PART-A (4x8=32 Marks)

1. Define partition ratio and retention time.
   (b) Write note on Capacity factor & Selectivity factor.

2. (a) Explain Magnetic Resonance Imaging (MRI)
   (b) What are chemically equivalent protons and Non-Equivalent protons in NMR?

3. (a) Define moment of inertia. Classify molecules based on moment of inertia giving examples.
   (b) Taking the diatomic molecule, discuss the selection rules for IR-Spectroscopic technique.

4. (a) Define Chromophore and Auxochromes, with an example. Explain their absorption wave length ($\lambda_{\text{max}}$)
   (b) Define Beers law & discuss its application.

PART-B (4x12=48 Marks)

5. (a) Explain in detail about different Chromatographic techniques.
   (b) Explain in detail about GC detectors.
   OR
   (c) Explain principle and Instrumentation of HPLC.
   (d) Write about applications & of HPLC.

6. (a) Explain principle of NMR spectroscopy.
   (b) Write about various factors effecting chemical shifts in proton NMR.
   OR
   (c) Explain in detail about various types of spin-spin coupling
   (d) Sketch NMR spectra of Paracetamol and Mesitylene.

7. (a) Explain calculation of bond length from rotational spectra of diatomic molecule.
   (b) Calculate and comment on the change in rotational constant from $^1\text{H}^{35}\text{Cl}$ to $^1\text{H}^{37}\text{Cl}$.
   OR
   (c) Explain IR spectra of metal coordinated $\text{NO}_3^-$, $\text{SO}_4^{2-}$ and $\text{CO}_3^{2-}$ ions.
   (d) Explain the Complimentary nature of IR and Raman Spectra.

8. (a) Explain Woodward Fieser rules.
   (b) Calculate the $\lambda_{\text{max}}$ of the following
   
   \begin{align*}
   (i) & \quad \text{C}_6 \text{H}_{5} \quad (ii) \quad \text{C}_2 \text{H}_2 \\
   \end{align*}

   OR

   (c) Discuss the absorption spectra of charge transfer complexes.
   (d) Explain in detail about the absorption spectra of Cis-trans isomers and cross conjugated systems.

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