



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3163908

SUBJECT NAME: NANOPOLYMERS-I

6th SEMESTER

Type of course: Material Science and Chemical Technology

Prerequisite: Fundamental of Chemistry , Synthesis of Nano materials, Physics of Nano materials

Rationale: The purpose of this course is to provide a basic knowledge about polymer and the composite materials with its application

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs.	% Weig
Chapter 1	Introduction : Polymers Defining Polymers Classification of Polymers and Some Fundamental Concepts Chemical Classification of Polymers Based on Polymerization Mechanisms Molecular-Weight Distributions Configurations and Crystallinity of Polymeric Materials Conformation of Polymer Molecules Polymeric Supports in Organic Synthesis	10	20%
Chapter 2	Effect of Chemical Structure on Polymer Properties Introduction Effect of Temperature on Polymers Additives for Plastics Rubbers Cellulose Plastics Copolymers and Blends Cross-Linking Reactions	10	20%



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	Ion-Exchange Resins		
Chapter 3	Synthesis-1 Step growth polymerization Condensation reaction Functionality Polycondensation reaction Kinetics of step growth polymerization Free radical addition polymerization Formation of active center Propagation Termination, kinetics. Cationic Polymerization Kinetics Anionic Polymerization	12	20%
Chapter 4	Synthesis-2 Co-polymerization Copolymer composition equation Reactivity ratios Copolymer structure Block copolymer Graft copolymer.	10	20%
Chapter 5	Measurement of Molecular Weight and Its Distribution Introduction End-Group Analysis Colligative Properties Light Scattering Ultracentrifugation Intrinsic Viscosity Gel Permeation Chromatography	10	20%



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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
Remembrance R Level	Understanding U Level	Application A Level	Analyze N Level	Evaluate E Level
24	19	20	7	-

Legends: R:Remembrance;U: Understanding; A: Application and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

TEXT BOOKS

1. Fundamentals of Polymer Science and Technology by Anshu Srivastava and Shakun Srivastava.
2. Introduction to polymers by R.J.Young and P.A. Lovell

REFERENCES

1. Fundamentals of Polymer Engineering by Neil K. Petchers, Rakesh K. Gupta, Anil Kumar
2. Fundamentals of Polymer Engineering by Anil Kumar and Rakesh Gupta

Course Outcome:

After a successful completion of the course, students should be able to

1. Describe the basic aspect associated with polymer science.
2. Describe the effect of chemical Structure on Polymer Properties.
3. Describe the synthesis of polymers ay various routes.

List of Experiments: (Any Five + Opend Ended Experiment)

1. Cross-Linking of Polymer
2. Preparation of Plasticized PVC and testing tensile modulus.
3. Preparation of ceramic based nanocomposites.
4. Preparation of metal-polymer nanocomposites.
5. Polymerization of Acrylamide in Water.



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6. Preparation Nanopolymer using Electrons spinning Technique.
7. Conversion of Polyacrylamide to Sodium Polyacrylate and Subsequent Conversion of Polyacrylate Salt to Poly-(Acrylic Acid).
8. Synthesis of Hydrogels from Acrylamide and N-isopropyl Acrylamide with Bisacrylamide in Water
9. Characterization of Polymer (prepared in the lab)

Major Equipment:

1. UV-Visible Spectrometer
2. Spin coater
3. Distil Water Unit
4. PH Meter
5. Necessary Chemicals and glassware for sol-gel and chemical synthesis.

List of Open Source Software/learning website:

1. <http://ocw.mit.edu/courses/chemical-engineering/10-467-polymer-science-laboratory-fall-2005/labs/>
2. UPAC Polymer Education Website (<http://iupac.org/polyedu/index.html>).
3. Macrogalleria (<http://pslc.ws/macrog/index.htm>)
4. POLYED (<http://www.uwsp.edu/chemistry/polyed/>)
5. Carnegie Mellon Education Website - Macromolecular products
<http://gelfand.web.cmu.edu/scimodules/>)