

3 hrs

(100 Marks)

NB: All questions are compulsory
 Figures to right indicate full marks
 Use of log table or non-programmable calculator is allowed
 Answers of the same question as far as possible write together

Q 1. A. Fill in the blanks with suitable option and rewrite the statement. (12)

- i. Thin layer chromatography is a type of _____ chromatography.
 a. adsorption b. partition c. ion-exchange
- ii. _____ is a separation method
 a. Ion exchange b. Conductometry c. pH metry
- iii. Partition coefficient & distribution ratio will be _____
 a. always equal b. always different
 c. will be equal only if the molecular condition of the solute is the same
- iv. The method of separation of two immiscible liquids that differ in density is _____
 a. solvent extraction b. centrifugation c. distillation
- v. In potentiometric titrations an electrode whose potential changes during the course of titration is called _____ electrode.
 a. reference b. saturated calomel c. indicator
- vi. A salt bridge is used in potentiometric measurements for connecting two _____.
 a. beakers containing electrolytes b. half cells c. indicator electrodes
- vii. A conductivity cell contains _____ electrode
 a. silver b. nickel c. platinized platinum
- viii. The unit of cell constant is _____
 a. S b. $S\text{ cm}^{-1}$ c. cm^{-1}
- ix. The Gaussian curve is symmetrical around _____.
 a. μ b. x c. S
- x. The F-test is used for _____.
 a. testing of significance b. rejection of data c. obtaining the best fitting line
- xi. The range _____ will cover 68.3% of the total population in Gaussian distribution curve.
 a. $\mu \pm 2\sigma$ b. $\mu \pm \sigma$ c. $\mu \pm 3\sigma$
- xii. Confidence limit is defined as _____
 a. ts/\sqrt{n} b. ts/n c. $\sqrt{ts/n}$

B. State whether the following statements are true or false (3)

- i. R_f value is independent of solvent system.
- ii. Coloured solutions can be titrated potentiometrically.
- iii. To obtain the normal error curve, small number of measurements are satisfactory.

C. Match the following:

- | A | B |
|--------------------------------|------------------------------------|
| 1. Separation of metal ions | a. Separation of proteins |
| 2. Electrophoresis | b. Testing of significance |
| 3. Platinum electrode | c. Reference Electrode |
| 4. Saturated Calomel Electrode | d. Paper Chromatography |
| 5. Null hypothesis | e. Conductivity cell |
| | f. Separation of uncharged species |

- Q 2. A. (i) Explain the term retardation factor. Give the significance for the qualitative analysis carried out in thin layer chromatography. (5)
- (ii) Give an account of physical methods of separation. (3)

OR

- A. (i) Compare and contrast Thin Layer (TLC) and Paper Chromatography? (5)
- (ii) What is the difference between partition coefficient and distribution ratio? (3)
- B. (i) 100 cm³ of an aqueous solution containing 1.2 g of solute is extracted three times with 20 cm³ portions of an organic solvent. The distribution ratio in favour of organic phase is 60. Calculate the amount of solute remaining un-extracted at the end of third extraction. (5)
- (ii) What is R_f value? How is it useful for separation? (3)

OR

- B. (i) What is the minimum value of the distribution ratio D which would allow 99.7% extraction of solute from 50 cm³ of an aqueous solution with four successive 30 cm³ portions of ether? (5)
- (ii) Explain the classification of chromatographic methods on the basis of the stationary and mobile phase. (3)

- C. (i) What are the different types of detectors used in HPLC? Discuss any one of it in detail. (4)

OR

- (ii) What are the factors that affect the extraction in solvent extraction process? (4)

- Q 3. A. (i) What is indicator electrode? Which are the electrodes that can be used as indicator electrodes in acid base titrations? (5)
- (ii) What are the advantages of conductometric titrations? (3)

OR

- A. (i) Explain the basic principle of conductometric measurements. Explain the construction of conductivity cell. (5)

(ii) What are the applications of potentiometric titrations? (3)

B. (i) Explain the nature of the curve for the titration of (i) strong acid against strong base and (ii) weak acid against weak base conductometrically. (5)

(ii) What is a pH meter? Explain any two types of pH meters. (3)

OR

B. (i) What is a quinhydrone electrode? Derive an expression between E_{cell} and pH using quinhydrone in acidic medium. (5)

(ii) With the help of a diagram discuss the construction of combined pH electrode. (3)

C. (i) Explain the principle of potentiometric titrations. (4)

OR

(ii) Discuss the applications of pH metry in biological and environmental analysis. (4)

Q 4. A. (i) The pH of a solution was determined with following results (5)

Trial	1	2	3	4	5	6
pH	4.50	4.53	4.55	4.51	4.57	4.52

Calculate the standard deviation and variance.

(ii) Explain 2.5 d rule and 4 d rule for the rejection of doubtful data. (3)

OR

A. (i) What is Gaussian distribution curve? Describe salient features of this curve? (5)

(ii) Calculate the mean and median for the following sets of values: (3)
19.60, 19.49, 19.63, 19.58, 19.59

B. (i) For the data in the following table, derive an equation of the type $y = mx + c$ by the method of least square (5)

x	1	2	3	4	5	6	7
y	2.5	3.1	3.6	4.2	4.5	5.0	5.6

(ii) Explain Null hypothesis. (3)

OR

B. (i) Explain different methods used to describe a precision of a measurement. (5)

(ii) In the analysis of sulphur content of a sample, the following values were reported: 0.47, 0.47, 0.48, 0.50 (3)

Find whether the value 0.50 can be retained on the basis of the Q-test.

($Q_{\text{tab}} = 0.76$)

c. A large number of measurements for the estimation of traces of titanium in several samples from the same source, gave a standard deviation of 0.1 ppm of titanium. If a single measurement of a particular sample gave 7.85 ppm titanium. Calculate the true mean with 95% confidence limit. (4)

(Z for 95% confidence limit = ± 1.96)

OR

- C. Define: a) The true value of a measurement b) Median (4)
c) Number of degree of freedom

Q 5. Answer **any four** of the following. (20)

- A. A 150 cm³ of aqueous solution containing 0.2 g of iodine is equilibrated with 100 cm³ of carbon tetrachloride. The distribution coefficient between carbon tetrachloride and water at room temperature is 75 in favour of carbon tetrachloride. Calculate the weight of iodine remaining un-extracted in the aqueous layer after
(i) two extractions with 50 cm³ of CCl₄
(ii) four extractions with 25 cm³ of CCl₄.
- B. Discuss the applications of thin layer chromatography?
- C. Discuss advantages and limitation of potentiometric titrations.
- D. Explain the various graphical methods used to determine the equivalence point in potentiometric titrations.
- E. Describe the method of least square for obtaining the best fitting line.
- F. For the data in the following table, derive an equation of the type $y = mx$ by using the method of averages:

x	0	1	2	3	4	5
y	0.0	2.2	4.5	7.1	9.6	11.6

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