

SARDAR PATEL UNIVERSITY
Programme & Subject: M.Sc (Physics)
Semester: IV
Syllabus with Effect from: June - 2014

Paper Code: PS04CPHY02	Total Credit: 4
Title Of Paper: Theoretical Solid State Physics	

Unit	Description in detail	Weightage (%)
I	Introduction to free electron model, free electron Fermi gas in three dimensions, plasma optics, longitudinal plasma oscillation, electrostatic screening, screened coulomb potential, nearly free electron model, origin of energy gap, Bloch function and Bloch theorem, Umklapp process/scattering. The Kronig-Penney model, the motion of electrons in one dimension according to band theory, the concepts of band effective mass and holes, Motion of electrons in three dimensional lattice.	25%
II	Introduction to Reciprocal lattice, Structure of Brillouin zones, Reduced zone scheme, Periodic zone scheme, Extended zone scheme, Construction of free electron Fermi surfaces, Methods of electronic band structure calculations, Formation of energy bands, The empty lattice energy bands, Plane wave method, Orthogonalized plane wave method, Pseudopotential method, Tight binding method, Cellular method, Quantum defect method, Augmented plane wave method, The KKR method.	25%
III	Measuring the Fermi surfaces, The de Haas-van Alphen effect, Oscillatory Galvanomagnetic effect, Free electron Landau levels, Bloch electrons Landau levels, Physical origin of oscillatory phenomena effects of electron spin, magnetoacoustic effect, ultrasonic attenuation, Anomalous skin effect, Cyclotron resonance and size effects, Lindhard dielectric function, Friedel oscillations, Thomas-Fermi, Debye-Huckel and Lindhard theory, Frequency-dependent Lindhard screening, Hamiltonian in density variables, Motion of electron-hole pair excitations, Dielectric screening function and energy spectrum, Discrete ω_{kq} case.	25%
IV	Superconductivity-its occurrence and experimental survey, Meissner effect, Heat capacity, energy gap, Microwave and infrared properties, Isotope effects, Theoretical survey, Thermodynamics of superconducting transition and London equation, Coherence length, BCS theory of superconductivity, Flux quantization in a superconducting ring, Type II superconductors, single particle tunneling and Josephson superconductor tunneling, Fullerenes.	25%

Basic Text & Reference Books:-

- Solid State Physics by N.W. Ashcroft and N.D. Mermin
- Introduction to Solid State Physics by C. Kittel (6th and 7th edition)
- Intermediate Quantum theory of crystalline solids by A.O.E. Animalu
- Solid State Physics by A.J. Dekker
- Elements of Solid State Physics by J. P. Srivastava

