SARDAR PATEL UNIVERSITY
Programme: B.Sc (Physics)
Semester: V
Syllabus with effect from: June-2013

Paper Code: US05CPHY03	Total Credit: 3
Title Of Paper: Solid State Physics	

Unit	Description in detail	Weighting (%)
I	**X-ray diffraction** Introduction of X-ray, Neutron and electron diffraction, X-ray diffraction and Bragg's law, Experimental diffraction methods, Laue's Method, Rotating crystal Method and Powder Method for determination of crystal structure, Reciprocal lattice and Bragg's law, Concept of reciprocal lattice, Geometrical construction of reciprocal space, Vector algebraic discussion of reciprocal and real space vectors, Properties of reciprocal lattice, Analysis of X-ray diffraction pattern from crystal, Structure factor for bcc crystal, Structure factor of mono atomic diamond lattice, Structure factor of polyatomic crystal, Measurement of diffraction pattern of crystal, The Ewald construction	
II	**Free electron Fermi Gas** Introduction of the free electron gas, Drude model, DC electrical conductivity of metals, Thermal conductivity of metals, Lorentz modification to Drude model, Energy levels and Density of orbital in one dimension, Effect of temperature on Fermi-Dirac distribution function, Free electron gas in three dimension, Heat capacity of the electron gas, Electrical Conductivity and Ohm's Law, Experimental Electrical resistivity of metals, Thermionic Emission, Motion in magnetic field (Hall effect), Hall voltage and Hall coefficient, Mobility and Hall angle, Importance of Hall effect Superconductivity: Flux exclusion – The Meissner Effect, Thermal Properties, The Energy Gap, Isotope Effect, Mechanical Effect, The Penetration Depth, Type-I and Type-II Superconductors	
III	**Semiconducting and Optical Properties of Metals** Introduction, Semiconductors, Free carrier concentration in semiconductors, Fermi Level and carrier concentration in semiconductors, Mobility of Charge carriers, Effect of temperature on mobility, Electrical conductivity of semiconductors, Hall effect in semiconductors, Junction properties, Absorption processes, Photoconductivity, Brief review of photoelectric effect, Photovoltaic effect, Photoluminesence, Colour centers, Types of Colour centers, Generation of colour centers	
IV	**Nanoscience** Introduction to Nanoscience, Some Nano Challenges, The fundamental Science Behind Nanotechnology, Tools for Measuring Nanostructures, Tools to Make Nanostructures, Point and Places of Interest (Sensors, Nanoscale Biostructures, Energy capture, Transformation and storage, Optics, Magnets, Fabrication, Electronics), Smart Materials (Self-Healing Structures, Recognition, Separation, Catalysts)	

Basic Text & Reference Books :-

- Introduction to Solid State Physics
  C. Kittel, (5^{th} Edition) Wiley Eastern Ltd.
- Elements of Solid State Physics
  J. P. Srivastava, Prentice-Hall of India
- Solid State Physics
  M. A. Wahab, Narosa Publishing House
- Solid State Physics
  S.O.Pillai,New Age International Publisher
- Elementary Solid State Physics
  M. Ali. Omar, Pearson Education.
- Nanotechnology A Gentle Introduction to the Next Big Idea
  Mark Ratner and Daniel Ratner, Pearson Education