GUJARAT TECHNOLOGICAL UNIVERSITY
RUBBER TECHNOLOGY
B. E. SEMESTER: VII

Subject Name: **Polymers Kinetics**
Subject Code: **172602**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
3	0	3	6	70	30	30	20

Sr. No	Course Content	Total Hrs.
1.	**Introduction:** Introduction to Chemical kinetics, Classification of reactions, Variables, affecting rate of reaction, definitions of reaction rates.	2
2.	**Kinetics of homogenous reactions:** Concentration dependent term of rate equation, single, multiple, elements & non-elementary reactions, molecules Hg & order of reaction, rate constant, representation of reaction rate, kinetic model & its testing, temp. dependent term of rate equation from Arhennius law, thermodynamics, collision theory, transition state theory, compression of theories, activation energy, searching mechanism, predictability of reaction rate.	7
3.	**Molecular weight & size:** Introduction, Molecular Weights of polymers, Number Average & Weight Average Molecular Weights, Methods of determination of Molecular Weights of polymers, Polydispersity & Molecular weight distribution in polymers, Size of polymer molecules. Determination of Reactive Molecular Mass, End group analysis, Osmotic pressure, Light Scattering, Ultracentrifuge methods, Viscosity method, molecular weight and degree of polymerization, Molecular weight distribution in polymers, Practical significance of polymer molecular weight, size of polymer molecules.	6
4.	**Reactors:** Interpretation of batch reactor data constant & variable volume batch reactor, CSTR, irreversible 1st and 2nd order reactions, Integral & differential method of analysis, search for a rate equation.	6

5.	**Kinetics of heterogeneous reactions:** Introduction to heterogeneous reaction, kinetics rate equation for heterogeneous reactions, contacting patterns, illustrations of fluid particles & fluid-fluid reactions solid & catalyzed reaction.	7
6.	**Kinetics of Polymerization:** Introduction, free radical, cationic, Anionic, chain Polymerization kinetics, Kinetics of condensation reactions.	6
7.	**Co-Polymerization:** Kinetics of free radical polymer & ionic Co-polymerization, Co-poly condensation.	2
8.	**The Chemical Modification of Rubbers & Polymers :** Introduction, Esterification, Etherification & Hydrolysis of Polymers, The Hydrogenation Of Polymers, Dehydrogenation, Elimination & Halogenations Reactions in Polymers, Other Addition Reactions to Double Bonds, Oxidation Reaction of Polymers, Functionalization of Polymers, Miscellaneous Chemical Reactions of Polymers, Block & Graft Copolymerization	6
9.	**Diffusivity, Solubility & Permeability in Rubber & Polymer Systems:** Diffusivity & Solubility of Simple Gases, Permeability of Simple Gases & Permachor, Moisture Solution & Diffusion, Permeation of Higher Activity Permeants, Polymer-Polymer Diffusion, Measurement Techniques & their materials	6
10.	**Polymer reactor design:** Introduction, ideal batch, mixed flows, plug flow, reactors, space time, space velocity, holding time mixed Vs. plug flow reactors 1st and 2nd order reaction.	6

Practical and Term work:

It should be based on theories

Text Books:

1. Polymer Reaction Engineering. By: Anil Kumar
2. Polymer Science & Technology By: By Gowarikar
3. Chemical Reaction Engineering By: Octave Levenspiel

Reference Books:

1. Science & Technology of Rubber,edited by James E. Mark, Burak Erman, Frederich R. Eirich
2. Polymer Processing Principles and Design, by Donald G. Baird, Dimitris I. Collias
3. Chemical Reaction Engineering By: Fogler