

## NSE 813 Essentials of Nanoscience and Engineering

**Credit Hours:** 3

**Pre-requisites:** None

### Course Objectives

- It will give an understanding of the basic concepts in Nano-science and Engineering.
- It will focus on the core aspects of the physical sciences which are relevant to nanotechnology.
- It will provide full understanding on how the dimensions of a Nano scale device impact its electronic, optical, magnetic, structural and chemical properties.
- The course will therefore provide an introduction to key elements of quantum and statistical physics, solid state physics, semiconductor devices, magnetism and superconductivity, basic atomic and molecular physics.

### Course Contents:

- Evolution of Nanotechnology, Sense of scale and its implications on surface area and volume calculations.
- The science behind the forces at Nanoscale -tools of Nanoscience
- Quantum confinement- density of states
- Nanoscience in nature-biology meets chemistry, physics and engineering
- Classification, characteristics, chemistry and properties of nanomaterials
- Synthesis and fabrication techniques of nanomaterials (top-down and bottom up approaches for the synthesis and fabrication of nanomaterials)
- Characterization techniques of nanomaterials (UV, FTIR, SEM, XRD, AFM etc.)
- Environmental and safety issues with nanomaterials

### Course Outcomes

- It will provide strong base on molecular bases to determine the properties and applications of nano structured materials
- It will provide skills to our graduates on the selected functional aspects of nano materials.

### **Recommended Reading (including Textbooks and Reference books)**

- Introduction to Nanotechnology, Poole Jr., Charles P. and Frank Owens, Wiley Interscience, **2020**, ISBN: 0-471-07935-9.
- Handbook of Nanotechnology, Bhushan, Editor, Springer, **2021**. Edition: First. ISBN: 3-540-01218-4.