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(A-85) SARDAR PATEL UNIVERSITY

M.Sc. (Analytical Chemistry) **Examination,** III[rd] **Semester** (CBCS)

April-2015

Wednes**day**, **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]

i) Which of the following is an example of hyphenated technique?
a) GC **b)** AAS
c) AFM **d)** ICP-MS

ii) A source of energy used in UV-Visible spectrophotometer is called
a) Starter **b)** Stimulus
c) Both a) & b) **d)** Resonant

iii) Analytical sensitivity can be expressed by the equation
a) $V = m/S_s$ **b)** $V = m/S$
c) $V = m_s/S$ **d)** $V = S_s / m$

iv) Alphanumeric printer is an _____
a) Output transducer **b)** Input transducer
c) Output transistor **d)** Input transistor

v) Right equation for population standard deviation(σ) would be
a) $[\sum(x_i-\mu)^2/n]^{1/2}$ **b)** $[\sum(x_i-x)^2/n]^{1/2}$
c) $[\sum(x_i-\mu)^2/n-1]^{1/2}$ **d)** $[\sum(x_i-x)^2/n]^{1/2}$

vi) A relative uncertainty appeared in 2.012 g measured quantity is
a) 0.5‰ **b)** 0.05%
c) Both a) and b) **d)** 0.001%

vii) Merit(s) of automated techniques is/are
a) Reproducible results **b)** Online-process control
c) Both a) and b) **d)** None

viii) Analyzer(s) that work(s) via monitoring absorbance is/are
a) Potentiometer **b)** Spectrophotometer
c) Refractometer **d)** All

Q.2 Attempt any **SEVEN** [14]

i) State the term 'sensitivity', and discuss limitation of calibration sensitivity.
ii) Explain the figure of merit for instrumental methods.
iii) Illustrate the dynamic range.
iv) Explain DVM and DMM.
v) State the terms 'automatic' and 'automated' devices, explaining their typical role in the chemical analysis.
vi) Distinguish between the terms 'continuous' and 'discrete' devises, used in the automation.
vii) 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 $\log_{10}[7.80X10^{-10}]$.

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 ±0.4g and ±0.6g 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.