

## MSc Sem.-1 Examination

405

## Polymer Science

February-2025

Time : 2-30 Hours]

[Max. Marks : 70

<b>Question-1:</b>		
(i)	Define conducting polymers. Classify conducting polymers on the basis of chemical structure, and give two examples of each category.	(7)
(ii)	Draw the chemical structures of seven common conducting polymers.	(7)
<b>OR</b>		
(i)	Define "intrinsically" and "extrinsically" conducting polymers. Give two examples of each category.	(7)
(ii)	Name the three stable oxidation states of polyaniline, mention their color, and draw their chemical structures.	(7)
<b>Question-2:</b>		
(i)	Write in details the chemical synthesis of polypyrrole. Mention the reagents and conditions used for the synthesis. Draw the reaction mechanism involved in the synthesis.	(7)
(ii)	What is template synthesis? Write in details the procedure involved in the template synthesis of polythiophene.	(7)
<b>OR</b>		
(i)	Name a suitable solvent for polyaniline. Write the steps involved in the electrochemical synthesis of polyaniline.	(7)
(ii)	Write a short note on poly(paraphenylene), mentioning its chemical preparation, properties and applications.	(7)
<b>Question-3:</b>		
(i)	What is IR spectroscopy? What are the relationships between (a) wavelength and wavenumber, and (b) wavenumber and frequency? IR spectra can be recorded in which two modes?	(7)
(ii)	Mention the wavelength range of electromagnetic radiation that is identified as UV radiation. Further divide the UV wavelength range in terms of UV-A, UV-B and UV-C. How can UV spectroscopy be useful in analyzing the conjugation length in conducting polymers?	(7)
<b>OR</b>		
(i)	Write three differences between scanning electron microscopy and transmission electron microscopy. Among these two techniques, which one is more suitable to view hollow objects and why?	(7)
(ii)	Write short notes on (a) impedance spectroscopy and (b) X-ray photoelectron spectroscopy.	(7)
<b>Question-4:</b>		
(i)	What is a rechargeable battery? Write the working principle of a rechargeable battery. Name two conducting polymers used in the fabrication of rechargeable batteries.	(7)
(ii)	How can a conducting polymer help in the functioning of an anti-static coating? Write a short note on the recent trend on conducting polymers.	(7)
<b>OR</b>		
(i)	Briefly mention the uses of conducting polymers in (a) supercapacitors, (b) analytical sensors and (c) polymer light emitting diodes.	(7)
(ii)	Write short notes on (a) conducting polymer based on nanocomposites, and (b) functionalized conducting polymers.	(7)
<b>Question-5: (Attempt any seven out of twelve)</b>		
	1. Conducting polymers are superconductors / semiconductors. (Choose the correct one) 2. The Nobel Prize for the discovery of conducting polymers was awarded in the year ..... 3. Bipolarons are quasi-particles formed by the pairing of two polarons. (True/False) 4. Oxidized polythiophene is dark blue in colour.(True/False) 5. Name a catalyst used in the synthesis of polyacetylene.	(14)

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| <ol style="list-style-type: none"><li>6. Polyaniline is soluble / dispersible in de-ionized water. (Choose the correct one)</li><li>7. Fourier Transform IR spectroscopy is an advanced form of IR spectroscopy. (True/False)</li><li>8. Charge transfer resistance is a part of impedance spectroscopy. (True/False)</li><li>9. Between IR and UV, which one has lower wavelength?</li><li>10. Signal-to-noise ratio is a measurable parameter in sensing analysis. (True/False)</li><li>11. Polyaniline can be used in the fabrication of electrocatalysts. (True/False)</li><li>12. Give two examples of organic-inorganic hybrid conducting polymer.</li></ol> |  |
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