Semester III

Physics of Nanomaterials

Course No: **PHY18308CR**

Max. Marks: 100

External Examination: 80

No. of credits: 04

Internal Assessment: 20

UNIT – I

Introductory aspects: Overview of nanomaterials, definition of nanomaterials based on Bohr radius, de-Broglie wavelength, Exciton radius, Surface to volume ratio, Estimation of number of atoms in nanostructures, Exciton, Confinement Regimes, Metallic and Semi-conducting nanomaterials.

UNIT – II

Preparation of Nanomaterials and General Characterization Techniques.

Bottom up: Thermal Evaporation techniques, Sputtering technique, Pulsed Laser Deposition Technique, Ion beam deposition. Top down: Ball Milling

Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), X-ray Diffraction Technique, Spectroscopic techniques (UV-Vis, IR, FTIR and Raman).

UNIT-III

Introduction - An overview of quantum mechanical concepts related to low-dimensional systems illustrating the confinement of particles in one, two, three dimensions. Density of state for bulk materials, energy subbands and density of electronic states in Quantum wells, Quantum wires, and Quantum dots.

UNIT-IV

**Carbon Nanostructures** — Introduction to Carbon molecules and clusters, Structure of and C60 its crystal, Small and Large Fullerenes and Other Buckyballs, Carbon nanotubes and their Electronic structure, Properties and Applications of Carbon Nanotubes

Text & Reference Books:


2. V.V. Mitin, V.A. Kochelap, and M.A. Stroscio, "Quantum Heterostructures: Microelectronics and Optoelectronics",

3. C.P. Poole, Jr. and F.J. Owens, "Introduction to Nanotechnology", Wiley India. 2006.


5. P. Harrison, "Quantum Wells, Wires, and Dots: Theoretical and Computational Physics", John W


**Reference Books:**