



University of Kerala

Discipline	CHEMISTRY				
Course Code	UK3DSECHE204				
Course Title	POLYMER CHEMISTRY I				
Type of Course	DSE				
Semester	3				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	1. Higher secondary level chemistry				
Course Summary	The course deals with polymer chemistry, students delve into the historical development, classification, methods of polymerization, and diverse applications of polymers, including plastics, engineering plastics, elastomers, and fibers. Through problem-solving exercises, seminars, open discussions, and assessments, students gain a deep understanding of polymer synthesis, structure-property relationships, and real-life applications.				

Detailed Syllabus:

Module	Unit	Content	Hrs
		POLYMER CHEMISTRY I	
I	BASIC PRINCIPLES OF POLYMER CHEMISTRY		12
	1	Historical development of polymer chemistry. Monomers, polymers, repeating units, functionality.	2
	2	Nomenclature of polymers. Importance and applications of polymers – acrylic, vinyl, cellulose, fluorinated, poly ethylene, & SAN copolymer.	4
	3	Classification of polymers. Ladder and spiral polymers. Cis- trans configuration. DL isomers and tacticity.	3
	4	Inorganic polymers- importance, advantages and applications- structure, preparation and properties of silicones and polyphosphazenes. Comparison with organic polymers.	3
II	METHODS OF POLYMERIZATION		18
	5	Free radical addition polymerization - Chain growth polymerization. Mechanism of chain growth polymerization. Initiation, propagation and termination. Types of free radical initiators (peroxo, azo and redox initiators). Initiator efficiency. Inhibitors and retarders – functions and examples. Chain transfer reactions.	4



	6	Ionic polymerization – anionic and cationic catalysts, Solvent effects in ionic polymerizations. Mechanism of anionic and cationic polymerizations. Counter ions. Termination modes. Living polymers.	4
	7	Coordination polymerization: stereo regularity, Ziegler-Natta catalysts. Metallocene catalysts. Bimetallic and monometallic mechanisms.	3
	8	Condensation or step growth polymerization-Average functionality, basic characteristics, extent of reaction, degree of polymerization	3
	9	Copolymerization: random, alternate, block and graft. Copolymerization involving two monomers (free radical mechanism). Polymerisation techniques (bulk, solution, suspension and emulsion). Melt, solution and interfacial condensation.	4
III	PLASTICS AND ENGINEERING PLASTICS		9
	10	Preparation, structure and properties of polyolefins (LDPE, HDPE, LLDPE and PP); vinyl polymers (PVC, Polyvinyl acetals and PMMA);	3
	11	Teflon and polyurethanes; Phenol formaldehyde and urea formaldehyde resins; nylons and polyesters (Terylene and Dacron).	2
	12	Engineering plastics, ABS, polyamides, polycarbonates, PPO, PPS, polysulphones, polyimides, polyesters, fluoropolymers, ionomers, and liquid crystalline polymers.	4
IV	ELASTOMERS AND FIBRES		9
	13	Natural rubber, composition, preservation & coagulation of latex, Structure, properties and preparation of synthetic rubbers (PB, SBR, NBR, polychloroprene, polyisobutylene, IIR, EPDM, buna-N, thiocol). Reclaimed rubbers.	5
	14	Thermoplastic elastomers- advantages, polyurethanes.	2
	15	Fibres: natural (structure and properties); synthetic (structure and properties of nylon, polyester and acrylics)	2
V	OPEN ENDED MODULE: Learning through problem solving, seminars, open discussions on real life applications, assignment discussions, Quizzes, Open book exams, etc on the above four modules.		12

References:

1. Billmeyer, "Textbook of polymer science", John Wiley and Sons.
2. D.D. Deshpande, "Physical chemistry of macromolecules", Vishal publications, New Delhi, 1985.
3. V.R. Gowariker, N.V. Viswanathan and J. Sreethan, "Polymer Science", Wiley Eastern Ltd, 1986.
4. K.J. Saunders, *Organic Polymer Chemistry*, 2nd Edn., Chapman and Hall, London, 1988.
5. Gowri Sankar Misra, *Introductory Polymer Chemistry*, New Age International, New Delhi.
6. P Ghosh, *Polymer Science & Technology*, Tata McGraw Hill Education, 1991.
7. Jeol R. Fried, *Polymer Science & Technology*, Prentice Hall of India (P) Ltd. New Delhi, 1999.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Differentiate between Natural and synthetic polymers	An	PSO-1,2,3
CO-2	Understand polymerization process of monomeric units	An	PSO-1,2,3
CO-3	Critically analyse the advantages and disadvantages of polymers	E	PSO-1,2,3,4
CO-4	Analyse different Applications of Polymers	C	PSO-1,2,3
CO-5	Enhance problem-solving and critical thinking skills, by applying the knowledge of polymer chemistry to address practical challenges	C	PSO-1,2,3,4,5

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: POLYMER CHEMISTRY I

Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	CO-1	PO-1,2,6 PSO-1,2,3	An	F, C	L	
2	CO-2	PO-1,2,6 PSO-1,2,3	An	F, C	L	
3	CO-3	PO-1,2,6 PSO-1,2,3,4	E	C	L	
4	CO-4	PO-1,2,6 PSO-1,2,3	C	P	L	
5	CO-5	PO-1,2,3,6 PSO-1,2,3,4,5	C	P	L/T	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:



	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO 1	3	2	2	-	-	2	1	-	-	-	1	-	-
CO 2	2	3	2	-	-	1	1	-	-	-	2	-	-
CO 3	2	2	3	2	-	2	1	-	-	-	2	-	-
CO 4	2	1	2	-	-	2	2	-	-	-	2	-	-
CO 5	1	2	2	1	2	3	2	-	-	-	3	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4	✓	✓		✓
CO 5		✓	✓	

