

(3 HOURS)

Total Marks-70

N.B:

1. All questions are compulsory
2. Answer all sub questions together
3. Draw neat labelled diagrams where necessary
4. Figures to the right indicate full marks

**Q.1.A. Do as directed: (Any seven)****(7)**

- i. Name any one mobile phase solvent which is used in RP-HPLC analysis
- ii. Write the structure for molecular ion peak of ethanol, stating its m/z value
- iii. Name the detector used in HPLC which allows detection at different wavelengths simultaneously
- iv. Name any one mass analyser
- v. Name the spectrometry technique that can distinguish different isotopes of an element
- vi. Name one reference standard used in  $^1\text{H-NMR}$  spectroscopic analysis
- vii. Name any one spraying reagent used for visualisation of spots in paper chromatography
- viii. Name any one type of column used in gas chromatography

**Q.1.B. Explain the following terms: (Any four)****(8)**

- i. Chemical shift
- ii. LOD in validation studies
- iii. Headspace analysis
- iv. Fast atom bombardment technique
- v. Internal standard

**Q.2.A. Answer the following: (Any two)****(8)**

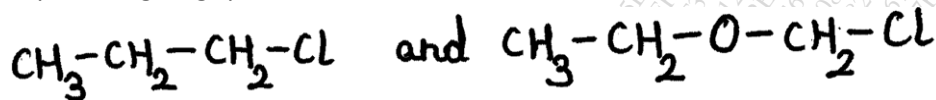
- i. With the help of suitable diagrams explain the working of reciprocating pump in HPLC
- ii. Explain the principle of ion pair chromatography
- iii. Enlist any four interfaces used in LC-MS. Explain any one interface in detail.

**Q.2.B.** Two compounds 'A' and 'B' were analysed by RP-HPLC using a column of length 30 cm. The retention times of 'A' and 'B' were found to be 5.7 min and 6.9 min respectively. The peak widths measured at the base were 0.98 min and 1.0 min respectively. Calculate the number of theoretical plates for compound A. Justify whether the calculated number of theoretical plates can be accepted or not. **(3)**

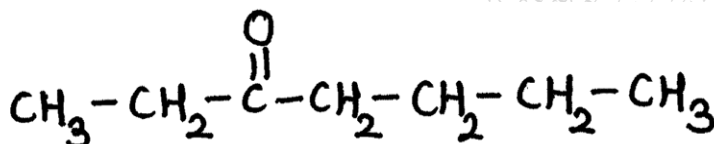
**TURN OVER**

**Q.3.A. Answer the following: (Any two) (8)**

- With the help of an inverted tree diagram explain the formation of a quartet for CH<sub>2</sub> protons of ethyl bromide.
- Suggest a suitable spectroscopic method to distinguish the following pairs of compounds, giving spectral characteristics.



- Depict any two different types of fragmentation pathways for the following compound:



**Q.3.B. With the help of diagram explain radial chromatographic technique in paper chromatography. (3)**

**Q.4.A. Answer the following: (Any Two) (8)**

- Discuss electron impact method of ionization in mass spectrometry
- Explain the effect of anisotropy on the chemical shift of alkene protons.
- Explain how precision studies for analytical method validation are carried out as described in ICH guidelines.

**Q.4.B. With the help of a diagram, explain the term asymmetry factor. (3)**

**Q.5.A. Answer the following: (Any Two) (8)**

- Discuss flame ionization detector used in gas chromatographic analysis.
- Predict the structure of the following compound whose spectral characteristics are as follows:

Molecular formula: C<sub>7</sub>H<sub>9</sub>N

I.R. (cm<sup>-1</sup>): 3433, 3350, 3034, 2900, 1300

<sup>1</sup>H-NMR (δ-ppm) = 7.0 - 7.3 (m) (4H)

3.5 (broad, s) (2H)

2.3 (s) (3H)

Give appropriate justification for your answer.

**TURN OVER**

- iii. Predict the structure of the following compound whose spectral characteristics are as follows:

Molecular formula:  $C_3H_6O_2$

I.R. ( $cm^{-1}$ ): 3200- 2800, 1670

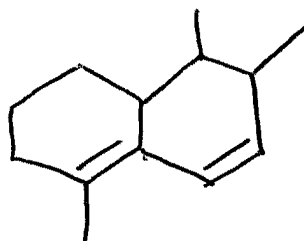
1 H-NMR ( $\delta$ -ppm)= 1.1 (t) (3H)-6.5 Hz

2.3 (q) (2H)-6.5 Hz

11.2 (broad s) (1H)

Give appropriate justification for your answer.

- Q.5.B Predict the  $\lambda_{max}$  for the following compound showing UV absorbance: (3)



- Q.6.A. Answer the following: (Any two) (8)

- Explain the working of evaporative light scattering detector used in HPLC
- Discuss any four factors affecting resolution in thin layer chromatography.
- Explain multicomponent analysis by UV spectroscopy using Simultaneous equations method.

- Q.6.B. Predict the positions of absorption bands in the IR spectra of the following compound: (3)

