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.

Q 1 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 cm³ of ethanol and 200 cm³ of acetone are mixed together. Find the mole fraction of each component of the mixture.

c Calculate pH of 2 x 10⁻³ M acetic acid (Kₐ = 1.75 x 10⁻⁵).

d Calculate mass of sodium acetate required to be added to 0.1 dm³ of aqueous acetic acid, containing 0.05 M acetic acid to obtain buffer of pH 4.5. (Kₐ =1.75 x 10⁻⁵)

Q 2 B Answer any ONE of the following (4)

a To prepare 500 cm³ of 250 ppm potassium ion solution, calculate the required weight of (i) KCl and (ii) KNO₃.

b Calculate the molar and normal concentration of K₂Cr₂O₇ prepared by dissolving 1245 mg K₂Cr₂O₇ in 250 cm³ distilled water.

Contd 2…….
Q 3 A Answer any TWO of the following

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

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:

<table>
<thead>
<tr>
<th>species</th>
<th>molar absorptivity, ( \varepsilon ), (dm(^3) mol(^{-1}) cm(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 nm</td>
<td>700 nm</td>
</tr>
<tr>
<td>X</td>
<td>3461</td>
</tr>
<tr>
<td>Y</td>
<td>3305</td>
</tr>
</tbody>
</table>

Calculate the molar concentration of “X” and “Y”

Q 4 A Answer any TWO of the following

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

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

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\(_4\).

Contd 3...........
d If 5000 ppm K⁺ ion solution, prepared using KCl is provided to you, how much volume of this solution if diluted to 250 cm³ 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?