(Time: 2½ hours) Total Marks: 75

N.B.: (1) All questions are compulsory.

(2) Figures to the right indicate full marks.

(3) Use of log table/ non-programmable calculator is allowed.

Q1. **Attempt any three of the following.** 15

A) Define the term quality. Discuss any four points of importance of quality concepts in industry.

B) The Mole fraction of $I_2$ in $CCl_4$ is 0.05. Calculate the molality and molarity of the solution.
( Given - density of solution = 1.45 g/cm$^3$, M.W. of $CCl_4$ = 154, M.W. of Iodine = 254)

C) What are primary and secondary reference standard? How many grams of copper pyrites CuFeS, will give 250 g of copper?
(Given – Atomic weights of Cu = 63, Fe = 55.85, S = 32)

D) What is flux? Name the different types of sample size reduction methods used in solid sampling. Explain any one of them.

E) List the methods of sampling of gases. With the help of a neat and labelled diagram describe any one of them.

Q2. **Attempt any three of the following.** 15

A) Calculate the pH of 25.0 cm$^3$ of 0.2M acetic acid which is to be titrated against 0.2M sodium hydroxide before the beginning of the titration.
(dissociation constant of acetic acid 1.75 x $10^{-5}$ at 25$^0$C)

B) Give three advantages and two limitations of EDTA as titrant.

C) Calculate the potential of the system at equivalence point in the titration of 10.0 cm$^3$ of 0.2M Fe(II) against 0.2M Ce(IV) solutions.
($E^0_{Pt|\,Fe+2,Fe+3}$ = +0.771V , $E^0_{Pt|\,Ce+3,Ce+4}$ = +1.440V )

D) Explain the following factors used to increase selectivity of EDTA as titrant:
i) pH control of the solution ii) use of masking and demasking agents.

E) Name the metallochromic indicators. Explain any one of them.

Q3. **Attempt any three of the following.** 15

A) With the help of a neat labelled diagram, explain the working of hollow cathode lamp.

B) Compare FES and AAS

C) What is fluorescence? What are the factors affecting fluorescence and phosphorescence?

D) What is phosphorescence? Draw a schematic diagram of Phosphorimeter and explain the role of shutter.

E) Draw a schematic diagram of turbidimeter and explain its working.

Q4. **Attempt any three of the following.** 15

A) With the help of diagram, explain the working of Craig countercurrent extractor.

B) In GLC using 25.0 cm column, component 'A' and 'B'are found to have retention times 13.30 min. and 14.60 min. respectively. An unretained species passed through the column in 1.32 minutes. The peak widths at the base for 'A' and 'B' were 1.12 min. and 1.20 min. respectively. Calculate the number of plates in each peak and resolution.

C) Explain the principle of solid phase extraction. Give any three advantages of it.

D) Give the comparison between GLC and GSC.

E) Describe TCD with the help of a diagram used in gas chromatography.

Q.5 A) **Select whether the following statements are true or false (Any five)** 05

a) Analytical Reagent (AR) grade is less pure than Laboratory Reagent (LR).

b) The primary goal of proper sampling is to ensure that the sample is a true representative of the bulk material.

c) The products of neutralisation reaction are salt and water.

d) The magnitude of conditional stability constant is independent of pH.

e) Hollow cathode lamp is used in AAS.

f) Flame photometry gives the information of molecular condition of the sample.

g) Efficiency of a column increases when number of theoretical plate is large and plate height is small.

h) Craig countercurrent extraction is a single stage extraction.

Q.5 B) **Select the correct option and complete the following statements: (any five)** 05

a) Quality control is primarily focused on _____ inspection and testing.
a) product b) facilities c) process

b) _____ is used for sampling of flowing liquids.
a) Angular sampler b) Hand Scoop c) Multiple tube sampler

c) Metal - EDTA complex is of _____ type.
a) 1:1 b) 1:2 c) 1:4

d) Fe(II) against Ce(IV) titration is _____ electron system.
a) one b) two c) five

e) Molecules having _____ bond are suitable for fluorescence and phosphorescence.
a) Conjugated double b) Sigma c) Pi

f) In _____ analysis, particle size is not important.
a) Nephelometric b) Turbidimetric c) Fluorometric

g) In GSC _____ is used as stationary phase.
a) Solid b) Liquid c) Gas

h) Tributyl phosphate is used for extraction of _____ ions.
a) Uranium b) Sodium c) Titanium

Q.5 C) **Match the columns: (any five)** 05

| Column A | | Column B | |
|---|---|---|---|
| a) | Sampling of gases | (i) | Phosphorimetry |
| b) | Normality | (ii) | Phenolphthalein |
| c) | Acid base titration | (iii) | LR grade |
| d) | Ferroin Indicator | (iv) | Liquid |
| e) | Narcotics detection | (v) | Sampling probe |
| f) | Decrease in fluorescence | (vi) | No. of gm equivalents per $dm^3$ of solution |
| g) | Stationary phase in GLC | (vii) | Demasking |
| h) | Solid phase extraction | (viii) | Redox titration |
| | | (ix) | Electron withdrawing groups |
| | | (x) | Silica |

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