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**(A-85) SARDAR PATEL UNIVERSITY****M.Sc. (Analytical Chemistry) Examination, III<sup>rd</sup> Semester (CBCS)****April-2015****Wednesday, Date: 22.04.2015****Session: Evening, Time: 2.30 p.m. to 5.30 p.m.****Course: PS03CANC02****Subject: Elements of Analytical Chemistry****Total Marks: 70**

N.B.: i) The numbers of the marks carried by each question is indicated at the end of the question  
 ii) Assume suitable data if considered necessary and indicate the same clearly.

- Q.1** Answer by highlighting the right option [08]
- Which of the following is an example of hyphenated technique?
    - GC
    - AAS
    - AFM
    - ICP-MS
  - A source of energy used in UV-Visible spectrophotometer is called
    - Starter
    - Stimulus
    - Both a) & b)
    - Resonant
  - Analytical sensitivity can be expressed by the equation
    - $V = m/S_s$
    - $V = m/S$
    - $V = m_s/S$
    - $V = S_s / m$
  - Alphanumeric printer is an
    - Output transducer
    - Input transducer
    - Output transistor
    - Input transistor
  - Right equation for population standard deviation( $\sigma$ ) would be
    - $[\sum(x_i - \mu)^2/n]^{1/2}$
    - $[\sum(x_i - x)^2/n]^{1/2}$
    - $[\sum(x_i - \mu)^2/n-1]^{1/2}$
    - $[\sum(x_i - x)^2/n]^{1/2}$
  - A relative uncertainty appeared in 2.012 g measured quantity is
    - 0.5‰
    - 0.05%
    - Both a) and b)
    - 0.001%
  - Merit(s) of automated techniques is/are
    - Reproducible results
    - Online-process control
    - Both a) and b)
    - None
  - Analyzer(s) that work(s) via monitoring absorbance is/are
    - Potentiometer
    - Spectrophotometer
    - Refractometer
    - All
- Q.2** Attempt any **SEVEN** [14]
- State the term 'sensitivity', and discuss limitation of calibration sensitivity.
  - Explain the figure of merit for instrumental methods.
  - Illustrate the dynamic range.
  - Explain DVM and DMM.
  - State the terms 'automatic' and 'automated' devices, explaining their typical role in the chemical analysis.
  - Distinguish between the terms 'continuous' and 'discrete' devices, used in the automation.
  - Distinguish between the terms 'systematic' and 'random' errors.

- viii) What do you understand by significant figures? Assign the number of significant figures to the answer of  $\log_{10}[7.80 \times 10^{-10}]$ .
- ix) A flask, with and without loading some quantity of liquid weighed 40 g and 20 g respectively. Standard deviations in empty- and loaded-flask weighing were  $\pm 0.4\text{g}$  and  $\pm 0.6\text{g}$  respectively. Calculate standard deviation associated with the final weight of liquid.

- Q.3** a) Explain 'selectivity' of analytical instruments. Specify the conditions when selectivity coefficient is negative. [06]
- b) Answer the following [06]
- i) What is the source of bias? Explain the bias of analytical method.
- ii) Discuss input and output transducers.

OR

- b) Answer the following
- i) Describe off-line, on-line, in-line and intra-line computer conjugations, with an analytical instrument.
- ii) Draw the data domain map, explaining digital domain.
- Q.4** a) Give the classification of analytical techniques. Discuss comparison of instrumental methods, based on physical properties measured. [06]
- b) Explain read-out devices, mainly employed in the analytical instrument, with diagram. [06]

OR

- b) Describe instrumental detection limits; LOQ and LOL. Elucidate sensitivity in terms of dynamic range.
- Q.5** a) State the terms 'accuracy' and 'precision'. Three sets of data given below were considered for statistical treatment. [06]

Set	Determinations
A	3.27, 3.26, 3.24, 3.24, 3.28
B	61.45, 61.53, 61.32
C	09.961, 10.004, 10.002, 09.973, 09.986

Calculate mean, estimated standard deviation, and coefficient of variation of each and comment on their precisions.

- b) Describe in brief significance of student *t*-test. A chemist reported 0.084, 0.089 and 0.079 as % age of alcohol content in blood in its three different samples respectively. Calculate 95% confidence interval (C.I.) of mean, assuming that  $s \rightarrow \sigma = 0.05\%$  alcohol [use value of  $t = 4.3$ ]. [06]

OR

- b) Outline the following
- i) Ruggedness testing.
- ii) Verification and validation.
- Q.6** a) Describe in brief the strategy of automation; write a note on automated laboratory analyzer. [06]
- b) Name the automated devices categorized under continuous flow method. State instrumentation and principle of any of them. [06]

OR

- b) Discuss the block diagram of automatic elemental analyzer.