SEMESTER: S8

FUNCTIONAL POLYMERS & APPLICATIONS

Course Code	PEPOT865	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	5/3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Basic Knowledge in Polymers	Course Type	Theory

Course Objectives:

1. Students will learn about the different types of functional polymers, their properties, and their applications in various fields

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	Introduction to Functional Polymers: - Definition and classification of functional polymers, Importance of functional polymers, Various synthesis methods- -step-growth polymerisation, chain-growth polymerisation, ring-opening polymerisation	9
2	Polymer Functionalisation: Chemical modification of polymers with suitable examples, Grafting of functional groups with examples, blockcopolymerisation with examples. Properties of functional polymers- mechanical, thermal, electrical and optical	9
3	**Applications of Functional Polymers:** biomedical applications, drug delivary systems, water treatment, catalysis, electronics, coatings and adhesives. Types of functional polymers with suitable examples- Hydrogels, smart polymers, conductive polymers, biodegradable polymers, shape memory polymers, self-healing polymers, water soluble polymers, stimuli responsive polymers.	9

4	**Characterisation of Functional Polymers-** using microscopic techniques, spectroscopic techniques, chramotographic techniques and thermal analysis. Modelling and simulation of functional polymers using molecular dynamics simulations, Monte Carlo simulations and finite element modelling.	**9**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Internal Ex	Evaluate	Analyse	Total
5	**15**	**10**	**10**	**40**

Criteria for Evaluation (Evaluate and Analyse): 20 marks

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1. **Problem Definition (2 points)**

- Check for clarity and completeness of the problem definition.
- Check for clear objectives and divide into sub objectives

2. **Problem Analysis (4 points)**

- Examine the problem and identify the variables and responses
- Divide the problem to manageable parts

3. **Implementation of software (2 points)**

- Use suitable software for getting the solution
- Check for the appropriateness of tools used

4. **Evaluate (4 points)**

- Evaluate the proposed solution.
- Assess the correctness of solution.

5. **Validation of the results (4 points)**

- Validate the results using available data.

- Do the error analysis of the results obtained.

6. **Conclusion and presentation (4 points)**

- Summarize the results obtained
- Do critical thinking of the results obtained and evaluate.
- Submit a technical report

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**

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Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Explain the importance of functional polymers	**K5**
CO2	Discuss the various synthetic ways of preparing functional polymers	**K6**
CO3	Summarize the properties and modifications of functional polymers	**K2**
CO4	Explain the applications of functional polymers	**K2**
CO5	Inspect the various characterisation techniques of functional polymers	**K4**

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

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Polymer Science and Engineering	Fred W. Billmeyer Jr		1971
2	"Introduction to Polymer Science and Chemistry" by	Manas Chanda		2013
3	"Chromatography: Fundamentals and Applications of Chromatography and Related Differential Migration Methods"	by Christian G. Fraga	Elsevier	2002

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	"Smart Hydrogels: Properties, Synthesis, and Applications"	Liang Guo	Wiley	2020
2	"Thermal Characterization of Polymer Materials"	A. R. Horrocks	Woodhead Publishing	2015
3	"Biomedical Applications of Polymers and Composites" by	V. K. Thakur	Elsevier	2018

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Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1-2	https://www.youtube.com/watch?v=54urJPOnaeU&list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
3	https://www.youtube.com/watch?v=xX5AWl6QcWU
4	https://www.youtube.com/watch?v=zMosmn5Sn-U

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