

Roll No.

January, 2023

B.Sc. (Chemistry) 1st Semester

BASIC ALGEBRA (OMTH-102)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) Find a matrix X such that $A + 2B + X = 0$, where

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

- (b) If $A = \begin{bmatrix} 3 & 4 \\ -1 & 2 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 1 & 2 \\ 1 & 2 & 3 \end{bmatrix}$, then find

$(2A' + B)$, where A' is transpose of matrix A.

- (b) Define difference of sets and complement of a set. If $A = \{4, 5, 8, 12\}$ and $B = \{1, 4, 6, 9\}$, then find $A - (B - A)$.

6. (a) Explain sum, difference, product and quotient of two functions.

- (b) If $\cos x \cdot \operatorname{cosec} x = -1$ and x lies in the fourth quadrant, find $\cos x$ and $\sin x$.

7. (a) If $\sin(\sin^{-1} \frac{1}{5} + \cos^{-1} x) = 1$, then find the value of x .

- (b) Prove that

$$2 \tan^{-1} \frac{1}{2} + \tan^{-1} \frac{1}{7} = \tan^{-1} \frac{31}{17}.$$

(c) If $A = \begin{bmatrix} 1 & 2 \\ 4 & 2 \end{bmatrix}$, check whether $|2A| = 4|A|$.

(d) Solve for x : $\begin{bmatrix} x & 2 & -1 \\ 2 & 5 & x \\ -1 & 2 & x \end{bmatrix} = 0$.

(e) Define Null matrix and Identity matrix.

(f) What do you mean by equal sets and equivalent sets ?

(g) Define cartesian product of sets.

(h) Define Domain and Range of a function.

(i) Find principal value of inverse trigonometric function

$$\sin^{-1}\left(\frac{1}{2}\right).$$

(j) If $\sin \theta = -\frac{1}{\sqrt{2}}$ and $\tan \theta = 1$; find the quadrant in which θ lies. (10×1.5=15)

PART-B

2. (a) If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, find $A^3 - 23A - 40I$, where I is

unit matrix.

(b) If $A = \begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$, check whether AB is equal to BA or not ? (8+7)

3. (a) Find the inverse of $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ by using elementary row operations.

(b) Find all the co-factors of $\begin{vmatrix} 1 & 2 & 3 \\ 4 & -5 & 6 \\ 7 & 0 & -1 \end{vmatrix}$. (8+7)

4. (a) Find the inverse of the matrix $A = \begin{bmatrix} 1 & 4 & 5 \\ 3 & 2 & 6 \\ 0 & 1 & 0 \end{bmatrix}$.

(b) Solve the following system of equations :

$$2x + 8y + 5z = 5; x + y + z = -2; x + 2y - z = 2$$

(8+7)

5. (a) If $A = \{1, 2, 3\}$, $B = \{2, 3, 4\}$, $C = \{1, 3, 4\}$ and $D = \{2, 4, 5\}$, then verify that

$$(A \times B) \cap (C \times D) = (A \cap C) \times (B \cap D).$$