

3rd Semester	RPL3C001	Chemistry & Physics of Polymers	L-T-P 3-0-0	3 CREDITS
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MODULE – I (10 Hrs.)

Basic concepts of macromolecules - Monomers- Functionality - Classification and nomenclature of polymers. Types of polymerization –Addition polymerization- Initiator systems – Catalyst systems - Ziegler Natta catalyst, Metallocene catalyst - Mechanism and kinetics of free radical- Cationic- Anionic Polymerisation – Control of molecular weight- Chain transfer- Inhibition - Coordination polymerisation-Mechanism - Kinetics- Ring opening polymerization - Diene polymerization – Advanced Polymerization Techniques - Atom Transfer Radical Polymerization (ATRP), Group Transfer Polymerization (GTP), Reversible Addition Fragmentation Termination (RAFT).

MODULE – II (09 Hrs.)

Copolymerization - Mechanism and Kinetics of free radical - Ionic copolymerization. Types of copolymers- Copolymer composition - Determination of Monomer reactivity ratios. Polymerization techniques -Bulk polymerization -Solution polymerization - Suspension polymerization - Emulsion polymerization - Interfacial condensation.

MODULE - III (08 Hrs.)

Condensation or step growth polymerization - Mechanism - Kinetics - Bi-functional systems - Poly functional systems- Molecular weight- Molecular weight averages- Molecular weight distribution- Unidispersity, polydispersity, degree of polymerization - Molecular weight determination - Basic concepts of end group analysis, colligative properties, osmometry, light scattering, and gel permeation chromatography - Viscosity of polymers solutions, size of the polymer molecules.

MODULE - IV (08 Hrs.)

Potential energy and conformational energy of molecules - Staggered and eclipsed states - conformations and configurations, isomeric states and isomerism in polymers - Tacticity, stereoisomerism, geometric isomerism - Unperturbed and Gaussian chains - Random coils and average end to end distance - Freely jointed and freely rotating chain models – Random flight analysis.

MODULE – V (10 Hrs.)

Amorphous State - Transition temperatures - Glass transition temperature - Free volume, kinetic, and thermodynamic views of glass transition - Factors influencing glass transition temperature.

Crystalline State - Crystal systems, unit cells, primitive cell, Bravais lattices, polymorphism - Polymer single crystals, lamellae, spherulites, supramolecular structures, fringed micelle model - Degree of crystallinity, factors affecting crystallinity - X-ray diffraction.

Chain orientation - Concept of chain orientation - orientation in amorphous and crystal line polymers - Uniaxial and biaxial orientation practical significance - Orientation processes - fibre spinning, blown film extrusion, solid state extrusion, profile extrusion - Properties of oriented polymers - Birefringence.


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Books:

- Paul C. Painter and Michael M. Coleman, Fundamentals of Polymer Science, Technomic Publishing Co. Inc., Lancaster, USA, 1994.
- F.W. Billmeyer, —Textbook of Polymer Science, Wiley international publishers, 2000
- George Odian , — Principles of polymerisation, Seymor Robert
- V.R. Gowariker, —Polymer Science – New Age International (P) Ltd, Publishers
- Ulf W. Gedde, Polymer Physics, Chapman & Hall, 1995.
- .M.G. Cowie, —Polymers: Chemistry and Physics of Modern Materials, Blackie, and London, 1991.
- R.J. Young and P.Lovell, —Introduction to Polymers, 2nd Ed., Chapman & Hall, 1991.
- Premamoy Ghosh, —Polymer Science and Technology of Plastics and Rubbers, Tata McGraw- Hill, New Delhi, 1990.



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