Ph.D. Entrance Exam Syllabus – 2022

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, Schotty, 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,1Dimensional materials and their properties, Synthesis and applications of nanotubes and nanowires, 2Dimensional materials, A brief history of 2Dimensional 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 Tg, Importance of Tg, Relationship between Tm and Tg 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), Electrochemcial-Characterization measurements.