

2. INTRODUCTION TO NANOTECHNOLOGY

(3-1-0) 4 Cr

Module I (10 hours)

Importance and emergence of nanotechnology, challenges, current and future research. Size dependence of properties, crystal structure, energy bands, insulators, semiconductors and conductors, gaps of semiconductors, Fermi surfaces, localized particles.

Module II (12 hours)

Laws of thermodynamics applied to nanoscale systems; activity and the equilibrium constant; solutions; phase relations; heterogeneous equilibria; free-energy-composition diagrams and their relation to phase transitions; phase diagrams.

Module III (12 hours)

Polymer based nanocrystals, supramolecular structures, polypeptide nanowire, and protein nanoparticles. Microelectromechanical systems (MEMS) Nanoelectromechanical systems (NEMS): fabrication and application, molecular and supramolecular switches. Optical and vibrational spectroscopy, luminescence, quantum wells, wires and dots.

Module IV (10 hours)

Metal nanoclusters, semiconductor nanoparticles, rare gas and molecular clusters: synthesis and properties, carbon molecules and clusters, applications of carbon nanotubes. Nanostructured materials: solid disordered nanostructures, natural nanocrystals, zeolites, photonic crystals, nanostructured multilayers.

Text Books

1. Introduction to Nanotechnology - Charles P Poole Jr, Frank J Owens
2. Mark Ratner, Daniel Ratner. - Upper Saddle River, Nanotechnology: A Gentle Introduction to the next Big Idea, c2003, Prentice hall.
3. Callister, William D. Jr., Fundamentals of Materials Science and Engineering: An Integrated Approach 2nd Ed., John Wiley and Sons, 2003
4. Nanotechnology Understanding Small Systems, Rogers Pennathur Adams, CRC Press, Taylor & Francis Group.

Reference Books

1. Robert K, Ian H, Mark G, Nanoscale Science and Technology, John Wiley & sons Ltd.,2005
2. Edward I Wolf. - Weinheim, Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, c2004, Wiley
3. S. N. Sahu, R. K. Choudhury, and P. Jena, Nano-scale Materials: From Science to Technology, Nova Science Publishers, 2006.
4. Yannick Champion, Hans-Jörg Fecht, Nano-Architected and Nanostructured Materials: Fabrication, Control and Properties, Wiley-VCH,2005.
5. Robert K, Ian H, Mark G, Nanoscale Science and Technology, John Wiley & sons Ltd.,2005