**Time: 3 Hours** **Max. Marks: 75**

**Note:**

1. **Draw net labeled diagrams wherever applicable**

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| **I.** | **Multiple choice questions** | **20M** |
| 1. | The following quantitation methods in UV - Visible spectroscopy need a reference standard except | 1M |
| a. | Standard curve method | |
| b. | Single point standardization | |
| c. | Double point standardization | |
| d. | Use of standard absorptivity | |
| 2. | Molar absorptivity is expressed as? | 1M |
| a. | Gram/100 ml | |
| b. | Gram/litre | |
| c. | Moles/ml | |
| d. | Moles/litre | |
| 3. | Which one of the following is an example of wavelength selector in uv-visible spectroscopy? | 1M |
| a. | Detector | |
| b. | Monochromator | |
| c. | Light source | |
| d. | Amplifier | |
| 4. | Paracetamol and Ibuprofen combination can be analyzed by using the following method? | |
| a. | Difference spectroscopy | |
| b. | Simultaneous equation | |
| c. | Calibration graph method | |
| d. | Use of standard absorptivity value | |

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| 5. | IR spectrum is a plot of? | 1M |
| a. | % Transmittance versus wavenumber | |
| b. | Absorbance versus wavelength | |
| c. | Peak area versus retention time | |
| d. | Absorbance versus concentration | |
| 6. | Stretching vibration is associated with? | 1M |
| a. | Change in bond rotation | |
| b. | Change in bond angle | |
| c. | Change in bond length | |
| d. | Change in chemical composition | |
| 7. | Which of the following is used in preparation of solid sample for IR spectroscopy | 1M |
| a. | Potassium carbonate | |
| b. | Potassium bromide | |
| c. | Potassium hydroxide | |
| d. | Potassium nitrate | |
| 8. | In flame photometry, as the energy gap between excited and unexcited metal atoms increases, the proportion of atoms in the ground state | 1M |
| a. | Increases | |
| b. | Decreases | |
| c. | Remains unaffected | |
| d. | Increases or decreases | |
| 9. | Atomic absorption spectroscopy involves? | 1M |
| a. | Measurement of concentration of elements | |
| b. | Measurement of concentration of molecules | |
| c. | Measurement of molecular mass | |
| d. | Measurement of degree of crystallinity | |

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| 10. | Nephelometry is based on? | 1M |
| a. | Light scattering | |
| b. | Light transmission | |
| c. | Light absorption | |
| d. | Light reflection | |
| 11. | The term _____is independent of the flow rate of mobile phase in column chromatography | 1M |
| a. | HETP | |
| b. | Mass transfer | |
| c. | Longitudinal diffusion | |
| d. | Eddy diffusion | |
| 12. | In paper chromatography, separation is based on the principle of ____phenomenon | 1M |
| a. | Partition | |
| b. | Adsorption | |
| c. | Size Exclusion | |
| d. | Ion exchange | |
| 13. | In electrophoresis, as the ionic strength of the buffer is decreased, | 1M |
| a. | rate of migration of charged particle decreases | |
| b. | rate of migration of the charged particle increases | |
| c. | No change in the migration rate of the charge particle | |
| d. | Particle becomes immobile | |
| 14. | In Gas chromatography, derivatization of a sample is carried out to: | 1M |
| a. | increase polarity of the analytes | |
| b. | increase volatility of the analytes | |
| c. | decrease solubility | |
| d. | Decrease detector response | |

15. Parameter used for the qualitative analysis by HPLC is 1M

a. Retention time

b. Peak height

c. Peak Area

d. Width at the base

16. Selectivity Factor in column chromatography is associated with 1M

a. Ability of the column to hold the sample component of a mixture

b. Ability of the column to efficiently separate components of a mixture

c. Presence of an asymmetric peak in the chromatogram

d. Selection of polarity of the mobile phase used for separation

17. A mixture of compounds X, Y , Z and M after separation by RP HPLC using mobile phase methanol : water (50:50) showed retention times of 2.5min, 2.8min, 12 min and 15 min respectively. Following is the most non polar component 1M

a. X

b. Y

c. Z

d. M

18. Resin of ion exchange are formed by polymerization of styrene and ?_____ 1M

a. Benzene

b. Chlorobenzene

c. Divinylbenzene

d. Bromobenzene

19. Separation based on molecular size occurs in _____ chromatographic technique 1M

a. Ion-exchange

b. Gel

c. Affinity

d. Gas

20. The chromatographic method of separating biological mixtures based on specific biological interactions is? 1M

a. Gel

b. TLC

c. Affinity

d. Ion exchange

**II. Long answer questions (Attempt <u>any two</u> out of three) 20M**

1. a. State Beer Lambert's law. Give its derivation. 5M

b. Explain the principle for IR spectroscopy. Give any two applications for IR spectroscopy 5M

2. a. Explain the term Radial Chromatography with a suitable diagram. Give one spraying agent used in paper chromatography. 5M

b. Classify the different types of ion exchange resins. Give suitable examples for each type. 5M

3. a. Enlist any four detectors used in Gas chromatography. Explain any one detector in detail. Support your answer with a suitable diagram 5M

b. An analyte X when passed through column A of length 12 cm showed a retention time of 7 mins with peak width of 0.54 mins at half the peak height. The same analyte X when subjected to chromatographic analysis on column B of length a 25cm, eluted out at a retention time of 12 mins and had a peak width of 0.72 mins at the base. Which column is more efficient for the separation of analyte X and why ? 5M

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| **III.** | **Short answer questions (Attempt <u>any seven</u> out of nine)** | **35M** |
| 1. | Enlist the methods for multicomponent analysis in UV - Visible spectroscopy.<br>If a 12µg/ml solution of molecule $C_8H_9NO_2$ gives an absorbance of 0.86 at its $\lambda_{max}$ in a 1cm cell, what is its molar absorptivity? | 5M |
| 2. | Explain the terms: i. Fluorescence ii. Phosphorescence.<br>Enlist any four factors affecting fluorescence intensity. | 5M |
| 3. | Write two points of distinction between atomic absorption spectroscopy and flame photometry. Explain principle of atomic absorption spectroscopy. | 5M |
| 4. | Enlist the detectors used in uv-visible spectroscopy. Write a detailed note on any one of them. | 5M |
| 5. | Give the principle of separation of compounds using thin layer chromatography. Give a detailed account of the methods used for detection of separated compounds in thin layer chromatography | 5M |
| 6. | Discuss guard column in HPLC. Explain the term isocratic elution and give one advantage and disadvantage of the Isocratic elution. | 5M |
| 7. | Write a note on paper electrophoresis. Give any two applications of paper electrophoresis. | 5M |
| 8. | Explain the term headspace analysis. Give its application. Enlist the carrier gases used in gas chromatography | 5M |
| 9. | Write a note on stationary phase and mobile phase employed in affinity chromatography | 5M |

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