

Dec 2023

B.Sc.(Chemistry)Re-Appear

1st SEMESTER

Basic Algebra (OMT-102)

Time: 3hr

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.
 4. Any other specific instructions

PART -A

- Q1 (a) If A and B are symmetric Matrices . Prove that ABA is also symmetric. (1.5)
- (b) Define null set, Singleton set and Finite set. (1.5)
- (c) Write down the Range and Domain of $\tan^{-1}x$ (1.5)
- (d) Prove that $(A \cup B)^c = A^c \cap B^c$. (1.5)
- (e) Solve the system of equations with the help of determinants $3x+4y=5$, $x-y=-3$. (1.5)
- (f) Construct a 3×3 matrix whose elements are $a_{ij} = \frac{(i+2j)^2}{2}$. (1.5)
- (g) Find the Domain and range of the function $\frac{x^2}{1+x^2}$. (1.5)
- (h) Find Matrix X, if $\begin{bmatrix} 3 & 5 & -9 \\ -1 & 4 & -7 \end{bmatrix} + X = \begin{bmatrix} 6 & 2 & 3 \\ 4 & 8 & 6 \end{bmatrix}$. (1.5)
- (i) If $A=\{1,2,5,6\}$, $B=\{2,3,5,7\}$ and $C=\{4,5,7,8\}$, Find $A \cup (B \cap C)$. (1.5)
- (j) Find the area of the triangle whose vertices are $(-2,4)$, $(2,-6)$ and $(5,4)$. (1.5)

PART -B

- Q2 (a) Evaluate $\begin{vmatrix} \cos\alpha\cos\beta & \cos\alpha\sin\beta & -\sin\alpha \\ -\sin\beta & \cos\beta & 0 \\ \sin\alpha\cos\beta & \sin\alpha\sin\beta & \cos\alpha \end{vmatrix}$. (8)

(b) Prove that if any two rows or columns of a determinant are proportional, then its value is zero. (7)

Q3 (a) Determine the value of a and b for which the system $\begin{bmatrix} 3 & -2 & 1 \\ 5 & -8 & 9 \\ 2 & 1 & a \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} b \\ 3 \\ -1 \end{bmatrix}$ has (8)

i) a unique solution ii) no solution iii) an infinite number of solutions (7)

(b) If $A = \begin{bmatrix} 1 & 0 & -2 \\ 3 & -1 & 0 \\ -2 & 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 0 & 5 & -4 \\ -2 & 1 & 3 \\ -1 & 0 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 5 & 2 \\ -1 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix}$ verify that $A(B - C) = (AB - AC)$.

Q4 (a) If $f(x) = 2^{|x|}$ and $g(x) = [x]$ where $[.]$ denotes greatest integer function. Find the value of $f \circ g(x)$ and $f \circ g(-17/2)$. (8)

(b) Graph the function f where $f(x) = \begin{cases} x^2 & \text{when } x < 2 \\ 4 & \text{when } x > 2 \end{cases}$ (7)

Q5 (a) Find the Principle value of $\cos^{-1}(\frac{1}{2})$. (8)

(b) Find the value of Trigonometric function $\cot x = 3/4$, x lies in third quadrant. (7)

Q6 (a) In a group of 50 people, 35 speak Hindi, 25 speak both English and Hindi and all the people speak at least one of the two languages. How many people speak only English and not Hindi? How many people speak English? (8)

(b) In a school, there are 25 teachers who teach Mathematics or Physics. Of these 14 teach Mathematics and 6 teach Physics and Mathematics. How many teach Physics? (7)

Q7 (a) Prove that $\begin{vmatrix} y+z & x & y \\ z+x & z & x \\ x+y & y & z \end{vmatrix} = (x+y+z)(x-z)^2$. (8)

(b) Prove that the sum of two symmetric matrices is symmetric and the sum of two skew-symmetric matrices is skew-symmetric. (7)
