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 nanostuctures, 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 a 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:

1. Introductory Nanoscience Physical & Chemical Concepts: Masaru Kuno (Garland Science).

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

Cambridge University Press, 1999.

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

4. T. Pradeep, "Nano: The essentials", Tata McGraw-Hill, 2007.

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

6.. Nanotechnology Principles and Practices: Sulabha K. Kulkarni (Capital Publishing company)

Reference Books:

1. Quantum Dot Heterostructures: D. Bimerg, M. Grundmann and N.N. Ledentsov (Wiley).
2. Nanoparticles and Nanostructured Films–Preparation, Characterization and Application : J.H. Fendler (Wiley).