Semester I

ADVANCE POLYMER SCIENCE

UNIT I: Basics in Polymer Chemistry, Condensation Polymerization

Monomers, functionality, degree of polymerization, nomenclature and classification of polymers Polymerization methods - addition and condensation - step growth polymerization – mechanism – kinetics- bifunctional systems - polyfunctional systems.

UNIT II: Addition Polymerization

Mechanism of Polymerization: Radial chain (addition) polymerization. Vinyl polymerization: generation of free radicals, initiation, propagation, termination, chain transfer, inhibition and retardation. Control of molecular weight – prediction of gel point. Effect of temperature and pressure on chain polymerization. Cationic, anionic polymerization, living polymerization, coordination polymerization. Mechanism of Ziegler-Natta catalysis.

UNIT III: Copolymerization

Copolymerization – Mechanism and Kinetics of free radical copolymerization – Ionic copolymerization - types of copolymers - alternating, random, block and graft copolymers - Copolymer composition – effects of monomer reactivity ratios - determination of Monomer reactivity ratios.

UNIT IV: Polymerization Techniques, Polymerization Reactors

Techniques for polymerization - bulk, solution, suspension, emulsion, interfacial poly condensation. Types of polymerization reactors: batch reactors, tubular flow reactors, stirred tank reactors. Reactors for typical polymers like PE.

Chemical reactions of polymers–Hydrolysis–Acidolysis–Aminolysis-Hydrogenation–Addition and substitution reactions–cross linking reactions. Polymer Degradation & Stabilization -oxidative degradation-thermal degradation- mechanical degradation and photo degradation. (Polysaccharides, Proteins, Malice Acids) - microbial degradation of synthetic polymers.

Text Books:

1. J.M.G. Cowie, Polymers: Chemistry and Physics of Modern Materials, Blackie & Sons Ltd Glassgow & London, 1991.
2. Joel R. Fried, Polymer science and Technology, Prentice Hall , NJ, 1995
3. Polymer Science: Gowariker V R, New age International Publishers
4. Textbook of Polymer Science :Billmeyer F W, Wiley India Publishers

References:

1. Handbook of Polymer Science and Technology- Vol 1& 2 : Ferry, CBS Publ
2. A Handbook of Applied Biopolymer Technology: Synthesis, Degradation Applications: Sharma, Wiley Publ.
3. R.J. Young and P.Lovell, Introduction to Polymers, 2nd Ed., Chapman & Hall, 1991.