

(3 Hours)

(Total Marks : 100)

Please check whether you have the right question paper.

- N.B.:**
- 1) All questions are **Compulsory**
 - 2) **Figures** to the **Right** indicate **full** marks
 - 3) Use of log table/non-programmable calculator is allowed.

Q.1. Attempt **any four** of the following:

- A)** Distinguish between : 5
- a) polarizable electrode and non-polarizable electrode
 - b) voltammetry and polarography
- B)** Explain the need to remove dissolved oxygen from a solution before recording its polarogram. 5
- C)** A Zn^{+2} ion solution of unknown concentration gave a diffusion current of $4.25 \mu\text{A}$. When 3.0 cm^3 of 0.01 mol dm^{-3} solution of ion was added to 25.0 cm^3 of unknown, the diffusion current increased to $12.5 \mu\text{A}$. Calculate the concentration of Zn^{+2} ions in the sample solution. 5
- D)** A 0.878 mM Pb^{+2} ion solution gave a diffusion current of $7.75 \mu\text{A}$. The mercury flow rate and drop lifetime were 2.63 mgs^{-1} and 2.88 s respectively. What is the diffusion coefficient of Pb^{+2} ? 5
- E)** Give the advantages and limitations of amperometric titrations. 5
- F)** Explain : a) basic principle of amperometric titrations. 5
- b) draw a neat labelled diagram of the H-shaped polarographic cell.

Q.2. Attempt **any four** of the following:

- A)** Mention the detectors used in GC. Describe the principle and construction of any one detector with a neat labelled diagram. 5
- B)** What are the applications of gas chromatography? 5
- C)** Explain the terms w.r.t. GC: retention time, HETP and resolution. 5
- D)** Substances A and B gave retention time 15.15 and 16.60 min. respectively, on a 0.2 m column. An unretained species passed through the column in 1.30 min . The peak widths at base for A and B were 1.01 and 1.20 min . respectively. Calculate i) resolution ii) number of theoretical plates iii) plate height. 5
- E)** What is ion exchange capacity? How is cation exchange capacity of a resin experimentally determined? 5
- F)** Define selectivity coefficient for an ion exchange process. What are the factors affecting selectivity coefficient? 5

Q.3 Attempt **any four** of the following:

- A** Discuss the use of chemicals as food preservatives. 5
- B** What is the role of chicory in coffee? Discuss the constituents present in coffee. 5
- C** Write the nutrients present in milk and discuss the analysis of milk for lactose by Lane Eynon's method. 5
- D** Write the composition of tea and discuss the detection of any four adulterants present in it. 5
- E** Write the properties of antiperspirants and describe a gravimetric method to estimate amount of zinc in antiperspirants. 5
- F** What are sensory properties of cosmetics? Describe a method to estimate amount of magnesium present in face powder. 5

Q.4 Attempt **any four** of the following:

- A** Draw a schematic diagram of TGA instrument and discuss any three of its components. 5
- B** Discuss the principle of DTA and explain the nature of DTA curve for dehydration of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. 5
- C** Discuss the factors that influence the TG curve. 5
- D**
 - a) Compare the technique of TGA with DTA. 3
 - b) Write a note on: Reference material used DTA. 2
- E** Discuss the principle of thermometric titrations and explain its application in the titration of HCl against NaOH. 5
- F** Discuss the need for validation of a method and explain the significance of linearity, selectivity and specificity w.r.t. method validation. 5

Q.5.A State true or false (**any five**) 5

- a)** The drop time can be changed by adjusting the height of the mercury reservoir in dropping mercury electrode.
- b)** In amperometric titrations, a 'V' shaped titration curve is obtained, when only the titrant is reducible species.
- c)** Limiting current is the sum of diffusion current and residual current.
- d)** Rotating platinum electrode is used for determination of halides by precipitation titration.
- e)** The indifferent electrolyte present in large concentration in the polarographic analysis is known as the maxima suppressor.
- f)** Polarogram is a plot of current versus voltage.
- g)** Due to continuous renewal of DME, simultaneous determination of several metals is possible.
- h)** The rotating platinum electrode has the working range upto +0.4V versus SCE.

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Q.5.B Select the correct option: (any five)

- a) The contribution to band broadening due to different velocities of solute molecules across the band is known as _____.
i) Eddy diffusion ii) Longitudinal diffusion iii) Non equilibrium mass transfer
- b) For weakly basic anion exchangers, pH must be _____.
i) greater than 7 ii) less than 7 iii) 7
- c) Cation exchange resin is a polymer containing _____ groups as an integral part of the resin.
i) amino ii) sulphonic iii) quaternary amino
- d) Sample port temperature in GC is kept at the boiling point of the _____.
i) most ii) least iii) neither (i) nor (ii)
- e) Ion exchange chromatography can be used for _____.
i) demineralisation of water ii) separation of amino acid iii) both (i) and (ii)
- f) Swelling of a resin is due to high proportion of _____ groups.
i) polar ii) non-polar iii) neutral
- g) _____ is a natural ion-exchanger.
i) clay ii) Amberlite IR-120 iii) Dowex-3

Q.5C State true or false (any five)

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- a) Irradiation reduces the need of food preservatives.
- b) Mannitol is used as an indicator for the determination of boric acid in food sample titrimetrically.
- c) The action of sodium salt of benzoic acid as preservative is pH dependent.
- d) Castrol oil is used in lipstick for the dissolution of dyes.
- e) Zinc oxide is added to face powder to give a covering power.
- f) Aluminium salts are used in antiperspirants to increase its fragrance.
- g) Sugar syrup is the adulterant added to honey.
- h) Amount of kaolin in face powder should not exceed 25%.

Q.5D Select the correct correct option: **(any five)**

- a) In the application of DTA, which of the following parameter is measured for glasses?
i)concentration ii)cooling temperature iii)transition temperature
- b) Which of the following thermal technique detects every physical or chemical change whether or not accompanied by change in weight?
i)TGA ii)DTA iii)both DTA and TGA
- c) Which of the following represents the loss of water of crystallisation in the TGA curve?
i)downward slope ii)upward slope iii)upward peak.
- d) How many peaks are observed in the thermometric titration curve for the titration of mixture Ca^{+2} and Mg^{+2} against EDTA?
i)one ii)two iii)three
- e) The formation of which of the following product shows an upward peak in the DTA curve of calcium oxalate monohydrate in the atmosphere of air?
i)calcium oxalate ii)calcium carbonate iii)calcium oxide iv) calcium
- f) How many endotherms are observed in the DTA curve of calcium oxalate monohydrate?
i)one ii)two iii)three iv)four
- g) Which of the following term is used for expressing stability of a method against extraneous influencing parameters.
i) precision ii) ruggedness iii)accuracy iv) selectivity