optical ceramics, summary.

### **Books Recommended:**

1. *SolidState Physics* by Ashcroft & Mermin, (1976).
2. *Introduction to SolidState Physics, 7th Edition*, by C. Kittel, (1996).
3. *Elementary SolidState Physics* by M. A. Omar, (1975).
4. *Quantum Theory of the SolidState* by J. Callaway, (1991).
5. *Principles of the Theory of Solids* by J. M. Ziman, (1969).