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MCH-014

**M. SC. (CHEMISTRY)/M. SC.
(ANALYTICAL CHEMISTRY)
(MSCCHEM/MSCANCHEM)**

Term-End Examination

December, 2024

MCH-014 : MATHEMATICS FOR CHEMISTS

Time : 1 Hour

Maximum Marks : 25

Note : (i) Attempt any **five** questions.

(ii) Usual notations are used.

(iii) Use of calculator is not allowed.

1. (a) Find the derivative of the function

$f(x) = ae^{x^2}$ with respect to x , where a is a

constant.

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(b) Let :

$$A = \{1\}, B = \{2, 3, 4\} \text{ and } C = \{3, 4, 5\}$$

Verify the following distribution laws : 4

$$(i) \quad A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

$$(ii) \quad A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

2. (a) Write down the Binomial expansion for $(1 + x)^n$ or the Maclaurin's expression for $f(x)$. 1

- (b) Find out the equation of normal and the equation of tangent at point (1, 7) of the circle $x^2 + y^2 = 50$. 4

3. (a) Find $\frac{dz}{dt}$ for $z = x^5 y^4$, where $x = at^2$ and $y = t^3$. 2

- (b) Evaluate any *one* of the following integrals : 3

(i) $\int (5xe^{2x})dx$

(ii) $\int x \cdot \sec^2 x^2 dx$

4. Prove that the straight line joining the mid-points of two sides of a triangle is parallel to the third side and its length is half of that of the third line. 5

5. (a) Solve the differential equation : 3

$$\frac{1}{\tan x} \frac{dy}{dx} + y = \operatorname{cosec} x$$

- (b) Find the product of the following matrices : 2

$$A = \begin{bmatrix} 7 & 2 & 3 \\ 1 & 8 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2 & 3 \\ 1 & 2 \\ 4 & 5 \end{bmatrix}$$

6. (a) If we toss a fair coin twice, then find the probability of getting at least one tail. 2

- (b) Find the eigen value of matrix : 3

$$A = \begin{Bmatrix} 5 & -3 \\ 6 & -4 \end{Bmatrix}$$

7. In the titration of HCl against NaOH the titre values were : 19.6 cm³, 19.9 cm³, 20.1 cm³ and 20.4 cm³.

Calculate the following :

- (a) Standard deviation 2
- (b) Standard deviation of mean 1
- (c) Variance 1
- (d) The coefficient of variance (in ppm) of the measurements. 1
8. (a) Find out the sum of the following series : 3

$$\frac{1}{2} + \frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots + \frac{1}{3^{n-2}} + \frac{1}{2 \times 3^{n-2}}$$

- (b) Expand $(3x + 7)^7$ using binomial theorem.

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