

DISCIPLINE SPECIFIC CORE COURSE – 17

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
POLYMERIC NANOMATERIALS AND NANOCOMPOSITES	4	3	0	1	Class 12th with Physics, Chemistry, Mathematics	-

Learning objectives

- To make students understand the basic concepts of nanomaterials and polymer nanocomposites.
- To learn the effect of shape, size, dispersion and percolation of nanomaterials on polymer nanocomposites
- To understand modification techniques of nanomaterials

Learning outcomes

After studying this paper, students will be able to

- Synthesize polymeric nanomaterials
- Demonstrate the knowledge of properties and structural aspects of polymeric nanomaterials
- Explore various areas of polymeric nanomaterial applications

SYLLABUS OF DSC-17

THEORY COMPONENT-

UNIT 1:

(9 Lectures)

NANO-REINFORCING AGENTS

Preparation, structure and properties of nano-reinforcing agents: 1 D, 2 D and 3 D nanomaterials eg. nanoparticles, nanotubes, nano-clays, POSS, carbon nanostructures (CNTS, graphene)

UNIT 2:

(21 Lectures)

PROPERTIES AND CHARACTERIZATION OF NANOMATERIALS

Morphology analysis of crystallites in nanocomposites: X-ray scattering & diffraction technique, Analysis of Nanostructure developed in semi-crystalline polymers during deformation, Nanostructure of two component amorphous block copolymers, effect of chain architecture. Factors governing properties of nanocomposites such as loading, dispersion and percolation, influence of size, shape and diameter of nanoparticles nanotubes, functionalization of nanomaterials

UNIT 3:

(15 Lectures)

POLYMER NANOCOMPOSITES

Basic

concepts, preparation, characterization and applications of polymer nanocomposites, technical challenges and understanding of interfacial dynamics using LJ potential and many body problems approach

PRACTICAL COMPONENT

(30 Lectures)

- To analyze particle size of nanomaterials (nanoparticles).
- To prepare polymer nanocomposites by solution casting
- To prepare polymer nanocomposite by melt compounding.
- To determine the polymer nanocomposite by in-situ polymerization
- Determination of mechanical properties of nanocomposites.
- To prepare graphene oxide and its nanocomposite.
- Chemical modification of nanoclay and its characterization.
- Characterization (morphology and thermal) of nanocomposites by optical microscope, SEM, TEM, DSC, DMA, TG-DTA etc.
- Determination of electrical properties of nanocomposites.
- To prepare nano metal oxides and nano silica by chemical modification.

ESSENTIAL/RECOMMENDED READINGS

- Koo J.H., (2010) Polymer Nanocomposites, Tata McGraw-Hill.
- Bhattacharya S.N., (2008) Polymeric Nanocomposites-Theory and Practice, Hanser Gardner.
- Michler G.H., Balta F.J., (2005) Mechanical Properties of Polymer based on Nanostructure and Morphology, CRC Press.

SUGGESTIVE READINGS

- Tjong S.C., (2006) Nanocrystalline Materials, Elsevier Science.
- Owens F.J., Papoose C., (2003) Introduction to Nanotechnology, John-Wiley & Sons.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.