

UNIVERSITY OF MADRAS
M.Sc. DEGREE PROGRAMME IN CHEMISTRY
 SYLLABUS WITH EFFECT FROM 2023-2024

Title of the Course	POLYMER CHEMISTRY						
Paper No.	Elective VI						
Category	Core	Year	II	Credits	4	Course Code	524E4A
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	Basic knowledge of general chemistry						
Objectives of the course	<p>To learn the basic concepts and bonding in polymers.</p> <p>To explain various types of polymerization reactions and kinetics.</p> <p>To understand the importance of industrial polymers and their synthetic uses.</p> <p>To determine the molecular weight of polymers.</p> <p>To predict the degradation of polymers and conductivities.</p>						
Course Outline	UNIT-I: Characterization, Molecular weight and its Determination: Primary and secondary bond forces in polymers; cohesive energy, molecular structure, chemical tests, thermal methods, T _g , molecular distribution, stability. Determination of Molecular mass of polymers: Number Average molecular mass (M _n) and Weight average molecular mass (M _w) of polymers. Molecular weight determination of high polymers by physical and methods.						
	UNIT-II: Mechanism and kinetics of Polymerization: Chain growth polymerization: Cationic, anionic, free radical polymerization, Stereo regular polymers: Ziegler Natta polymerization. Reaction kinetics. Step growth polymerization, Degree of polymerization.						
	UNIT-III: Techniques of Polymerization and Polymer Degradation: Bulk, Solution, Emulsion, Suspension, solid, interfacial and gas phase polymerization. Types of Polymer Degradation, Thermal degradation, mechanical degradation, photodegradation, Photo stabilizers, Solid and gas phase polymerization.						
	UNIT-IV: Industrial Polymers: Preparation of fibre forming polymers, elastomeric material. Thermoplastics: Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester. Thermosetting Plastics: Phenol formaldehyde and expoxide resin. Elastomers: Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene. Conducting Polymers: Elementary ideas; examples: poly sulphur nitriles, poly phenylene, poly pyrrole and poly acetylene. Polymethylmethacrylate, polyimides, polyamides, polyurethanes, polyureas, polyethylene and polypropylene glycols.						
	UNIT-V: Polymer Processing: Compounding: Polymer Additives: Fillers, Plasticizers, antioxidants, thermal stabilizers, fire retardants and colourants. Processing Techniques: Calendaring, die casting, compression moulding, injection moulding, blow moulding and reinforcing. Film casting, Thermofoaming, Foaming. Catalysis and catalysts – Polymerization catalysis, catalyst support, clay compounds, basic catalyst, auto-exhaust catalysis, vanadium, heterogeneous catalysis and active centres.						

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Extended Professional Component (is apart of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<ol style="list-style-type: none"> 1. V.R. Gowariker, <i>Polymer Science</i>, Wiley Eastern, 1995. 2. G.S. Misra, <i>Introductory Polymer Chemistry</i>, New Age International (Pvt) Limited, 1996. 3. M.S. Bhatnagar, <i>A Text Book of Polymers</i>, vol-I & II, S.Chand & Company, New Delhi, 2004.
Reference Books	<ol style="list-style-type: none"> 1. F. N. Billmeyer, <i>Textbook of Polymer Science</i>, Wiley Interscience, 1971. 2. A. Kumar and S. K. Gupta, <i>Fundamentals and Polymer Science and Engineering</i>, Tata McGraw-Hill, 1978.
Course Learning Outcomes (for Mapping with POs and PSOs)	
Students will be able:	
CO1: To understand the bonding in polymers.	
CO2: To scientifically plan and perform the various polymerization reactions.	
CO3: To observe and record the processing of polymers.	
CO4: To calculate the molecular weight by physical and chemical methods.	
CO5: To interpret the experimental data scientifically to improve the quality of synthetic polymers.	

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	S

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low