

## **Nanotechnology Syllabus**

### **Crystal structure**

Bonding in solids, Ionic bonding, Covalent Bond, Metallic bond, Intermolecular bonds, Dispersion bonds, dipole bonds, hydrogen bonds–properties, structure of solids, Lattice Parameter, Primitive cell crystal systems, Defects, Vacancy, Schottky, Frenkel

### **Preparation and characterization of nanomaterials**

Top down and bottom up approaches, Ball Milling, Molecular beam epitaxy (MBE), Chemical vapour deposition (CVD) method. Template assisted synthesis, Catalyst assisted chemical vapour deposition (CCVD), Wet chemical approaches (Hydrothermal/solvothermal)

### **Crystal structure and Properties of nanomaterials**

Classification of nanomaterials, 1D, 2D, 3D and Bulk materials, 1 Dimensional materials and their properties, Synthesis and applications of nanotubes and nanowires, 2 Dimensional materials, A brief history of 2 Dimensional material, Bulk material and 2D materials a comparison, Crystal structure of 2D materials, Band gap, Optical properties and electronic structure, Quantum confinement

### **Polymer Nanotechnology**

Basic Aspects: Classification, Some basic definitions. Glass transition and melting temperatures, Factors affecting T<sub>g</sub>, Importance of T<sub>g</sub>, Relationship between T<sub>m</sub> and T<sub>g</sub> and their control. Speciality polymers: Bio-medical polymers, Bio, degradable polymers, Liquid crystalline polymers, Conducting Polymers Discovery –Applications of conducting, Polymer Nanocomposites Definition, Self-cleaning nanocomposites

### **Nanostructured materials Characterization Techniques**

Basics of X-ray diffraction (XRD), SEM, EDAX, TEM, Elemental mapping, FTIR, UV-Visible spectrophotometer, Nanomechanical Characterization using Nanoindentation, Differential Scanning Calorimeter (DSC), Differential Thermal Analyzer (DTA), Thermo gravimetric Analysis (TGA), TEM, X-ray Photoelectron Spectroscopy (XPS), Electrochemical-Characterization measurements.