

**POST GRADUATE DIPLOMA IN
ANALYTICAL CHEMISTRY (PGDAC)**

Term-End Examination

December, 2023

MCH-001 : BASIC ANALYTICAL CHEMISTRY

Time : 3 Hours

Maximum Marks : 75

Note : (i) Answer **five** questions in all. Q. No. 1 is compulsory.

(ii) All questions carry equal marks.

1. Answer any **five** of the following :

- (a) Illustrate accuracy and precision taking the case of five rifleman shooting bird eye. 3
- (b) Define standard deviation and relative standard deviation with mathematical expressions. 3
- (c) Draw the nature of plot between $\log (P)$ vs. formation time (t). $[P]$ is the concentration of the product. 3

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- (d) Explain redox reactions with a suitable example. 3
- (e) Explain the terms masking and demasking with a suitable example for each. 3
- (f) Give the names of any **three** organic precipitants and draw the structure of any *one* of them. 3
2. (a) Define accuracy and precision. A sample was analyzed five times with results; 31.8, 32.3, 32.7, 31.6 and 32.6 ppm with true value of 32.5 ppm. Calculate mean, median and % relative error. 5
- (b) State the laws of probability of occurrence of error in empirical way. Draw the nature of normal error curve showing mean in terms of σ . 5
- (c) Write briefly about Chi-square (χ^2) test and discuss its significance. 5
3. (a) Discuss briefly the applications of complexometric titrations. 5
- (b) Explain the terms BOD and SPM. For what type of samples these terms are used ? Discuss their significance. 5
- (c) Describe representative sampling of food materials with illustration. 5

4. (a) Describe any **ten** common precautions followed during handling of glassware to avoid risk. 5
- (b) Explain how rate law for second order reaction differs from first order. If half life of a first order reaction is 1.5 s, then calculate its rate constant. 5
- (c) Give the advantages and disadvantages of graphical logarithmic extrapolation method. 5
5. (a) Explain successive dissociation of H_2CO_3 and H_3PO_4 in steps. 5
- (b) Describe the titration of a weak acid and strong base with an example. Draw a pH variation plot of such a system. 5
- (c) Discuss Ostwald's theory of indicators and derive expressions for pH considering an indicator as acid or base. 5
6. (a) What are the different types of non-aqueous solvents ? Discuss any *one* of them. 5
- (b) Explain the cases where potentiometric method yields better equivalence point. Write all the details of potentiometric titration-choice of indicator, reference electrodes. 5

- (c) Schematically illustrate an electrochemical cell considering an example of redox reaction of Zn in CuSO_4 solution. Write the Nernst equation for the system explaining all the terms. 5
7. (a) Define 'redox indicator' and derive an expression for potential for the indicator half cell. Name the indicator used in titration of Fe(II) with Ce(IV) in acidic medium and write its half reaction. 5
- (b) Explain with chemical equation, oxidizing properties of KMnO_4 in acidic, neutral and alkaline medium. How will you prepare a standard solution of KMnO_4 ? 5
- (c) What are metallochromic indicators ? Write names of any *three* of them giving their useful pH range. 5
8. (a) What type of indicators are used in precipitation titrations ? Describe Volhard method for titration of Cl^- with KSCN. 5
- (b) Explain supersaturation and nucleation in the context of gravimetric analysis. 5
- (c) What is the principle involved in electro-analytical methods of analysis ? Name any *four* methods and describe any *one* of these briefly. 5