SEMESTER S3

POLYMER SCIENCE

Course Code	PCPOT302	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To establish fundamental principles of Polymer Science in a simple and up-front manner and to provide the broad background
2. Introduces students to basic concepts of polymer microstructures, polymer solutions, chemical reactions and properties of polymer materials which acts as the fundamental to the core areas of Polymer Engineering course.

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SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction: Glass transition temperature -** Amorphous state, molecular motion, first order and second order transitions, Tg, Tm, secondary transitions, free volume, kinetic and thermodynamic views of glass transition, factors influencing glass transition temperature, Crystalline state, polymorphism, polymer single crystals, lamellae, spherulites, super molecular structures, fringed micelle model, degree of crystallinity, factors affecting crystallinity, X-ray diffraction	11
2	**Polymer solutions-** terms and definitions: - types of solutions, Hildebrand approach, Flory-Huggin's theory, thermodynamic view of miscibility, upper critical solution temperature (UCST), lower critical solution temperature (LCST), concentration regimes in polymer solutions, theta conditions	11

3	**Optical and Electrical Properties of polymers: -** Effect of polymer structure on dielectric constant, capacitance, dielectric loss, power factor, dissipation factor and loss factor, effect of additives on electrical properties of polymers, effect of polymer structure on optical properties, clarity, transparency, haze, transmittance, reflectance, gloss**.** Chemical reactivity of linear and cross-linked polymers, hydrolysis, acidolysis, aminolysis, hydrogenation, addition and substitution reactions, cross linking reactions, reactivity of functional groups**.**	**11**
4	**Polymer analogous reactions**: - polymer bound reagents, chain end and random degradation, degradation by oxygen, ozone, heat, UV light, microorganism, crazing, weathering, stabilisation to prevent degradation.	**11**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

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Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the basic concepts of Tg, crystallinity and polymer morphology.	**K2**
CO2	Estimate the properties of polymer solutions	**K6**
CO3	Relationship of the structure of polymers with their electrical and optical properties.	**K4**
CO4	Define the reactions and degradation of polymers	**K1**
CO5	Develop polymer systems capable of resistance to various degrading agents	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		1								
CO2	3	3	2									
CO3	3	1			2							
CO4	3	2		1								
CO5	3	2		3								

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Essentials of Polymer Science and Engineering	Paul C. Painter, M.M. Coleman	DES tech Publications	2008
2	Textbook of Polymer Science	F W Billmeyer	John Wiley & Sons	Third Edition, 2007
3	Physical Properties of Polymers Handbook	J. E. Mark (Ed.)	Springer	2007
4	An Introduction to the Mechanical Properties of Solid Polymers.	I. M. Ward, J. Sweeney	John Wiley & Sons	2005

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Properties of Polymers	D.W. V. Krevelen, K. Nijenhuis	Elsevier	2009
2	Introduction to Polymer Science & Technology	Manas Chanda	CRC Press	2nd Edition, 2013
3	Material Science of Polymers for Engineers	TA Osswald and G Menges	Hanser	2012
4	Electrical Properties of Polymers	D. A. Seanor	Elsevier	2013

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/noc24_ch50
2	https://archive.nptel.ac.in/noc24_cy37
3	https://archive.nptel.ac.in/noc24_ch50
4	https://archive.nptel.ac.in/noc24_ch55

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