

Post Graduate Teaching Department of Chemistry
Master of Science (M.Sc.) Semester-I (CBCS) (Chemistry) Examination
Analytical Chemistry (CH-104)
Paper-IV

Time: Three Hours]

[Max. Marks: 60

- N.B.: 1. All questions are compulsory and carry equal marks
 3. Use of Calculator is permitted
 4. Draw labelled diagrams wherever necessary

- 1 (a) Discuss classification of analytical techniques based on their principles. 6
 (b) A dye forms colourless complex with nickel metal ion. The effect of nickel concentration on the colour intensity was plotted from the following observation table. Calculate the correlation coefficient and interpret your result. 6

Conc of Ni ²⁺ (mM)	2	4	6	8	10
Absorbance	1.03	0.91	0.83	0.70	0.60

OR

- 1(c) You have developed a new spectrofluorometric method for estimation of Ni(II) in a solution using a new reagent 'R'. How will you validate your method for 'Accuracy' and 'Precision'? 6
 (d) An enzymatic method for determining alcohol in wine is evaluated by comparison with gas chromatography method. The same sample was analyzed by two methods giving following results. Determine if the means of the two methods differ significantly at 95% confidence level. ($t = 2.776$ for $v = 4$ at 95 % confidence level). 6

Enzymatic method (%)	13.1	12.7	12.6	13.3	13.3
GC method (%)	13.5	13.3	13.0	12.9	13.0

- 2(a) Explain principle, technique and any two applications of TLC. 6
 (b) Define 'ion exchange capacity'. A 0.5 g anion exchanger in Cl⁻ form was eluted with excess of sodium sulphate solution. The volume of eluate was made up to 100 mL. From this, 20 mL solution was titrated with 0.10 M AgNO₃ requiring 13.5 mL for complete precipitation of chloride ions; calculate the ion exchange capacity of resin. 6

OR

- 2(c) State various factors governing solvent extraction efficiency. If the distribution coefficient of a solute between two solvents is 10 in favour of organic solvent, calculate the percentage extraction from 100 mL aqueous solution into 50 mL organic solvent if two aliquots of 25 mL are used for extraction. 6

- (d) What are crown ethers and cryptands? Explain their application in solvent extraction. 6

- 3(a) Explain the phenomena of masking and demasking with suitable examples. 6

- (b) The solubility of AgCl in water at 25 °C is 1.85 mg/L. Calculate its solubility product. (Mol. Wt of AgCl = 143.5 g/mol) 6

OR

- 3(c) Explain the theory of redox indicator and show that an emf change of 0.12 V is necessary to observe rapid colour change at the end point. 6

- (d) Write steps involved in gravimetric estimation of barium as barium sulphate. Explain the method of 'ash treatment'. Why is it required? 6

- 4(a) Explain the nature of curve obtained in the conductometric titration of mixture of acetic and oxalic acid with standard NaOH solution. Calculate the volume of NaOH consumed by acetic acid if the two equivalence points are $V_1 = 5.3$ mL and $V_2 = 18.5$ mL. 6

- (b) Explain the construction and working of hydrogen electrode and show that it can be used for pH determination. 6

OR

- 4(c) Explain the application of Kohlrausch law in determination of degree of dissociation of weak electrolyte and solubility of sparingly soluble salt. 6

- (d) Define 'buffer' and 'buffer capacity'. Calculate the pH of buffer which is 0.2 M with respect to NH₄OH and 0.1 M with respect to NH₄Cl. Given that, $K_b = 1.75 \times 10^{-5}$ for ammonium hydroxide. 6

- 5(a) What is the method of least squares in curve fitting? 1½

- (b) Explain the terms: repeatability, robustness and reproducibility. ×8

- (c) What is meant by 'synergistic extraction'?

- (d) What are calixarenes? Give an example.

- (e) Draw titration curve (pH versus volume of titrant) of orthophosphoric acid with NaOH.

- (f) Explain the term 'peptization'.

- (g) What is the effect of dilution on equivalent conductance of strong and weak electrolytes?

- (h) Draw neat diagram of saturated calomel electrode.