

This question paper contains 5 printed pages]

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S. No. of Question Paper : **1842**

Unique Paper Code : **2173012016**

Name of the Paper : **DSE : Analytical Methods in Chemistry**

Name of the Course : **B.Sc. (Hons.) Chemistry**

Semester : **IV/VI**

Duration : **3 Hours**

Maximum Marks : **90**

(Write your Roll No. on the top immediately on receipt of this question paper.)

The question paper consists of 8 questions in all.

Attempt any six questions.

All questions carry equal marks.

1. (a) Discuss the concept of blank analysis in analytical chemistry. How is it possible to apply blank analysis in minimization of systematic errors ?
- (b) In a dataset of five measurements : 12.4, 12.6, 12.5, 12.7, 12.3, compute the mean, standard deviation and relative standard deviation.
- (c) Give an outline of the general steps involved in an analytical procedure. Briefly describe each step.

5,5,5

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2. (a) Compare the operations of a single beam and a double beam spectrophotometer.
- (b) What are the drawbacks of the Beer Lambert's law. A 20 ppm solution of a DNA molecule (unknown molecular weight) isolated from *Escherichia coli* was found to give an absorbance of 0.80 in a 2 cm cell. Calculate the absorptivity of the molecule.
- (c) Explain the concept of charge transfer transitions in UV-Visible spectroscopy. 5,5,5
3. (a) What is Thermogravimetry ? What are the various components of a thermobalance ? Explain working of a thermobalance giving a schematic diagram.
- (b) Enumerate the principle of TGA and write down any four applications of TGA.
- (c) A mixture of CaO and CaCO₃ is analyzed using TGA technique. The TG curve of the sample shows a change of mass from 150 mg to 110 mg between 650°C and 920°C. Calculate the percentage of calcium carbonate in the mixture. 5,5,5
4. (a) Explain the method of solvent extraction using continuous process when the organic phase (extractant) is heavier than water with the help of a diagram.

- (b) 5 g of compound A is dissolved in 90 mL of water. The partition coefficient for compound A between hexane and water is 5.
- (i) How much of compound A will be extracted in hexane if it is extracted from aqueous solution with 90 mL of hexane ?
- (ii) How much of compound A will be extracted in hexane if three consecutive extractions are performed using 30 mL of hexane each time and then combine the hexane extracts ?
- (c) Describe *two* principal solvent extraction systems for metal ions. Give examples of each. Ninety-six percent of a solute is removed from 100 mL of an aqueous solution by extraction with two 50 mL portions of an organic solvent. What is the distribution ratio of the solute ? 5,5,5
5. (a) Explain the process of sample delivery in flame spectroscopy and describe how atomization of the sample is achieved during the analysis.
- (b) Discuss the importance of obtaining good resolution in chromatography. Describe other factors influencing the separation of components in chromatography.

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- (c) Classify different chromatographic techniques and their underlying principles. Discuss various applications of chromatography. 5,5,5
6. (a) Discuss various equilibrium processes involved the solvent extraction of metal ion from an aqueous solution using a chelating agent. Write an expression the distribution ratio (D) of the chosen system. Mention the condition for better extraction of metal chelates
- (b) What is a Q-test in analytical chemistry ? Discuss how is it useful in rejecting or retaining of data obtained for an experiment.
- (c) Compare flame emission spectrometry and flame atomic absorption spectrometry with respect to applicability of instrumentation, sensitivity and interferences. 5,5,5
7. (a) A serum sample is analyzed for potassium by flame emission spectrometry using the method of standard additions. Two 0.500 mL aliquots are added to 5.00 mL portions of water. To one portion is added 10.0 μ L of 0.0500 M KCl solution. The net emission signals in arbitrary units are 32.1 and 58.6. What is the concentration of potassium in the serum ?
- (b) Name the various interferences in Atomic Absorption spectroscopy. How can chemical interferences be removed in AAS ?

(c) What are the various laws governing the absorption of UV radiations by a sample ? Which of the following pairs of compounds is likely to absorb radiation at the longer wavelength and with greater intensity ?

(i) Propanoic acid and Prop-2-enoic acid

(ii) Hexan-2, 4-diene and hexan-2, 4-diyne

(iii) Toluene and anisole. 5,5,5

8. (a) What is achromatogram ? What are the various methods of development of chromatogram ? Explain any *one* of them.

(b) Describe the principle and technique of column chromatography. How does the technique serve as a useful analytical technique ?

(c) Define the term accuracy. Why no measurement can be done with absolute certainty ? How is accuracy expressed ? 5,5,5

