(2½ Hours) [Total Marks : 60

N. B. : (1) **All** questions are **compulsory.**
(2) **Figures** to the **right** indicate **full** marks.
(3) The use of a log table or a non-programmable calculator is permitted.

1. (a) Attempt any **two** of the following :– 8
(i) State the reasons for obtaining incorrect analytical results. How can one correct the results?
(ii) How is sample register maintained? What are the points to be documented regarding a particular sample in the register?
(iii) Explain the "method validation" of analytical processes.
(iv) What is sampling scheme? How does it varies with bulk size?

(b) Write a detailed note on 'Calibration of Measurement'. 4

OR

(b) Give an account of acceptance criteria of sample. 4

2. (a) Attempt any **two** of the following :– 8
(i) Explain the uncertainty evaluation process with reference to specification and identification.
(ii) Explain the terms "Limit of Detection" and "dynamic range".
(iii) What is FDA? What is its role in pharma and food industry?
(iv) How does S/N ratio affect the sensitivity and the detection limit of the instrument?

(b) Three measurements and their uncertainties are as follows:– 4
Measurements: 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 the type Y = a + b + c, calculate the combined uncertainty in the measurement of Y.

OR

(b) The following data in 'g' were obtained for the replicate weighing of a 2.000 g standard weight on a balance: 4
2.003, 1.995, 2.001, 2.005, 2.006, 1.999, 2.007, 1.998, 2.007
Assuming the noise is random, calculate the signal to noise ratio for the said balance.

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3. (a) Attempt any **two** of the following :– 8
   (i) Describe liquid ion exchangers.
   (ii) What do you mean by critical and supercritical state of the matter?
   (iii) Give an account of "inorganic ion exchangers".
   (iv) What are chelating resins? Describe their applications with appropriate examples.

   (b) Calculate the amount in 'mg' of sodium and calcium retained by 4.150 g of the cation exchange resin with an exchange capacity of 3.750 m mol/g of the resin. (at. wt. Na = 23, Ca = 40) 4

   OR

   (b) Explain the role of suppressor column in ion chromatography. 4

4. (a) Attempt any **two** of the following :– 8
   (i) Why is CO_2 the supercritical fluid of choice?
   (ii) Write note on "inorganic molecular sieves".
   (iii) Describe the different modes of elution with respect to affinity chromatography.
   (iv) What is the difference between gel permeation chromatography and size exclusion chromatography?

   (b) Discuss the principle and applications of inverse gas chromatography. 4

   OR

   (b) With the help of a neat schematic diagram, explain the setup used in the supercritical fluid chromatography with special reference to the function of each component. 4

5. Attempt any **four** of the following :– 12
   (i) Explain the terms "quality assurance" and "quality control" with reference to the chemical industry.
   (ii) What is meant by random sampling?
   (iii) How is signal to noise ratio enhanced by
   (a) Filtering (b) Integration.
   (iv) Elaborate the term 'Flicker Noise'.
   (v) State the applications of ion chromatography.
   (vi) Give an account of non aqueous ion exchangers.
   (vii) Discuss the retention behaviour in exclusion chromatography.
   (viii) Describe the instrumental method for the determination of molecular weight of polymers.