B.Sc. V Semester

Nanotechnology :Core

Nano science of special materials - I

Credits: 6(4+2) (60hrs. Theory + 30hrs. Lab)

[Marks: 100(60+40)] Passing Marks: 35

The objectives of the course are:

	Course Objectives	**Cognitive Level**
CO -I	To study the fundamentals of Polymer Science.	U, R
CO -II	To make aware students about different Polymers having special properties.	U, R, Ap
CO -III	To understand basics of Carbon Nanotubes and their synthesis Techniques.	R, U, Ap, An, E,C
CO -IV	To learn about special carbon based materials and their properties.	R, U, An, Ap
CO -V	To study different types of Nano Composites and their synthesis methods.	U,R, An, Ap, E

Course Learning Outcome (CLO)

CLO No.	**Course Outcomes**	**PSOs Addressed**	**Cognitive Level***
CLO -I	Students will be able to understand the various aspects of polymerization and different polymerization techniques.	1,3,4,5	U, R
CLO -II	Students will be able to explain various types of Polymers e.g. conducting Polymer etc.	1,7	U, R, Ap
CLO -III	Students will be able to understand different types of carbon nano tubes and various synthesis method	1,7	R, U, Ap, An, E,C
CLO -IV	Students will understand Graphene , Fullerence ,their synthesis methods and applications.	5,9	R, U, An, Ap

CLO -V	Students will understand synthesis method of nano-composites and their applications.	5,8	U,R, An, Ap, E

CO- Course Objective; CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit 1: Effect of Polymer structure on properties (12L)

Classification and Nomenclature of Polymers, Molecular weight of polymers: Number average, weight average and viscosity average Determination of molecular weight of polymers by end group analysis and Viscometry methods.

Physical state of polymers, Elastic Property , Chemical Resistance, Solubility inter molecular forces in monomers and Polymers, Plastics, Elastomers and Fibers, Mechanical behavior of Polymers.

Unit 2: Polymerisation (12L)

Polymerization methods: condensation Polymerization , addition or chain Polymerization, free radical addition Polymerization ,Branching and crosslinking in free redical addition Polymerization , cationic and anionic addition polymerizations, Bulk, Solution, Suspension and Emulsion polymerizations, Chemical (Oxidative) polymerization, electrochemical polymerization,

Unit 3: Bio polymers (12 L)

Bio-polymers: Classification, Properties, Processing and applications, Bio-degradable polymers, Fire retardant/Thermally stable polymers, and Liquid Crystalline polymers.

Unit 4: Conducting Polymers (12 L)

Conducting Polymers: Discovery, Classification of conducting polymers (intrinsic and extrinsic conducting polymers). Chemical and electrochemical methods of the synthesis of conducting polymers, Structural characteristics and doping concept, charge carriers and conducting mechanism, Applications of conducting polymers

Unit 5: Polymer Nanocomposites: (12 L)

Definition of nano-composites:- Nano-fillers, Classification of nano-fillers, Synthesis and properties of nanofilers-Types of nanocomposites, Synthesis of nanocomposites: Direct mixing, solution mixing, In-situ polymerization -Polymer Metal oxide nanocomposites, Polymer/CNTS and Polymer/Nano-clay based composites and their properties and functional applications.

References:

1. B.K Sharma, Polymer Chemistry, Goyal Publishing

2. Bill Meyer, A Text Book of Polymer Chemistry, John Wiley & Sons, Singapore, 1994.

3. Gowariker and Visivanathan, Polymer Science, Wiley Eastern, 1986.

4. Nanostructured Conductive Polymers, Editor. Ali Efekhari, Wiley, 2010.

5. Nanocomposites Science and Technology M. Ajayan, L.S. Schadler, P. V. Braun Wiley-VCH, 2004

Text Book(s)

1. Peter. J.F Harris, Carbon Nanotube Science: Synthesis, Properties and Applications, Cambridge University Press, 2011

2. Jamie H. Warner, Franziska Schaffel, Mark Rummeli, Alicja Bachmatiuk, Graphene: Fundamentals and Emergent Applications, Elseiver, 2013

Related Online Contents

1. **https://ebooks.inflibnet.ac.in/eadhyayan/site/genre?id=Material%20Science**
2. **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+4mIqRALksfwQH9v8YSMrw==**

Practicals

Credits: 2 (30 hrs.)

[Marks: 100(50+50)] Passing Marks: 35

1. To prepare Nanocomposite materials and its characterizations.
2. To determine the elemental contents in nanoalloys using different analytical techniques.
3. Native agarose – gel electrophoresis for DNA.
4. Quantification of DNA oligonucleotides using UV – spectrophotometer.
5. To prepare Graphene oxide doped PMMA nanocomposite materials and its characterizations.