Duration: 2 1/2 Hrs

N. B.: 1. All questions are compulsory
2. Figures to the right indicate full marks.

Q.1) (A) Attempt ANY TWO of the following: (8)
   (i) How is sample register maintained? Discuss the important points to be documented when a particular sample is registered.
   (ii) Explain subsampling and storage of samples.
   (iii) State the reasons for obtaining incorrect analytical results. How one can correct the results?
   (iv) How is calibration of measurement done?

   (B) Explain the “method validation” of analytical processes. (4)
   OR
   (B) Explain the importance of charting in analysis of result (4)

Q.2) (A) Attempt ANY TWO of the following: (8)
   (i) How does signal to noise ratio (S/N) affect the sensitivity and detection limit of the instrument?
   (ii) Write a note on FDA and its role in pharma and food industry.
   (iii) Explain the uncertainty evaluation process with reference to specification and identification.
   (iv) Explain the Boxcar Technique used to reduce noise.

   (B) Three measurements and their uncertainties are as follows: (4)
   Measurement:  a= 11.38,  b=9.89,  c=10.29
   Uncertainties:  a= 0.012,  b=0.011  c=0.008
   If the final measurement is of type Y=a +b +c, calculate the combined uncertainty in the measurement of Y
   OR
   (B) The following data were obtained for a current measurement in mA on a noisy system :15.86, 16.57, 18.09, 11.40, 15.91, 12.21, 15.85, 13.77, 11.85, 16.53
   Assuming that the noise is random, Calculate the signal to noise ratio of the system.

Q.3) (A) Attempt ANY TWO of the following: (8)
   (i) Explain the principle of Ion Chromatography with the help of instrumentation diagram.
   (ii) Discuss the applications of supercritical fluid extraction method in food and environmental analysis.
   (iii) Write a note on ‘Synthetic Ion Exchangers’
(iv) Discuss the terms, ion exchange equilibrium and break through capacity of resin?

(B) Elaborate the term critical and supercritical state of the matter. (4)

OR

(B) Calculate the number of mili grams Na\(^+\) and Ca\(^{2+}\) taken up by 5.250g of cation exchange resin with exchange capacity of 4.250 m mol/g of resin (At wt of Na= 23 and Ca=40) (4)

Q.4) (A) Attempt ANY TWO of the following: (8)

(i) What is inverse gas chromatography? What are its applications?

(ii) How is affinity chromatography used in the separation of biomolecules?

(iii) Write a note on “Inorganic molecular sieves”

(iv) What is pressure programming? Why it is used in supercritical fluid chromatography?

(B) What is the difference between gel permeation chromatography and size exclusion chromatography? (4)

OR

(B) What are the types of columns and detectors used in supercritical fluid chromatography? (4)

Q5) Attempt ANY FOUR of the following: (12)

(i) Give details of quality control in the laboratory.

(ii) Explain the importance of good laboratory practices.

(iii) Elaborate the term “Thermal Noise”

(iv) List the hardware devices used for noise reduction.

(v) Explain the role of suppressor column in Ion Chromatography.

(vi) Give an account of non-aqueous ion exchangers.

(vii) Describe the retention behaviour in exclusion chromatography.

(viii) Describe the instrumental method for the determination of molecular weight of polymers.

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