

Course Syllabi: UPH062 Nano Science and Nano Materials (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UPH062; Nano Science and Nano Materials
2. **Credits and contact hours:** Credits: 3.5; Hours: 4
3. **Text book, title, author, and year**
 - *Booker, R., Boysen, E., Nanotechnology, Wiley India Pvt. Ltd. (2008).*
 - *Rogers, B., Pennathur, S., Adams, J., Nanotechnology, CRS Press (2007).*
 - *Bandyopadhyay, A.K., Nano Materials, New Age Int., (2007).*
 - *Niemeyer, C. N., and Mirkin, C.A., Nanobiotechnology Concepts, Applications and Perspectives, Wiley VCH, Weinheim, Germany (2007).*
 - a. Other supplemental materials
 - Nil
4. **Specific course information**
 - a. Brief description of the content of the course (catalog description)

Fundamental of Nanoscience: Features of Nanosystem, Free electron theory and its features, Idea of band structures, Density of states in bands, Variation of density of state and band gap with size of crystal.

Quantum Size Effect: Concepts of quantum effects, Schrodinger time independent and time dependent equation, Electron confinement in one-dimensional well and three-dimensional infinite square well, Idea of quantum well structure, Quantum dots and quantum wires.

Nano Materials: Classification of Nano Materials their properties, Basic concept relevant to application, Fullerenes, Nanotubes and nano-wires, Thin films chemical sensors, Gas sensors, Vapour sensors and Bio sensors.

Synthesis and processing: Sol-gel process, Cluster beam evaporation, Ion beam deposition, Chemical bath deposition with capping techniques and ball milling, Cluster assembly and mechanical attrition, Sputtering method, Thermal evaporation, Laser method.

Characterization: Determination of particle size, XRD technique, Photo luminescence, Electron microscopy, Raman spectroscopy, STEM, AFM.

Applications: Photonic crystals, Smart materials, Fuel and solar cells, Opto-electronic devices.
5. **Specific goals for the course**

After the completion of the course, the students will be able to:

 - Explain quantum size effect on the properties of materials at nanoscale.
 - Design and characterize materials at nano-scale.
6. **Brief list of topics to be covered**
 - Fundamental of Nanoscience
 - Quantum Size Effect
 - Synthesis and processing
 - Nano materials