

**P. G. DIPLOMA IN ANALYTICAL  
CHEMISTRY (PGDAC)**

**Term-End Examination**

**December, 2023**

**MCH-004 : ELECTROANALYTICAL AND  
OTHER METHODS**

*Time : 3 Hours*

*Maximum Marks : 75*

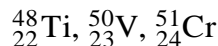
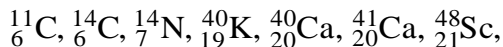
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***Note :** Answer any **five** questions. All questions carry equal marks.*

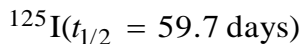
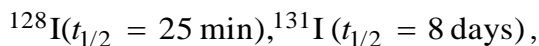
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1. (a) Mark the following statements as True (T) or False (F) : 5
  - (i) Ohm is a unit of electrical conductance. (T/F)
  - (ii) Coulomb is a unit of quantity of electricity. (T/F)
  - (iii) Siemens is a unit of conductance. (T/F)
  - (iv) A galvanic cell is also called voltaic cell. (T/F)
  - (v) Metal with higher positive potential acts as a cathode in a galvanic cell. (T/F)
  
- (b) Differentiate between molar conductivity and limiting molar conductivity. 5

- (c) List the factors affecting the conductivity of the solution. Explain any *one* in detail. 5
2. (a) How does boundary potential of glass electrode change with change in  $H^+$  concentration? Explain. 5
- (b) Explain the term overvoltage. State its importance. 5
- (c) A current of 9.65 amp. is passed through a solution of  $AgNO_3$  for 50 minutes. Calculate the amount of silver deposited at the cathode. [At. wt. of Ag is 108 and  $1 F = 96490 C$ ] 5
3. (a) Amongst the following, identify at least *two* pairs each of (i) Isotopes (ii) Isobars (iii) Isotones : 5



- (b) How many naturally occurring radioactive decay series are known? What is the end product of each series? 5
- (c) Which one of the following should be used as radiotracer for treatment of thyroid cancer? 5



Give reason.

4. (a) Explain the technique of substoichiometric isotope dilution analysis. 5
- (b) A mixture of CaO and CaCO<sub>3</sub> is analysed by TGA. The mass of the sample decreases from 250.6 mg to 190.8 mg between 600°C and 900°C. Calculate the percentage of CaCO<sub>3</sub> in the mixture. 5
- (c) Which isotope of Mn will you use to determine manganese in steel—<sup>54</sup>Mn has a  $t_{1/2} = 31.2$  days and <sup>56</sup>Mn has a  $t_{1/2} = 2.56$  hours ? Explain. 5
5. (a) Draw a labelled polarogram of a metal ion and indicate (i) half-wave potential, (ii) limiting current, and (iii) residual current. 5
- (b) Explain the advantages of using a mercury cathode during control potential coulometry. 5
- (c) A 0.180 g of a purified organic sample was titrated coulometrically with OH<sup>-</sup> produced in 5 minutes by a constant current of 0.514 amps. Calculate the molar mass of the acid if  $n$  is 1. 5
6. (a) Distinguish between concentration polarisation and kinetic polarisation. 5

- (b) Draw a labelled plot of volume of titrant *vs.* potential in case of an acid-base potentiometric titration. Also draw 1st and 2nd derivative plots of this titration and indicate the end point in each. 5
- (c) List the errors that commonly occur during TGA studies of a sample. How can these be avoided ? Explain. 5
7. (a) What type of standard is required for temperature calibration of a TGA unit ? 5
- (b) State the advantages of stripping voltametry. Also mention disadvantages, if any. 5
- (c) Of the two thermal methods—DTA and DSC—which one will you prefer for quantitative determinations ? Give reasons. 5
8. Write brief notes on any *three* of the following : 5 each
- (i) Ion-selective electrode
  - (ii) Errors in pH measurements
  - (iii) Advantages of coulometric analysis over electrogravimetric analysis.
  - (iv) Maximum suppressors used in polarography
  - (v) Why are some nuclides radioactive ?
  - (vi) Radioimmunoassay