

**Subject Code: 01CH0805**  
**Subject Name: Polymer and Nanotechnology**  
**B.Tech. Year – IV<sup>th</sup> (Semester VIII)**

**Objective:** The course is intended to focus on understanding of basic science and technology of polymer and nanotechnology. The course will focus on learning of various solid state structure and properties of polymers and their proper selection for applications in domestic as well as industrial uses.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Explain the basic methodologies in synthesis and characterization of various polymers
2. Demonstrate the knowledge of application based modifications in polymers
3. Analyse and explain synthesis, properties, and characterization of nano-materials and their applications.

**Pre-requisite of course:** Stoichiometry, Engineering Chemistry, Chemical Reaction Engineering

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	CSE	Internal (I)	Viva (V)	Term work (TW)	
3	0	0	3	50	20	30	25	25	150

**Contents:**

Unit	Topics	Contact Hours
1	<b>Introduction to Polymers</b> Basic concepts on polymers, Raw materials for polymers, Polymerization principles and processes (step, chain and other polymerizations, polymer kinetics). Techniques for polymerization and unit operations (polymerization reactors, separation, purification, storage and handling); Nylon 6 and Nylon 66 manufacturing process	8
2	<b>Characterization of Polymers</b> Polymer structure and property, Various characterization techniques for polymer, modification in polymer structure. Polymer miscibility, Polymer blends and alloys, filled plastics, polymer composites.	6



3	<b>Applications of Polymers</b> Biodegradable polymers, biomedical polymers, conducting polymers – manufacturing processes, standards specifications and applications. Limitations in use of polymers – fire hazards, thermos-oxidative stability, toxicity, waste management, etc.	6
4	<b>Introduction to Nanotechnology</b> Importance of Nanotechnology – History of Nanotechnology, Opportunity at the nano scale-length and time scale in structures-energy landscapes, Inter-dynamic aspects of inter molecular forces, Classification based on the dimensionality – Nanoparticles, nanoclusters, nanotubes, nanowires and nano-dots, Semiconductor – nanocrystals, carbon nanotubes, Influence of Nano- structuring on Mechanical, optical, electronic, magnetic and chemical properties.	8
5	<b>Synthesis of Nano-materials</b> Self-assembly, self-assembled monolayers (SAMs). Langmuir-Blodgett (LB) films, clusters, colloids, zeolites, organic block copolymers, emulsion polymerization, template synthesis, and confined nucleation and/or growth. Biomimetic Approaches: polymer matrix isolation, and surface-template nucleation and/or crystallization.	6
6	<b>Characterization of Nano-materials and their applications</b> X-ray Diffraction – Thermal Analysis Methods, Differential Thermal Analysis and Differential scanning calorimetry - Spectroscopic techniques, UV-Visible Spectroscopy – IR Spectroscopy – Microwave Spectroscopy - Raman Spectroscopy - Electron Spin Resonance Spectroscopy – NMR Spectroscopy. Particle size characterization: Zeta Potential Measurement – Particle size Analysis – X-ray Photoelectron spectroscopy. Applications in Chemical, Biotechnical, Biomedical field	6
<b>Total Hours</b>		<b>40</b>

### References

#### Text Books:

1. Polymer Science by V. R. Gowarikar, N.V. Vishwanathan, Jayadev Sreedhar, New Age International Publication, ISBN – 9788122438130.
2. The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Volume 2 by C. N. R. Rao, Achim Müller, A. K. Cheetham, WILEY-VCH Publication, ISBN - 3527306862

#### Reference Books:

1. Polymer Science and Technology by Premamoy Ghosh, Second Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, ISBN – 9780070707047
2. A textbook of Nanoscience and Nanotechnology by T. Pradeep, Tata McGraw –Hill Publishing Company Ltd., New Delhi, ISBN – 9781259007323.

### Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process



Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
35%	35%	10%	10%	5%	5%

**Instructional Method:**

- The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**Design Based Problems (DP)/ Open Ended project (OEP):**

In the beginning of the session, subject faculty will allot an OEP / DP to the students. Students will be free to choose a topic of their choice which will be relevant to the syllabus and they will either prepare a working model/ report / presentation / poster on their topic.

**Online course material**

- <https://nptel.ac.in/courses/113105028/>