Course Code	Course Name	Credits
26CH610	POLYMER CHEMISTRY	04

Course Objectives

- To understand the classification, structure, and types of polymers, along with their nomenclature and polymerization techniques.
- To explain the kinetics, mechanisms, and properties of polymers, including structure–property relationships and characterization methods.
- To develop knowledge of industrial and advanced polymers, including their preparation, applications, and emerging functional materials.

Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Describe the principles and concepts of contemporary polymer chemistry.
- Explain the basic concepts of polymer synthetic techniques.
- Characterize the polymers using various experimental techniques.

Unit 1 - Fundamentals of Polymer Chemistry and Polymerization Techniques (12 Hrs.)

Molecular forces and chemical bonding; functionality; classification, nomenclature and isomerism; molecular weight; linear, branched and cross-linked polymers; thermoplastic and thermosetting polymers; elastomers, fibers and resins; techniques of polymerization—emulsion, bulk, solution and suspension.

Unit 2 – Kinetics and Mechanisms of Polymerization (12 Hrs.)

Kinetics and mechanisms of polymerization; free radical, cationic, anionic and coordination polymerization (Ziegler–Natta catalyst); copolymerization; kinetic chain length and degree of polymerization; chain transfer; initiators, inhibitors and retarders; general characterization.

Unit 3 - Structure–Property Relationships and Polymer Characterization (14 Hrs.)

Structure–property relationship; mechanical and thermal properties; glass transition temperature and factors affecting it; crystallinity and melting point; polymer characterization techniques—X-ray diffraction, differential scanning calorimetry (DSC), thermogravimetric analysis (TGA); molecular weight determination—osmometry, viscosity, ultracentrifuge and gel permeation chromatography.

Unit 4 – Industrial and Natural Polymers: Preparation and Applications (12 Hrs.)

Preparation and applications of industrial polymers—polyethylene, polyvinyl chloride (PVC), polyurethanes, polytetrafluoroethylene (PTFE/Teflon), Nafion and ion-exchange resins; natural polymers—structure and applications of starch, cellulose and chitosan derivatives.

Unit 5 - Advanced and Functional Polymers (10 Hrs.)

Biopolymers; biodegradable and biomedical polymers; polyelectrolytes; conducting polymers; polymers in nonlinear optics; high-temperature and fire-retardant polymers; polymer blends, composites and nanocomposites; interpenetrating polymer networks (IPN); electroluminescent polymers.

Reference Books:

1. F. W. Bill Meyer, Text book of polymer science, III Edition, John Wiley and sons, New York.
2. V. R. Gowarikar, B. Viswanathan, J. Sridhar, Polymer Science, 1986, Wiley Eastern.
3. G. S. Misra, Introduction to Polymer Chemistry, Wiley Eastern Ltd.
4. P. Bahadur, N. V. Sastry, Principles of Polymer Science, Narosa Publishing House.
5. A. Rudin, The Elements of Polymer Science and Engineering, 1973, Academic Press, New York.
6. I. C. E. H. Brawn, The Chemistry of High Polymers, 1948, Butter worth & Co., London.
7. G. S. Krishenbaum, Polymer Science Study Guide, 1973, Gordon Breach Science publishing, New York.
8. E. A. Coolins, J. Bares and E. W. Billmeyer, Experiments in Polymer Science, 1973, Wiley Interscience, New York.

Websites and eLearning Sources:

1. https://nptel.ac.in/courses/104105039
2. https://onlinecourses.nptel.ac.in/noc20_cy21/preview

COs and Bloom's Taxonomy Mapping – 26CH610		
Course Outcomes	**On completing P.G. program the students will be able to**	**BTL**
CO1	Recognize the basic different classification and properties of materials	K1, K2
CO2	Apply concepts of polymer structure and bonding to determine their influence on material properties.	K3
CO3	Apply the role of catalysts in polymer synthesis and explore advanced topics in copolymerization, block copolymers, and functional polymers.	K4
CO4	Evaluate the impact of polymer structure, crystallinity, and Tg on rheological and viscoelastic behavior in processing and applications.	K5
CO5	Design innovative polymer-based solutions for industrial applications by integrating emerging trends in nanocomposites, smart polymers, and sustainable materials.	K6

BTL K1 and K2 – remembering and understanding, K3- Applying, K4 – Analyse, K5- Evaluate and K6- Create

Relationship Matrix – 26CH610												
Course Outcomes	**Programme Outcomes (POs)**						**Programme Specific Outcomes (PSOs)**					**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	3	1	1	2	3	2	3	1	2	2.1
CO2	3	3	3	1	1	3	3	3	3	2	3	2.5
CO3	3	3	3	1	1	3	3	3	3	3	3	2.6
CO4	3	3	3	1	1	2	2	3	3	3	3	2.4
CO5	2	3	3	1	2	3	3	3	3	3	3	2.6
											Total	2.4

Mean Score: 3- High, 2- Medium/Moderate, 1-Low