(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 the peak in mass spectrum with 100% peak intensity
ii. Name any one spraying reagent that can be used for visualization of spots in paper chromatography
iii. Name any one interface used in LC-MS technique
iv. Name one carrier gas used in GC-MS
v. Give the splitting pattern of $-CH_3$ in CH_3-CHCl-CH_2OH
vi. Give one example of bulk property detector used in HPLC
vii. Name any one mobile phase solvent used in RP-HPLC
viii. Name one reference standard used in ^1H NMR spectroscopic analysis

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

i. Capacity factor
ii. Precision studies
iii. MALDI
iv. Metastable ion
v. Precessional frequency

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

i. Explain principle of ion-pair chromatography. Give any one application of the same.
ii. Write a note on columns used in HPLC
iii. Give the significance of GC-MS technique. Discuss any one interface used in GC-MS

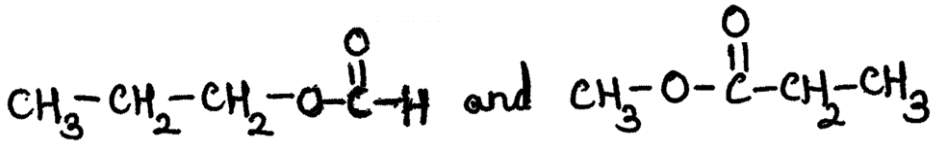
Q.2.B. Compound 'R' when analysed by HPLC on a 25 cm length column was found to elute at 6.07 min. The peak width at base was found to be 1.87 min. Calculate the number of theoretical plates and justify whether the calculated number of theoretical plates is acceptable or not. **(3)**

TURN OVER

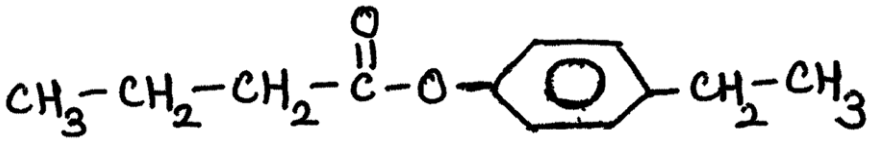
Q.3.A. Answer the following: (Any two) **(8)**

i. Explain anisotropy in ^{1}H NMR spectroscopy with the help of any two suitable examples.

ii. Suggest a suitable spectroscopic method to distinguish the following pairs of compounds, giving spectral characteristics.



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



Q.3.B. Draw the diagram of rheodyne injector showing 'LOAD' and 'INJECT' position in HPLC analysis **(3)**

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

i. Explain any one ionization technique used in mass spectrometer

ii. Draw a diagram showing various components of a ^{1}H NMR spectrometer. Explain the term chemical shift with respect to ^{1}H NMR spectroscopy.

iii. Explain linearity studies with reference to analytical method validation

Q.4.B. Write the Van-deemeter equation and state what each term means. Draw diagram to depict Van-deemeter equation **(3)**

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

i. Explain the working of any one pump used in HPLC instrument.

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

Molecular formula: $C_5H_{10}O$
I.R. (cm^{-1}): 1710, 2900
1 H-NMR (δ-ppm)= 1.1 (d) (6H)
2.1 (s) (3H)
2.6 (septet) (1H)

Give appropriate justification for your answer.

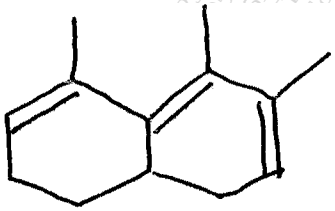
TURN OVER

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

Molecular formula: $C_8H_{10}O$
I.R. (cm^{-1}): 3050, 2963, 1600, 1500, 1200
1 H-NMR (δ-ppm)= 2.3 (s) (3H)
3.8 (s) (3H)
6.8 (d) (2H)
7.2 (d) (2H)

Give appropriate justification for your answer.

Q.5.B Predict the λ max for the following compound showing UV absorbance: **(3)**



Q.6.A. Answer the following: <u>(Any two)</u> **(8)**

i. Give schematic classification of chromatographic methods.

ii. Explain one method that can be used for multicomponent analysis by UV spectroscopy.

iii. Distinguish between UPLC and HPLC (any 4 points).

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