# 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

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

## Subject : Chemistry

## Course : DSE-2 (OR)

## (Instrumental Methods of Chemical Analysis)

**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) How will you distinguish between $CH_3CONH_2$ and $CH_3CH_2NH_2$ by FTIR?

(b) Define '$R_f$ value' in case of TLC.

(c) What are the sources of radiation in fluorescence spectrophotometer?

(d) What do you mean by signal to noise ratio (S/N) in a spectrometer?

(e) Which of the following diatomic molecules do not absorb in the Infra-red region : HCl, ClBr, $N_2$, $O_2$ and $H_2$?

(f) What do you mean by the base peak in mass spectrometry?

(g) Which electrode is used in potentiometry?

(h) What are the information could you obtain from the XPS spectra?

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

(a) Explain the factors that influence 'chemical shift' in NMR spectroscopy. What is the function of 'Chopper' in UV-VIS spectrometer? 3+2=5

(b) Which of the following compounds would be suitable as a solvent for use in recording UV spectra of an organic compound?

(i) Iodoethane, (ii) Diethyl ether, (iii) Benzene, (iv) Cyclohexane and (v) DMSO

(c) Why KBr is used to make sample in FTIR? Using FTIR spectroscopy, how can you characterize the following: 1+4=5

O – H, C – O, C = O and C = C

(d) Explain the various types of electronic transition. Name the fuels used in flame photometry. 1+4=5

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

(a) (i) What are the differences between single and double beam spectrophotometer?

(ii) Draw a block diagram of a double beam UV-VIS spectrophotometer.

(iii) What are the sources of radiation in UV-VIS spectrophotometer? 3+5+2=10

(b) (i) Why TMS is employed as internal standard in NMR spectroscopy?

(ii) How would you distinguish the following pair by $^1H$ NMR spectroscopy? $CH_3 - CH_2 - C \equiv C - H$ and $CH_3 - C \equiv C - CH_3$.

(iii) Why is deuterated solvent used in proton NMR? Give two examples. 3+4+3=10

(c) (i) What are the essential components of a mass spectrometer? Mention the function of the components.

(ii) What is molecular ion peak in mass spectrometry? 2+6+2=10

(d) (i) Describe the principle of Atomic Absorption Spectoscopy (AAS). Draw a schematic diagram of AAS.

(ii) What is flame-less atomisation? When this technique is used? (4+3)+3=10