



I Semester M.Sc. Degree Examination, January 2015
(2010-11 Onwards (NS) Scheme)
CHEMISTRY

C-104 : Analytical Chemistry and Mathematics for Chemists

Time : 3 Hours

Max. Marks : 80

Instructions : Answer Part A and Part B in separate answer booklets.

PART – A

(Analytical Chemistry)

Marks : 44

Note : Answer question No. 1 and any three of the remaining.

1. Answer **any seven** of the following : (7×2=14)
- Explain why continuous extraction is preferred over batch extraction.
 - Distinguish between relative and absolute errors with examples. How is relative error expressed ?
 - Explain the terms elution, eluent and development as applied to column chromatography.
 - Explain the working of tcd in gas chromatography.
 - Why double beam instrument is preferred over a single beam instrument for precise measurement of absorbance in spectrophotometric analysis ? Explain.
 - Fluorimetry is more sensitive than absorptiometry method. Substantiate.
 - What is meant by radiotracer technique ? Give its applications.
 - Calculate the molar absorptivity of a solution of an organic compound in 0.1 M HCl giving an absorption of 0.586 in a 2 cm cell at λ_{\max} 281nm. The concentration of the solution is $0.00004568 \text{ mole}^{-1}$.
2. a) Explain the various methods adopted to minimise the determinate errors.
- b) The following results were obtained in the determination of bismuth present in a sample.
59.83, 59.88, 60.04, 60.24, 60.32 and 60.45. Determine the standard deviation and coefficient of variation.
- c) With the help of a block diagram explain the role of each component in gas chromatography method. (3+3+4)



3. a) Explain the principle of electrophoresis and give its applications.
 b) Describe how the choice of an eluting solvent is made in tlc ?
 c) Discuss 2D-paper chromatography with reference to the basis of separation, methodology and uses. **(3+3+4)**
4. a) Derive Beer-Lambert's law and explain its deviations.
 b) What are photometric titrations ? Explain different photometric titration curves with examples.
 c) What is turbidimetry ? Describe its application in quantitative analysis. **(3+4+3)**
5. a) What is isotopic dilution analysis ? How is it useful in the determination of concentration of an unknown sample ?
 b) Give an account of neutron activation analysis.
 c) Describe the principle and working of a proportional counter. **(4+3+3)**

PART – B

(Mathematics for Chemists)**Marks : 36**

Answer **any three** of the remaining.

1. a) Find the volume of parallelopiped if $\vec{a} = -3i + 7j + 5k$, $\vec{b} = -3i + 7j - 3k$ and $\vec{c} = -7i - 5j - 3k$ are the three edges of the parallelopiped. **3**
- b) Solve the system
 $x - 3y - 4z = 1$
 $-x + y - 3z = 14$
 $y - 3z = 5$ by Cramer's rule. **5**
- c) Find the characteristic polynomial and eigen values of the matrix.

$$\begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & -1 \end{pmatrix}$$
 4



2. a) Find the derivative of the following :

i) $y = (ax + b)^n$ ii) $y = \sqrt{1+x^2}$ 4

b) If $y = \cos 2x$ then prove that $4y + \frac{d^2y}{dx^2} - \frac{dy}{dx} = 2\sin 2x$. 4

c) Discuss the maxima and minima of $f(x) = x^3 - 18x^2 + 96x + 4$. 4

3. a) Evaluate

i) $\int \frac{x+2}{x(x^2-1)} dx$

ii) $\int x^2 e^{x^3} dx$ 5

b) If $z = \sqrt{x^2 + y^2}$ then show that $x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = z$. 3

c) Solve $(xy^2 + x) dx + (yx^2 + y) dy = 0$. 4

4. a) Obtain the Fourier series of the function $f(x) = x$ on $[-\pi, \pi]$. 4

b) A book shelf contains 20 books of which 12 are on chemistry and 8 are on mathematics. If three books are taken out at random, find the probability that all the three are on the same subject. 4

c) By the method of least squares, fit a straight line to the following data : 4

x	1	2	3	4	5
y	14	13	9	5	2

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