

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5513

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Unique Paper Code : 2512043601

Name of the Paper : Analytical Instrumentation -II

Name of the Course : B.Sc. (H) Instrumentation

Semester : VI

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions in all. Question No. 1 is compulsory. **All** questions carry equal marks. Use of non-programmable scientific calculator is allowed.

1. (a) Why Hydrogen molecule does not exhibit any absorption in the IR region? (3)
(b) "Magnesium and Silver atoms exhibit different absorption profile in Flame Atomic Absorption Spectroscopy"- Explain the reason. (3)
(c) Represent a glass-calomel electrode used for pH measurement with standard Schematic diagram. (3)
(d) Why are silica particles end capped in bonded reverse phase chromatography? (3)
(e) Ethanol and Methanol are separated in capillary GC column with retention time of 370 and 390 s, respectively and the base widths of 16.0 and 17.0s. An unretained air peak occur at 10.0s. Calculate selectivity factor and the resolution. (3)
(f) Explain various processes occurring during sample atomization in Flame emission spectroscopy. (3)
2. (a) A ketone possesses an absorption band with a peak centered around 1710 cm^{-1} . From this information deduce a value for the force constant of the double bond. (6)
(b) How the column of HPLC is different from GLC columns? What are the advantages of smaller ID HPLC columns? (6)
(c) Explain the principle and construction of a Primary Reference Electrode used in potentiometric methods of analysis. (6)
3. (a) Calculate the absorption frequency corresponding to the -C—H stretching vibration treating the group as a simple diatomic C—H molecule with a force constant of $k=5.0\times 10^2\text{ N/m}$. (5)

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- (b) What types of interferences are observed in AAS? Suggest a few methods to overcome these interferences. (6)
- (c) Derive an expression for estimating the hydrogen ion concentration using potentiometric methods. (7)
4. (a) What is the energy possessed by a radiation of wavenumber 1000 cm^{-1} ? What is the wavelength corresponding to a wavenumber of 1700 cm^{-1} ? (5)
- (b) Explain the construction and working of total consumption and laminar flow types of atomizers used in AAS. List some of their advantages and disadvantages. (4+2)
- (c) Why the electrodes of first kind are seldom used for potentiometric analysis? Explain the types of indicator electrodes that could be used in place of these electrodes. (7)
5. (a) What do you understand by the term degassing in HPLC? Suggest any four methods used for this purpose. (6)
- (b) Describe the various modes of vibrations in a molecule joined by the covalent bond. (6)
- (c) A pesticide sample is received in an analytical lab. The sample is volatile in nature. Suggest a suitable chromatographic technique for the analysis. Draw the block diagram of the instrument and explain its instrumentation considering the nature of the sample. (6)
6. (a) Explain the principle of any one type of detector used with a non-dispersive type IR instrument. (5)
- (b) Explain the construction and working of any two selective analyte types HPLC detectors. (6)
- (c) Draw schematic diagram of a double beam dispersive IR spectrophotometer. Briefly explain the role of each component. How is it different from a double beam UV -Vis spectrophotometer? (2+4+1)
7. (a) Why temperature programming is a good technique to achieve desired resolution in Gas chromatography? Explain. (5)
- (b) Explain different types of sample injection methods used in GLC instrument. (6)
- (c) Explain the principle of Ionophore based liquid membrane electrodes. Write some of its advantages and limitations. (4+2+1)