

Subject: Chemistry
Paper - IV: Analytical Techniques and Spectroscopy

Time: 3 Hours

Max. Marks: 80

Note: Answer all questions from Part - A and Part - B.
Each question carries 4 marks in Part - A and 12 marks in Part - B.

PART - A (4 x 8 = 32 Marks)
(Short Answer Type)

- 1 (a) Discuss the classification of chromatographic techniques.
(b) Briefly explain the principle of Gas Chromatography.
- 2 (a) Define spin-spin coupling. Explain its impact on the NMR spectrum with an example.
(b) Write short notes on anisotropy in NMR.
- 3 (a) Give a brief description of a microwave spectrometer.
(b) Briefly explain the quantum theory of Raman effect.
- 4 (a) Define and explain bathochromic and hypochromic shifts with examples.
(b) How do cis and trans – isomers differ in their electronic spectra? Explain with suitable examples.

PART - B (4x12 = 48 Marks)
(Essay Answer Type)

- 5 (a) Briefly discuss the principle, instrumentation of HPLC.
(b) Write short notes on the different types of detectors used in Gas Chromatography.
OR
(c) Give a procedure for determination of assay of paracetamol and aspirin in tablets using HPLC.
(d) Write notes on plate theory.
- 6 (a) Briefly explain the principle and instrumentation of NMR.
(b) Explain the NMR spectra of (i) ethyl acetate, (ii) 2-chloro propionic acid.
OR
(c) Discuss shielding and deshielding effects in NMR with examples.
(d) Explain the application of NMR spectroscopy in the conformational study of cyclohexane and decalin.

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- 7 (a) Write notes on the calculation of bond lengths from rotational spectra of diatomic molecules.
(b) Explain the complementary nature of IR and Raman spectroscopy.
OR
(c) Describe the normal modes of vibration of linear and non-linear triatomic molecules with one example each.
(d) Discuss about the application of IR spectroscopy to metal co-ordinated sulphate and carbonate ions.
- 8 (a) Discuss about the different types of electronic transitions in molecules.
(b) Write notes on Woodward-Fieser rules.
OR
(c) What are the selection rules involved in electronic spectra? Explain.
(d) Explain the application of Beer's law to dissociation constant of weak acid.