PCH231 NANOCHEMICAL ENGINEERING

L	T	P	Cr
3	1	0	3.5

Course Objective:
To learn the fundamental concepts of energy, mass and electron transport in materials confined or geometrically patterned at the nanoscale, where departures from classical laws are dominant.

Introduction: History of nano-revolution, Nano scale materials and their applications, Carbon nano tubes, Organic and inorganic nano structures, Main engineering activities of design, manufacture and testing in nanotechnology context.

Materials: An overview of the physical (mechanical, electrical) and chemical properties of different classes of solid materials such as metals, semi conductors, insulators and polymers, Focus on different nanomaterials: Carbon nanotubes, inorganic nanowires, organic molecules for electronics, biological and bio-inspired materials, metallic nanomaterials, Different shape nanomaterials, Examples of size effects of properties observed in thin films, colloids and nano-crystals.

Characterization: Photoelectron, Optical and ion spectroscopy and probe microscopy, Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM).

Applications: Examples of applications in Micro and nano-technology including, Micro fluidics, Micro Electron Mechanical Systems (MEMS) membrane technology, Drug-delivery, Catalysts and coatings.

Course learning outcomes (CLOs):

The students will be able to

1. apply basic concepts of nanotechnology and nanoscience
2. select different nano-materials and perform their characterization
3. apply the concepts of nanotechnology in chemical engineering

Recommended Books:

1. *Zikang, T. and Ping, S.,NanoScience and Technology: Novel Structures and Phenomena, Taylor and Francis (2003).*
2. *Rieth, M.,Nano-Engineering in Science and Technology: An Introduction to the World of Nano design, World Scientific (2003).*
3. *Kelsall, R., Hamley, I., and Geoghegan, M.,Nanoscale Science and Technology, Wiley (2005).*
4. *Ventra, M.D.,Evoy, S., and Heflin J.R., Jr., Introduction to Nanoscale Science and Technology, Springer (2004).*
5. *Meyyappan, M., Carbon Nanotubes, Science and application; CRCPress(2005).*
6. *Watarai, H., Teramae, N., and Sawada, T., Interfacial Nano-chemistry, Kluwer Academic/Plenum Press(2005).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (may include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25