DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE-9)

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
		Lecture	Tutorial	Practical/ Practice		
POLYMER PHYSICS	**4**	**2**	**0**	**2**	**Class 12th with Physics, Chemistry**	**---**

Learning objectives

- To learn about the conformations of polymer chains.
- To understand the morphology of crystalline and amorphous polymers.

Learning outcomes

After studying this paper, students will be able to

- Apply concepts of polymer physics.
- Classify polymers on the basis of physical properties.
- Determine crystal structure of polymers.

SYLLABUS OF DSE-9

THEORY COMPONENT-

UNIT 1 (12 Hours)

FUNDAMENTALS OF POLYMER PHYSICS

Potential energy and conformational energy of molecules, conformations and configurations, tacticity, isomeric states and isomerism in polymers, stereoisomerism, geometric isomerism, Random coils and average end to end distance, more realistic chains, excluded-volume effect, chain flexibility and the persistence length.

UNIT 2 (10 Hours)

REGULAR CHAINS AND CRYSTALLINITY

Regular and irregular chains, Polymers with 'automatic' regularity, Polydienes, Helical molecules, Determination of crystal structures by X-ray diffraction, Crystal structures of some common polymers (PE, PP, PET, Nylons, PVC)

UNIT 3 (8 Hours)

MORPHOLOGY AND MOTION

Introduction, degree of crystallinity, Experimental determination of crystallinity. Crystallites: fringed-micelle model, Chain-folded crystallites, Extended-chain crystallites, Non-crystalline regions and polymer macro-conformations:, Lamellar stacks, Spherulites and other polycrystalline structures, Concept of chain orientation, orientation in amorphous and crystalline polymers, Uniaxial and biaxial orientation practical significance, Optical microscopy of spherulites, Light scattering by spherulites.

PRACTICAL COMPONENT (60 Hours)

- To determine density of fibres by Density Gradient Column.
- To develop and study the growth of PP spherulites in different crystallization conditions.
- To study the morphology of the given fibre sample by Infrared spectroscopy.
- Interpretation crystallization and isothermal crystallization of polymers by DSC thermogram
- To determine crystallinity and orientation in polymers by XRD
- To determine the d-spacing in a given polymer sample by XRD.
- Morphological study of polymers by optical microscopy and interpretation of optical micrograph.
- Interpretation of molecular weight distribution curve/chromatogram
- To study Tyndall effect in polymer solution.
- To study the effect of crystallinity on mechanical properties of fibres.
- R&D Lab Visits

ESSENTIAL/RECOMMENDED READINGS

- Sperling L.H., (1993) Introduction to Physical Polymer Sciences, J. Wiley N.Y.
- Crompton R.T., (1989) Molecular Motions in High Polymers, Pergamon Press N.Y.
- Hiemenz, P. C., & Lodge, T. P. (2007). Polymer chemistry. CRC press.

SUGGESTIVE READINGS

- Crompton T.R., (1989) Analysis of Polymers, Pergamon Press N.Y.
- Ward I.M., (1979)Mechanical Properties Of High Polymers, John Wiley.