

## UCH847: NANO-MATERIALS FOR CHEMICAL ENGINEERS

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3.0</b>

### **Course Objectives:**

To learn about various kinds of nanomaterials, their properties, synthesis routes and applications in Chemical Engineering and allied fields.

**Introduction:** Definition, Classification, Synthetic routes and general applications.

**Surface:** Solid-vapor interface, Surface defects and crystal defects, Effect of surface curvature and solid-liquid interface.

**Zero Dimension Nanoparticles:** Size dependent properties, review of some topics related to physics covering free electron model in solids, band gap and band structure in metals and semiconducting nanomaterials, energy levels and discretization based on quantum mechanics.

**Zero-Dimension Nanostructure Colloids and Colloidal Structure:** Van der Waals interaction, effect of particle geometry, surface charge, zeta potential and electro static stabilization.

**Carbon Nanostructures:** Structure, preparation of carbon nanotubes, graphene, electrical and mechanical properties and applications.

**One-Dimension Nanostructures:** Growth of one-dimensional structures using various processes and selected properties and applications.

**Two-Dimension Nanostructures:** Various thin film deposition techniques: atomic layer deposition, layer-by-layer deposition, multilayer techniques and mechanisms of nanocomposite coating.

**Polymers Nanocomposites:** Synthesis, processing, properties and applications of polymer-CNT nanocomposites, and polymer-clay nanocomposites.

### **Course Learning Outcomes (CLO):**

The students will be able to:

- select an appropriate nanomaterials (zero, one and two dimension) with regard to their preparation, properties and applications.
- identify various synthesis and processing methods for nanomaterials and polymer nanocomposites.
- identify nanomaterials for Chemical Engineering applications.

### **Text Books:**

*Dinesh C. Agrawal, Introduction to Nanoscience and Nanomaterials, World Scientific Publishing (2013).*

### **Reference Books:**

*GuoZhong Cao, Nanostructures & Nanomaterials, synthesis, properties & applications, Imperial College Press (2008).*

**Evaluation Scheme:**

<b>S. No.</b>	<b>Evaluation Elements</b>	<b>Weightage (%)</b>
1	MST	30
2	EST	50
3	Sessionals (May includes assignments/ quiz's etc)	20