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**AB-233676**

**M.Sc. (Semester-II) Examination, June-2025**

**( Regular / Backlog )**

**CHEMISTRY**

**[ Paper : Second ]**

**( Theory and Application of  
Spectroscopy )**

***Time Allowed : Three Hours***

***Maximum Marks : 70***

**Note :** This question paper is divided into four sections.  
Attempt questions from all sections as per given  
direction. Distribution of marks is given in each  
section.

**SECTION-A**

**( Objective Type Questions )**

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**( 1 )**

**[P.T.O.]**

Note : Attempt any ten questions. Each question carries 1 mark. [10×1=10]

1. (A) Multiple choice questions :

(i) Identify the type of transition in crotonaldehyde at  $\lambda_{\max}$  214 nm and  $\epsilon$  -15850 :

- (a)  $n \rightarrow \pi^*$ , R - band
- (b)  $\pi \rightarrow \pi^*$ , K - band
- (c)  $n \rightarrow \sigma^*$ , B - band
- (d)  $n \rightarrow \pi$ , B - band

(ii) Electronic excitations occur in the range from :

- (a) 200 to 780 nm
- (b) 220 to 500 nm
- (c) 250 to 700 nm
- (d) 290 to 1000 nm

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(iii) Total number of vibrations in allyl bromide,  $\text{CH}_2 = \text{CHCH}_2\text{Br}$  are :

- (a) 18
- (b) 21
- (c) 14
- (d) 16

(iv) The vibrations without a centre of symmetry are, active in :

- (a) Infrared but inactive in Raman
- (b) Raman but inactive in IR
- (c) Raman and IR
- (d) None of the above

(v) A high resolution mass spectrophotometer is required for :

- (a)  $\text{C}_2\text{H}_4^+$ ,  $\text{CH}_2\text{N}^+$
- (b)  $\text{CO}^+$
- (c)  $\text{N}_2^+$
- (d) All of the above

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(vi)  $C^{13}$  was first studied in 1957 by :

- (a) P.C. Lawberbur
- (b) Hansen
- (c) Packard
- (d) Purcell

(B) Fill in the blanks :

(vii) The intensity of light absorbed by a sample in UV-visible spectroscopy is directly related to its.....

(viii) A.....is a device that allow you to select a specific wavelength of light to measure absorbance.

(ix) The Fingerprint region of an IR spectrum is located in the range of.....

(x) The absorption of IR radiation by a molecule causes its atoms to.....at specific frequencies.

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(xi) Different functional groups have characteristics absorption.....in the IR spectrum.

(xii) The most intense peak in mass spectrum is known as .....

#### SECTION-B

( Very Short Answer Type Questions )

**Note:** Attempt any five questions. Each question carries 2 marks.(Maximum word limit 25-30 words) [5×2=10]

2. (i) Why is ethanol a good solvent in ultraviolet spectroscopy?
- (ii) Amines absorb at higher wavelength than alcohols, why?
- (iii) Name the lines arising from  $\Delta J = -2, -1, 0, +1$  and  $+2$ .
- (iv)  $C^{13}$  is NMR active while  $e^{12}$  is not? Explain.
- (v) Why greater sensitivity is required to record  $C^{13}$  NMR spectra compared to that of PMR spectra?

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[P.T.O.]

- (vi) Identify the amide which gives a strong peak at  $m/e-44$ .
- (vii) Identify signals in NMR spectrum of ETHYL BROMIDE.

#### SECTION-C

##### ( Short Answer Type Questions )

**Note:** Attempt **any five** questions. Each question carries **4** marks. (Maximum word limit 250 words) [ $5 \times 4 = 20$ ]

3. Explain the following :

- (i) Lambert-Beer's law.
- (ii) Solvent effects on electronic transitions.
- (iii) Factors influencing vibrational frequencies with special reference to IR spectroscopy.
- (iv) Factors affecting Vicinal Coupling.
- (v) Coupling constant.
- (vi) Applications of mass spectroscopy.
- (vii) McLafferty Rearrangement Law.

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#### SECTION-D

##### ( Essay Type Questions )

**Note:** Attempt **any three** questions. Each question carries **10** marks. (Word limit 500 words) [ $3 \times 10 = 30$ ]

- 4. (i) What is NMR spectroscopy? Discuss its theory in detail and its applications in medical diagnostics.
- (ii) Discuss the basic principle, instrumentation and applications of IR spectroscopy.
- (iii) Explain the basic theory and instrumentation of mass spectroscopy. Discuss the factors affecting fragmentation.
- (iv) Explain Woodward-Fieser rules for conjugated dienes and carbonyl compounds with examples.

—x—

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