

YMCA UNIVERSITY OF SCIENCE & TECHNOLOGY, FARIDABAD

M.Sc. CHEMISTRY- Ist SEMESTER (Under CBCS)

Mathematics for Chemists (CH-104A)

Time: 3 Hours

Max. Marks: 50

Note: 1. It is compulsory to answer the questions of Part-1

2. Answer any four questions from Part-2 in detail.

3. Different parts of the same question are to be attempted adjacent to each other

PART-1

1. (a) If $\vec{A} = 3\hat{i} - 4\hat{j} - \hat{k}$ and $\vec{B} = \hat{i} + 5\hat{j} - 6\hat{k}$, then find $(\vec{A} + \vec{B})$ and $(\vec{A} - \vec{B})$

(b) If matrix $X = \begin{bmatrix} 1 & 5 \\ 2 & 3 \\ 5 & 2 \end{bmatrix}$ and $Y = \begin{bmatrix} -1 & 3 \\ 0 & 5 \\ 3 & 1 \end{bmatrix}$, then find the matrix X-Y.

(c) Define diagonal matrix and null matrix along with one example for each.

(d) Write the formula for finding distance between two points.

(e) Simplify: $\log_{10} 5 - 2\log_{10} 3 + \log_{10} 18$

(f) Write the equation of a line passing through the origin and having slope m.

(g) If $y = \frac{6}{7}x^7 + 4x^{-3}$, then find $\frac{dy}{dx}$.

(h) If $z = x^3 + 3x^2y + xy^3$, find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$

(i) Define Laplace transform of a function.

(j) Evaluate $\int (\sqrt{x} + \frac{1}{\sqrt{x}}) dx$ (10×1=10)

PART-2

2. (a) If $\vec{A} = 2\hat{i} - 3\hat{j} - \hat{k}$, $\vec{B} = \hat{i} + 4\hat{j} - \hat{k}$, $\vec{C} = 2\hat{i} - 2\hat{j} + \hat{k}$ then find $\vec{A} \times \vec{B}$, $\vec{A} \cdot \vec{C}$, $\vec{A} \cdot (\vec{B} \times \vec{C})$ (5)

(b) Find the values of t such that the vectors $\vec{A} = 3t^2\hat{i} - 4t\hat{j} - 5t^2\hat{k}$, $\vec{B} = 3\hat{i} - 2\hat{j} + 10\hat{k}$, are orthogonal. (5)

3. (a) For the matrix $A = \begin{bmatrix} -2 & 3 & 4 \\ 5 & -4 & -3 \\ 7 & 2 & 9 \end{bmatrix}$, find $\frac{1}{2}(A - A^T)$, where A^T is transpose of the matrix. (5)

(b) Find AB if $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$ (5)

4. (a) The coordinates of two points A and B are $(-1, 2)$ and $(2, -1)$ respectively. Find the equation and slope of line AB. (5)

(b) Find the equation of the straight line passing through the point $(-3, 1)$ and parallel to the line $5x - 2y + 7 = 0$. (5)

5. (a) If $y = \frac{1-x}{1+x}$, find $\frac{dy}{dx}$. (5)

(b) If $u = x^3 + 3xy^2 + y^3$, find $\frac{\partial^2 u}{\partial x \partial y}$. (5)

6. Evaluate the following:

(a) $\int \frac{x}{(x-1)(2x+1)} dx$ (5)

(b) Find the area of the region bounded by the curve $y^2 = 4x$, y axis and the line $y=3$. (5)

7. (a) Find the Laplace transform of $t \sin 4t \cos 3t$. (5)

(b) Find the dimensions of the rectangular box open at the top of maximum capacity, whose surface is 432sq.cm . (5)