<u>**TIME: 2 ½ HOURS**</u>   <u>**MAX.MARKS:60**</u>

Please check whether you have got the right question paper.
N.B. 1) All questions are compulsory.
    2) Figures to the right indicate full marks.
    3) Use of logarithmic table/non programmable calculator is allowed.
    4) At. Wts: H=1, C=12,N=14,O=16,Na=23,Al=27,S=32, Cl=35.5,
      K=39,Ca=40,Ag=108.Ba=137, Pb=207,Mg= 24.3,F=19,Cu= 63.5, Cr = 52

Q.1 **A)** Attempt **any two** of the following:
  a) Define 'Determinate Errors'. Discuss (a) Instrumental Errors (b) Personal Errors.   **4**
  b) Discuss briefly the following terms with respect to quantitative performance criteria   **4**
    of an analytical instrument i) Detection limit ii) Dynamic range
  c) What six sigma? What is DMAIC process of six sigma?   **4**
  d) Define the term:" Quality system review" Discuss the activities involved in quality   **4**
    system review meeting.

  B) Attempt **any one** of the following:
  a) Discuss briefly Indian government standards with respect to ISI, Hallmark and   **4**
    Agmark.
  b) Name the different methods to minimize determinate errors. Discuss any two in   **4**
    brief.

Q.2 **A)** Attempt **any two** of the following:
  a) 1) How many milligrams of sodium chloride present in $100cm^3$ of 0.4 molar   **2**
      solution of sodium chloride?
    2) Assign oxidation number to each element in $V_2O_7^{-4}$ **2**
  b) Chloroform reacts with chlorine, to form CCl_4 and hydrogen chloride. In an   **4**
    experiment 25 gm of chloroform and 15 gm of chlorine were allowed to react. Which
    is the limiting reagent? What is the maximum yield of CCl_4 in moles and grams?
  c) A $21.70cm^3$ sample of $Ca(OH)_2$ solution was titrated with 0.25 M HCl.   **4**
    $45.8 \ cm^3$ of the acid was required to reach the endpoint of the titration
    i) What is the equation of the reaction?
    ii) What was the molarity of calcium hydroxide solution?
  d) What is the minimum pH of 0.1M Mg^{+2} solution, from which Mg $(OH)_2$ will not   **4**
    precipitate. Given: Ksp of Mg $(OH)_2$ $=1.2x10^{-11}$M.

  B) Attempt **any one** of the following:
  a) Calculate the mass of anhydrous HCl in 5.0 ml concentration of HCl (sp.gr.19 g/ml)   **4**
    containing 37.23% of HCl by weight.
  b) Calculate the pH of a buffer solution containing 0.1 M acetic acid and 0.1M sodium   **4**
    acetate. What will be the change in pH on adding,
    (i) 0.01M HCl to 1.0 dm^3 of buffer and
    (ii) 0.01M NaOH to 1.0 dm^3 of buffer. ($K_a = 1.8 \ X \ 10^{-5}$)

Q.3 **A)** Attempt **any two** of the following:

    a) With the help of block diagram describe the Dual Wavelength Spectrophotometer.   4
What types of samples can be analysed by it?

    b) Enlist different types of Infrared transducers. Describe pyroelectric transducer   4

    c) Discuss the effect exerted by solvents on Wavelength of peaks in absorption   4
spectroscopic techniques.

    d) Explain charge transfer absorption with respect to UV-Visible spectroscopy   4

    B) Attempt **any one** of the following:

    a) Explain the sample handling methods with respect to IR spectroscopy.   **4**

    b) A solution containing two absorbing species 'A' and 'B' was analysed   **4**
spectrophotometrically at two different wavelengths in a cell of path length 1.0
cm.The absorbance of mixture was 0.620 and 0.045 at 400nm and 700nm
respectively. The molar absorptivities of two species were given as below:-

Species	Molar absorptivity (ε) $mol^{-1} dm^3 cm^{-1}$	
	400 nm	700 nm
A	3640	435
B	3300	12.4

    Calculate the molar concentration of A and B.

Q.4 **A)** Attempt **any two** of the following:

    a) Give the differences between power compensated and heat flux DSC instruments.   **4**

    b) How does automation enhance the acceptability of the results?   **4**

    c) Explain "Flow injection analysis" with suitable example.   **4**

    d) Explain application of Differential Scanning Calorimetry (DSC) for drug analysis   **4**
and oxidative stability.

    B) Attempt **any one** of the following:

    a) What are the gas monitoring equipments?   **4**

    b) Give a brief account on comparison between DSC and DTA (Any 4 points)   **4**

Q.5 Attempt **any four** of the following: **12**

    a) Explain calibration curve method to quantify an analyte in a sample.

    b) Discuss in brief,' Klimisch score'

    c) Calculate the number of hydrogen present in 5.0 moles of Ethyl alcohol. (Given
Avogadro number $N_A = 6.02 \times 10^{23}$

    d) Calculate the pH of 2×10^{-3} M solution of acetic acid. K_a for acetic acid is
1.75×10^{-5}.

    e) In what way the Fourier Transform (FT) instruments differ from other optical
instruments?

    f) With respect to spectroscopic studies, discuss continuum sources and Line sources
in brief.

    g) Explain how sample size and sample shape affect DSC curves.

    h) Distinguish between discrete and continuous automated devices.

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