Time: 3 Hours   **Marks: 100 Marks**

Note: 1 All questions are compulsory
       2. Figures to right indicate full marks
       3. The use of log-table/nonprogrammable calculator is allowed.

Q 1   **A**   Select the correct option & complete the sentences (**any TWELVE**)   **(12)**

i.   Electrophoresis is a _____ method.
     a. separation   b. electroanalytical   c. thermal

ii.   _____ is a chemical method of separation.
     a. Precipitation   b. Centrifugation   c. Filtration

iii.   Solvent extraction is governed by _____ law.
     a. Nernst Distribution   b. Beer's   c. Boyle's

iv.   Chromatography consists of _____ phases.
     a. three   b. infinite   c. two

v.   In chromatography R_f value is _____ factor.
     a. real   b. rate   c. retardation

vi.   _____ is a planar chromatographic technique.
     a. GLC   b. TLC   c. GSC

vii.   Quinhydrone electrode is used as _____ electrode in acid base potentiometric titration
     a. reference   b. indicator   c. counter

viii.   When a strong base like NaOH is added to the solution of strong acid, pH of mixture _____
     a. remains constant   b. increases   c. decreases

ix.   The unit of conductance is _____.
     a. Siemens   b. ohms   c. volts

x.   In conductometric titrations, _____ is measured during the course of titration.
     a. pH   b. corrected conductance   c. conductance

xi.   If the pH of the aqueous solution is 11.2, then it will be _____.
     a. acidic   b. neutral   c. alkaline

xii.   The plot of pH vs. volume of titrant added is _____ shaped.
     a. "V"   b. "U"   c. "S"

xiii.   Variance is _____ .
     a. s^2 b. s   c. v^2

xiv.   Mode of the following set of data is _____.
Data: 19.10,   19.12,   19.10,   19.11
     a. 19.11   b. 19.12   c. 19.10

xv.   In normal error curve _____ is plotted on Y - axis.
     a. observation   b. frequency of occurrence   c. mean

70511

xvi. Confidence limit using range can be obtained by _____ formula.

    a. $\pm C_n$ R   b. C_v R   c. C_w R

xvii. _____ is used as rejection of the doubtful observation from the set.

    a. F – test   b. T - test   c. Q - test

xviii Null hypothesis is valid means _____.

    a. $t_{cal} < t_{tab}$ b. $t_{cal} > t_{tab}$ c. $t_{cal} = t_{tab}$

Q 1   **B**   State whether the following statements are true or false (any **THREE**)   **(03)**

i. The partition coefficient and distribution ratio are always same.

ii. Batch extraction method is used for solvent with small "D" value.

iii. Potential of an indicator electrode remains constant.

iv. Glass electrode is a type of ion selective electrode.

v. The process of finding, how dependent variables are linked to independent variable is known as regression analysis. .

vi. Variance ratio test is also known as Q - test.

Q 1   **C**   Match the columns (Any **FIVE**)   **(05)**

Column A	Column B
1. Distillation	a. Rejection of result
2. Adsorbent	b. Volatilization
3. Saturated KCl	c. Centrifugation
4. Glass electrode	d. Salt bridge
5. Gaussian curve	e. pH – metry
6. 4.0 d rule	f. Al_2O_3
	g. Conductometry
	h. Bell - shaped

Q 2   Answer Any **FOUR** of the following   **(20)**

a. What are the different types of separation methods? Explain any two of them in detail.

b. Prove that multiple extractions using small volume of extractant are more efficient than carrying out a single extraction involving same total volume.

c. i. Explain the term "separation factor".

ii. When 0.1 dm^3 of an aqueous solution containing 0.2 g of a substance "S" is extracted with 0.5 dm^3 of ether; the ether layer was found to contain 0.186 g of "S". Calculate distribution ratio ($D_{o/w}$) in favour of ether.

d. Describe the preparation of plates used in TLC. What are the other steps involved in TLC?

70511

e. 100 cm^3 of aqueous solution containing 100 μg of substance "M". the solution is to be extracted with an organic solvent. If the distribution ratio D = 12.0, calculate

(i) The extraction efficiency for five extractions using 100 cm^3 solvent.

(ii) the minimum number of extractions using 10 cm^3 solvent to leave 1μg of "M" un-extracted.

f. What are the different methods used for the development of chromatogram in paper chromatography? Explain any one of it in detail with suitable diagram.

Q 3 Answer Any **FOUR** of the following **(20)**

a. Describe different methods used to determine the equivalence point from the "S" shape graph of E$_{cell}$ vs. volume of titrant added.

b. What are the advantages and limitations of conductometric titrations?

c. Describe construction and working of glass electrode.

d. What is the principle of conductometric titration? Give an account of conductivity cell with a neat and labelled diagram.

e. Explain the terms with suitable examples and give electrode representation:

    i. Indicator electrode   ii. Reference electrode

f. What is the principle of pH–metry? Give an account of titration curve when a strong acid is neutralized by a strong base using pH meter.

Q 4 Answer Any **FOUR** of the following **(20)**

a. What is variance ratio test?

Following are the two sets of observations for analysis of calcium in the given sample of limestone by two independent methods. Verify whether the two standard deviations are same or different.

Set I (% Ca)	10.25	10.32	10.40	-
Set II (% Ca)	10.42	10.29	10.35	10.26

b. What are the salient features of Gaussian distribution curve?

c. The following table gives dependence of y on x

x	0	1	2	3	4	5
y	0.0	2.4	4.7	7.3	9.8	11.8

Assuming a linear relationship between the variables make least square analysis of the data to derive an equation of the type y = mx

d. What is Q – test? What are the different steps involved in Q – Test?

e. In the analysis of a sample for its Fe content, the values reported are: 4.5, 4.7, 4.6 and 4.9. on the basis of 2.5 d rule and 4.0 d rule, find whether the value 4.9 can be retained or rejected.

Page **3** of **4**

70511

f. The following results were obtained in the replicate analysis of the samples of blood for its lead content

Sample I (ppm)	0.752	0.756	0.760
Sample II (ppm)	0.764	0.768	0.772

If the combined standard deviation value is 0.004. Find whether the two methods differ statistically or only numerically.

Q 5 Answer Any **FOUR** of the following **(20)**

a. Explain the term chromatography. Give classification of chromatogra- phic methods on the basis of nature of phases involved in it.

b. What are the criteria for selection of an extracting solvent?

c. Explain any two applications of conductometry in neutralization titrations.

d. What are the different types of pH meters? What is the use of pH metry in biological analysis?

e. Five replicate measurements for the determination of iron in the sample gave the following results:

15.61, 15.52, 15.63, 15.68 and 15.64

Calculate 95% confidence limit for the mean if

i. No additional information about the precision of the method is known.

ii. A large number of measurements have given $\sigma = 0.02$

$(t = 2.78, Z = 1.96$ at 95% confidence limit.)

f. In six lead determinations from the sample, each of which contain 400 mg of Lead, the following results were obtained.

Sample	1	2	3	4	5	6
Pb in mg	398	392	398	396	393	401

Calculate the mean, median, range, average deviation and standard deviation

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70511