

**PCE8J002**

**NANO TECHNOLOGY**

**Module I:**

Importance and emergence of nanotechnology, challenges, current and future research. Size dependence of properties, crystal structure, energy bands, insulators, semiconductors and conductors, gaps of semiconductors, Fermi surfaces, localized particles.

**Module II:**

Laws of thermodynamics applied to nanoscale systems; activity and the equilibrium constant; solutions; phase relations; heterogeneous equilibria; free-energy composition diagrams and their relation to phase transitions; phase diagrams.

**Module III:**

Polymer based nanocrystals, supramolecular structures, polypeptide nanowire, and protein nanoparticles. Microelectromechanical systems (MEMS), Nanoelectromechanical systems (NEMS): fabrication and application, molecular and supramolecular switches. Optical and vibrational spectroscopy, luminescence, quantum wells, wires and dots.

**Module IV:**

Metal nanoclusters, semiconductor nanoparticles, rare gas and molecular clusters: synthesis and properties, carbon molecules and clusters, applications of carbon nanotubes. Nanostructured materials: solid disordered nanostructures, natural nanocrystals, zeolites, photonic crystals, nanostructured multilayers.

**Text and Reference Books:**

1. Introduction to Nanotechnology by C Poole and F Owens, Wiley.
2. Nanotechnology: A Gentle Introduction to the Next Big Idea by D Ratner and M Ratner, Pearson Education.
3. Nanotechnology: Understanding Small Systems, 3rd ed. by B Rogers, J Adams, and S Pennathur, CRC Press.
4. Nanotechnology: Principles and Practices, 3rd ed. by S K Kulkarni, Capital Publishing Co.