

GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL ENGINEERING (COMPUTER AIDED PROCESS DESIGN) (16)

POLYMER SCIENCE & SYNTHESIS OF POLYMERS (PSSP)

SUBJECT CODE: 2711607

SEMESTER: I

Type of course: Major Elective-I (M.E.CAPD)

Prerequisite: --

Rationale: --

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2	0	4	70	30	30	0	20	0	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Introduction: Introduction to polymers, Classification of Polymers, Carother's equation.	6	10
2	Chemistry of Polymerization: Addition and condensation polymerization tech. (bulk, solution, suspension, emulsion, solid phase, gas phase, interfacial, melt polycondensation, plasma, phase transfer etc.).Chain polymerization, free radical mechanism / polymerization. Ionic polymerization / mechanism, group transfer polymerization. Oxidative Polymerization, Step polymerization stoichiometry, gelation and cross linking, polyaddition polymerization, ROP.	08	15
3	Molecular weight and size : "Average" Molecular Weight, Number- Average and Weight-Average Molecular Weights, Sedimentation and Viscosity-Average Molecular Weights, Molecular Weight and Degree of Polymerization, Polydispersity and Molecular Weight Distribution in Polymers, The Practical Significance of Polymer Molecular Weight, Size of Polymer Molecules.	8	15
4	Kinetics of Polymerization: Introduction, Free-Radical Chain Polymerization, Cationic Polymerization, Anionic Polymerization, Polycondensation.	08	15
5	Chemical and Geometrical Structure of Polymer Molecules: General Remarks on Polymer Microstructure, Microstructures based on the Chemical Structure, Microstructure Based on the Geometrical Structure.	08	15
6	Polymer Solutions: The process of Polymer dissolution, Thermodynamics of Polymer dissolution, Some solvents and non-solvents for Polymers, Effect of	08	15

	molecular weight on solubility, solubility of crystalline and amorphous polymers, Nature of polymer molecules in solution, Viscosity of dilute polymer solution, Viscosity of concentrated polymer solution.		
7	Polymer Reactions: Hydrogenation and substitution reactions, Reaction of specific groups like hydroxyl, aldehyde, ketone, carboxyl, amino, vulcanization. Additional reactions, polymers as catalysts, polymers as substrates (Merrifield synthesis etc.) Polymer supported reactions.	08	15

Reference Books:

1. Polymer Science, New age international (P) Ltd. Publishers, V.R. Gowarikar, Pearson publication, 2003.
2. Text book of Polymer Science, Wiley Eastern, F.W. Billmeyer Jr 2003.
3. Polymer Chemistry an Introduction, Oxford University Press, M.P. Stevens, 1991.
4. Principles of Polymerization, Wiley eastern, George Odian, 1991.
5. Polymer Chemistry by B. K. Sharma

Course Outcome:

After learning the course the students should be able to:

1. Know about the classification of Polymers.
2. Derive the Carother's equation.
3. Learn the Chemistry of Polymerisation.
4. Calculate the Molecular Weight & Size.
5. Learn the Kinetics of Polymerisation.
6. Understand the Chemical & Geometrical structure of Polymer Molecules.
7. Differentiate between the crystalline and amorphous polymers.
8. Study about the nature of polymer molecules in solution.
9. Understand the polymer reaction and its effect on properties of Polymer & Products.

List of Experiments:

Tutorials/Presentation/Practicals based on above topics.

Major Equipments:

Muffle Furnance, Redwood Viscometer, Kinematic Viscometer Bath, Tar Viscometer Apparatus, Flow Cup Viscometer etc

List of Open Source Software/learning website:

- www.prenhall.com/settle/chapters/ch46.pdf
- www.wernerblank.com/equat/equations_for_polymer.htm
- www.springer.com › Home › Chemistry › Polymer Science