2 1/2 hrs   (60 Marks)

Note: 1. Please check whether you have received the right question paper.
2. All questions are compulsory.
3.. Figures to right indicate full marks.
4. The use of log-table / non-programmable calculator is allowed.

[Given Atomic weight: H = 1, N = 14, O = 16, Na = 23, S = 32, Cl = 35.5, K = 39, Fe 55.85]

Q 1 A   Answer any **TWO** of the following   (8)

a   Explain the difference between following terms with respect to chemical analysis:
i. Procedure and Protocol   ii. Method and Technique

b   What are transducers? Explain "Piezoelectric transducers".

c   Define the term "Error". Give classification of errors.

d   Discuss the importance of personal safety in laboratory and elaborate the protection equipments (PPE) to be used in analytical laboratory.

B   Answer any **ONE** of the following   (4)

a   What is accreditation of laboratory? Discuss Indian Government standard – "Hallmark".

b   Discuss any four criteria used in selection of analytical method for a particular analysis..

Q 2 A   Answer any **TWO** of the following   (8)

a   An industrial effluent contains 2% W/V sulphuric acid, 4% W/V hydrochloric acid and 10% W/V nitric acid. Calculate the amount of 10N NaOH required to completely neutralize 2.5 liter of above effluent.

b   125 cm^3 of ethanol and 200 cm^3 of acetone are mixed together. Find the mole fraction of each component of the mixture.

c   Calculate pH of 2×10^{-3} M acetic acid ($K_a = 1.75 \times 10^{-5}$).

d   Calculate mass of sodium acetate required to be added to 0.1 dm^3 of aqueous acetic acid, containing 0.05 M acetic acid to obtain buffer of pH 4.5. ($K_a = 1.75 \times 10^{-5}$)

B   Answer any **ONE** of the following   (4)

a   To prepare 500 cm^3 of 250 ppm potassium ion solution, calculate the required weight of (i) KCl and   (ii) KNO$_3$

b   Calculate the molar and normal concentration of $K_2Cr_2O_7$ prepared by dissolving 1245 mg $K_2Cr_2O_7$ in 250 cm^3 distilled water.

Q 3   A   Answer any **TWO** of the following   (8)

    a   Write note on – "LASER: a source of radiation"

    b   With the help of neat diagram, explain the working of Michaelson's interferometer in FTIR.

    c   Derive Beer – Lambert's equation and give its limitations.

    d   Describe the effect exerted by solvents on wavelength of peak in absorption spectroscopic technique.

    B   Answer any **ONE** of the following   (4)

    a   Name the Infra Red (IR) sources and explain any one of them in detail

    b   The solution containing two elements, "X' and "Y", was analyzed at two different wavelengths using a cell of 1.0 cm path length. The absorbance of a mixture was 0.620 and 0.050 at 400 nm and 700 nm respectively. The molar absorptivity of "X" and "Y" are :

species	molar absorptivity, $\mathcal{E}$, ($dm^3\ mol^{-1}\ cm^{-1}$)	
	400 nm	700 nm
X	3461	436
Y	3305	12.0

Calculate the molar concentration of "X" and "Y"

Q 4   A   Answer any **TWO** of the following   (8)

    a   Distinguish between TGA and DTA

    b   Discuss the applications of DSC in Drug analysis.

    c   What is flow injection analysis? What are its advantages?

    d   With the help of block diagram explain working of differential scanning calorimetry (DSC).

    B   Answer any **ONE** of the following   (4)

    a   What are the advantages of automated analysis over discrete analysis?

    b   Discuss the industrial applications of thermal analysis.

Q 5   Answer any **four** of the following   (12)

    a   Explain standard addition method of analysis and give the conditions, when this method is to be used.

    b   What is GLP? Explain its objectives and advantages.

    c   How will you prepare 0.5 dm^3 of 100 ppb Fe^{2+} solution using $FeSO_4$. What will be the ppb concentration of the same solution with respect to $FeSO_4$.

d If 5000 ppm K^+ ion solution, prepared using KCl is provided to you, how much volume of this solution if diluted to 250 cm^3 will give 0.02 N KCl solution.

e Explain the use of bolometer in IR spectrometry.

f Explain charge transfer absorption with respect to UV – Visible spectroscopy.

g Discuss the role of multilayered films in automated analysis.

h What are the factors affecting the DSC curves?

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