TIME: 2 ½ HOURS **MAX.MARKS:60**

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) What are transducers and sensors? Explain the "piezoelectric effect" that forms the basis of quartz crystal micro balance (QCM) sensor. What is the detection limit for a piezoelectric sensor? **4**

b) What is Six sigma? Explain the DMAIC approach in implementing six sigma. **4**

c) With reference to performance characteristics of instrument explain the following terms: **4**
1) Bias
2) Detection limit
3) Sensitivity

d) Define the terms,'Quality audit' and 'Quality review'. Explain the importance of Quality Audit in an analytical laboratory. . **4**

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

a) With respect to chemical analysis explain the following terms **4**
(i) Analysis (ii) Determination (iii) Measurement

b) With respect to chemical analysis explain, (i) Instrumental errors (ii) Methodic errors **4**

Q.2 A) Attempt **any two** of the following:

a) 1. Calculate the pH of 2 X 10^{-3} M solution of acetic acid. K_a for acetic acid is 1.75×10^{-5}. **2**
2. Assign oxidation number to each element in $Cr(OH)_4^{-1}$ **2**

b) A sample of pure $CaCO_3$ (MW 100.09) weighing 0.425 gm is dissolved in 1:1 hydrochloric acid, and the solution is diluted to 250 cm^3. **4**
25 cm^3 of above solution is titrated with EDTA solution using EBT indicator. A volume of 20.4 cm^3 is required to reach end point. Calculate the molarity of the EDTA solution.

c) A solution is prepared by dissolving 1245 mg of $K_2Cr_2O_7$ in 500 cm^3 water.
Calculate
i) Molar concentration of the solution
ii) w/v percentage of $K_2Cr_2O_7$.
iii) Millimiles of $K_2Cr_2O_7$ in 100 cm^3 of solution.

d) Chloroform reacts with chlorine to form CCl_4 and hydrogen chloride. In an experiment 20gm of chloroform and 12gm of chlorine were allowed to react. Which is the limiting reagent? What is the maximum yield of CCl_4 in moles and grams? **4**

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

a) What is the normality of 12.30% (v/v) solution of sulphuric acid (specific gravity =1.085g/ml)? How many ml of 3.00M potassium hydroxide would be neutralized by 18.0 ml of the acid? **4**

b) Calculate the mass of sodium acetate that should be added to 0.2dm^3 of an aqueous solution containing 0.05 mol acetic acid to obtain a buffer solution of pH 4.5. Given: Ka for acetic acid =1.8 x10^{-5}. **4**

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

a) With the help of a neat labeled diagram, Explain the working of Michaelson's interferometer in FT IR. **4**

b) Explain the use of laser as a source of radation. **4**

c) What are the different ways of obtaining 'Derivative Spectra' in UV and Visible region? What are its applications? **4**

d) Derive Beer Lambert's equation. What are its limitations? **4**

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

a) Name the different types of Infrared transducers. Describe any one in detail. **4**

b) The following data is obtained during the analysis of elements 'X' and 'Y' Spectrophotometrically at two different wavelengths. Calculate the molar concentration of X and Y. (Given b=1cm) **4**

Elements	Concentration mol dm $^{-3}$	Absorbance at	
		450nm	620nm
X	1.6x10^{-3}	0.846	0.102
Y	5.4x10^{-3}	0.178	0.978
X+Y	--	0.575	0.543

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

a) Write a note on heat flux DSC cell. **4**

b) Explain the application of DSC for characterization of polymers **4**

c) Compare discrete analyzers and continuous flow analyzers. **4**

d) Discuss how automation enhances the acceptability of results. **4**

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

a) Explain factors affecting nature of DSC curves. **4**

b) Describe the principle of flow injection analysis. **4**

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

a) What is meant by Sensitivity of an instrument? Explain calibration Sensitivity.

b) Define Accreditation and Certification.

c) How will you prepare 0.5 dm^3 of 200 ppb of Cu^{+2} solution from $CuSO_4$?

d) The pH of magnesium hydroxide is 10.45 at 25^{0}C.Calculate the solubility product constant of magnesium hydroxide.

e) Describe the use of Nernst Glower in IR Spectroscopy.

f) The λ_{max} of 1, 4 pentadiene is 176nm and the λ_{max} of 1, 3 pentadiene is 215nm Explain**.**

g) Explain why in thermal analysis methods, the thermocouple for measuring sample temperature seldom immersed directly into the sample?

h) Name the different types of thermal methods define any one of them.
