

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE.

NAME OF DEPTT/CENTRE: **CHEMISTRY DEPARTMENT**

1. Subject code: **CY-009** Course Title: **Polymer Chemistry**
2. Contact Hours: **L: 3 T: 1 P: 0**
3. Examination Duration (Hrs): **Theory: 3 Practical: 0**
4. Relative Weightage: **CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0**
5. Credits: **4** 6. Semester: **Autumn** 7. Subject Area: **BSC**
8. Pre-requisite: Nil
9. Objective: To familiarize students with polymeric materials and its importance.
10. Details of the Course:

S. No.	Contents	Contact Hours
1.	Polymeric materials: Historical development of polymers, classification and nomenclature of polymers. Homopolymers, copolymers, block copolymers, polymer blends, inorganic polymers, and composites. Bio- and non-bio-degradable polymers. Soluble and insoluble polymers. Specialty of polymers in comparison to low molecular weight materials. Macromolecules <i>versus</i> polymers.	4
2.	Polymer structures: Linear, branched and cross-linked polymers. Polymer chain configuration, conformation and tacticity. Size of polymer chains and estimates of polymer chain size. Polymer chain interactions and cohesive energy density. Polymer chain polarity and its effect on physical properties of polymers—density, crystallinity and solubility.	6
3.	Molecular weights and properties of polymers: Molecular weight and degree of polymerization, weight average and number average molecular weight, sedimentation and viscosity average molecular weight, polydispersity and size of polymer molecule. Molecular weight dependence physical properties of polymers. Hydrodynamic radii of polymers and its relation with molecular weight of polymers. Amorphous polymers and crystalline polymers. Glass transition and melting temperatures. Degree of crystallinity and mesophase polymers.	8
4.	Polymerization methods: Purity and polymerizability of monomers, common initiators, inhibitors and chain transfer agents used in polymerization, bulk polymerization and auto acceleration. Solution polymerization and role of the solvent. Suspension and emulsion polymerization. Interfacial and phase transfer polymerization and its advantages. Effect of methods of polymerization on properties of the polymers.	10
5.	Polymer reactions and mechanisms of polymerization: Polymer chain hydrolysis, acidolysis, aminolysis and alcoholysis. Hydrogenation, addition, substitution, cyclization and chemical cross-linking reactions. Polymer chain functionality and gelation, physical and chemical degradation. Classification of polymerization reactions, free radical and ionic chain polymerization, addition and step growth polymerization, coordination polymerization, Zeigler-Natta catalysis and polymer chain tacticity.	8
6.	Commercial polymers and their applications: Polyethylene, high and low density polyethylene, ultrahigh molecular weight polyethylenes, polycarbonates, nylons,	6

	amino and epoxy based resins and their commercial importance, thermosetting and thermoplastic polymers and their applications.	
	Total	42

11. Suggested Books:

S. No.	Name of Authors/Book/ Publisher	Year of Publication/ Reprint
1	Flory, P.J., "Principles of Polymer Chemistry", Cornell University Press, Ithaca, New York.	1953
2	Fried, J.R., "Polymer Science and Technology", Prentice Hall , U. K.	2002
3	Odean, G., Principles of Polymerization, 4 th Edition, John Wiley & Sons, New Jersey	2004
4	Young R.J., Lovell, P.A., "Introduction to Polymers" 3 rd Edition, CRC Press, Taylor and Francis Group	2011
5	Carraher, Jr C.E. "Introduction to Polymer Chemistry" 3 rd Edition CRC Press, Taylor & Francis group.	2012