MEDI-CAPS UNIVERSITY, INDORE

DEPARTMENT OF PHYSICS

Value Added Course

PHYSICS OF SOLIDS AND MOLECULES

UNIT -I

Introduction: Matter and states of matter, Fundamentals of solids and molecules, Classification and features, Structure, Types of solids-Crystalline, Polycrystalline and Amorphous solids, Diatomic and polyatomic molecules, Motion of molecule and molecular comparison in different materials, Synthesis methods.

UNIT –II

Bonding in Solids and Molecules: Bonding network and types of bonds, Models of chemical bonding, Primary and Secondary bonds, Bond length, Bond order and bond energy, Polar, non-polar and Hydrogen bonded molecular solids, Chemical bonds outside metal surfaces, Electron corelation in molecules.

UNIT -III

Energy Spectra and Analysis Methods: Energy band and band gap, Free electron theory of metals, Classification of materials based on energy bands, Electronic, Rotational and Vibrational energy levels, Rigid rotator model, Electronic structure calculations for solids and molecules, Spectroscopic techniques: Absorption spectroscopy, Fourier transform infrared spectroscopy, Raman spectroscopy, Fluorescence and photoluminescence spectroscopy.

UNIT -IV

Electrical Conduction: Electric charge, Resistivity, Effect of temperature and coefficient of resistivity, Electronic and Ionic conduction, Conduction mechanism, Electrical conduction through molecules, Skin effect, Electrical conduction in thin samples.

UNIT -V

Devices and Applications: Semiconductor crystals, Solar cells, LED, Semiconductor lasers, Image sensors, Photovoltaic cells, Photodetectors, Transistors, Molecular electronics and devices, Molecular nanotechnology, Molecular biology.

Text Books

1. D. G. Pettifor, Bonding and Structure of Molecules and Solids, Oxford Science Publications (1995).
2. Jorge Kohanoff, Electronic Structure Calculations for Solids and Molecules: Theory and Computational Methods, Cambridge University Press (2006).
3. P. Fulde, Electron Corelation in Molecules and Solids, Springer (2003).

Reference Books

1. V. Bortolani, N. H. March, M. P. Tosi, Interaction of Atoms and Molecules with Solid Surfaces, Plenum Press, Springer (1990).
2. C. Kittel, Introduction to Solid State Physics, Wiley (1953).
3. W. Demtröder, Molecular Physics: Theoretical Principals and Experimental Methods, Wiley (2006).

Course Outcomes (Cos):

CO_{01}	Participants will have a basic understanding of the physics of solids and molecules.
CO_{02}	Participants will be able to distinguish the properties and related phenomena of various materials.
CO_{03}	Participants will have an idea of various energy levels in materials and also the different characterization techniques to study the energy levels.
CO_{04}	They will know conduction mechanisms in solid and molecular materials.
CO_{05}	Participants will be able to realize the applications of materials in various devices used in day-to-day life.