B.Sc. 5th Semester (Honours) Examination, 2022 (CBCS)

Subject : Chemistry

Course : DSE-2

(Analytical Method in Chemistry)

Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

1. Answer *any five* questions from the following: 2×5=10

(a) Write down the meaning of the word 'sample' used in a chemical and statistical sense.

(b) Give the functions of neon or helium gas filled in the hollow cathode lamp.

(c) Define ion-exchange capacity stating its unit.

(d) What do you mean by solvent extraction technique on the basis of solvation and chelation?

(e) Distinguish between distribution ratio and partition coefficient.

(f) State the Lambert-Beer's law mentioning all the symbols used in this law.

(g) Define systematic error and random error with suitable one example in each.

(h) Write down the basic principle of electrogravimetry.

2. Answer *any two* questions from the following: 5×2=10

(a) (i) Explain the role of pH in solvent extraction process taking suitable example.

(ii) Describe two important factors for choice of satisfactory chelating agents during the separations of various metalions by solvent extraction method. 3+2=5

(b) (i) Write down three basic differences between gas chromatography (GC) and high performance liquid chromatography (HPLC).

(ii) TLC is essential before performing column chromatography—Explain. 3+2=5

(c) (i) A chemist obtained the following data for the alcohol content of a sample of blood % C_2H_5OH : 0·084, 0·089 and 0·079. Calculate the 95% confidence interval for the mean assuming the three results obtained are the only indication of the precision of the method. [Given: 95% confidence level $t = 4{\cdot}30$ for two degrees of freedom]

(ii) High precision with low accuracy is possible but reverse statement is not true.—Justify with proper example. 3+2=5

(d) (i) Indicate actual criteria of an I R active molecule.

(ii) Write down three disadvantages of single-beam I.R. spectrometer. 2+3=5

3. Answer *any two* questions from the following: 10×2=20

(a) (i) 50 ml 0·1(N) Fe^{2+} solution is titrated with 0·1(N) Ce^{4+} solution potentiometrically. Calculate the potential values at different stages, after the addition of Ce^{4+} solution— 10 mL, 40 mL, 50 mL and 60 mL. [Given $E^0_{Ce^{4+}/Ce^{3+}} = 1 \cdot 44V$ and $E^0_{Fe^{3+}/Fe^{2+}} = 0 \cdot 77V$]

(ii) Explain the following conductometric titration with proper diagram: 6+(2+2)=10

(A) Strong acid with a weak base

(B) Weak acid with a weak base

(b) (i) Define the term of low frequency titration and high frequency titration.

(ii) Write down some important roles of computers used in instrumental methods of analysis.

(iii) Point out the basic requirements of a useful resin employed in ion-exchange chromatography.

(2+2)+3+3=10

(c) (i) Briefly describe with a schematic diagram of a hollow cathode lamp as the radiation source in atomic absorption spectrophotometer (AAS).

(ii) Write down the differences between atomic absorption spectroscopy and flame emission spectroscopy.

(iii) How a mixture of two cations can be seperated using an anion-exchange resin?

5+3+2=10

(d) (i) Notify different requirements of a radiation source used in UV-spectrometer. Name two such sources of radiation.

(ii) Point out the advantages of double-beam UV-spectrometer rather than the single-beam UV-spectrometer.

(iii) Express the value of wave length in UV-visible region in cm^{-1} unit. (3+2)+3+2=10
