INFINITY
THINK BEYOND...........

AN EDUCATIONAL INSTITUTE

SUBJECT:MATHS   MAX. MARKS : 30
DATE : 18/11/24   DURATION : 60 MIN

PBMT – 02
UNIT – 2 ALGEBRA
Ch – 3 Matrices
Ch –4 Determinants

General Instruction:
This Question Paper has 5 Sections A-E.
1. Section A has 6 MCQs carrying 1 mark each.
2. Section B has 2 questions carrying 02 marks each.
3. Section C has 2 questions carrying 03 marks each.
4. Section D has 1 questions carrying 04 marks each.
5. Section E has 2 questions carrying 05 marks each .
Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION – A
Questions 1 to 6 carry 1 mark each.

1. If $\begin{pmatrix} a & c & 0 \\ b & d & 0 \\ 0 & 0 & 5 \end{pmatrix}$ is a scalar matrix , then the value of a +2b+3c+4d is

(a)0   (b)5   (c)10   (d)25

2. If A = $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$, then A^{10} is

(a) 10A   (b)9A   (c)29A   (d) 210 A

3. If $\begin{pmatrix} -2 & 0 & 0 \\ 1 & 2 & 3 \\ 5 & 1 & -1 \end{pmatrix}$, then the value of $| A (adj\ A) |$

(a) 1001   (b) 101   (c) 10   (d) 1000

4. The maximum value of determinant $of \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1+\sin x & 1 \\ 1 & 1 & 1+\cos x \end{pmatrix}$ is

(a) $\frac{\sqrt{3}}{2}$ (b) $\frac{1}{2}$ (c) $\frac{\sqrt{2}}{2}$ (d) $2\sqrt{3}$

5. Assertion (A): For any two matrices of the same order, $(A + B)^{\mathsf{T}} = A^{\mathsf{T}} + B^{\mathsf{T}}$.
Reason (R): For any two matrices such that AB is defined, then $(AB)^{\mathsf{T}} = A^{\mathsf{T}}B^{\mathsf{T}}$
(a) Both(A) and (R) are true and (R) is the correct explanation of (A).
(b) Both(A) and (R) are true and (R) is not the correct explanation of (A)
(c) (A) is true and (R) is false
(d) (A) is false and (R) is true

6. Assertion (A): If the matrix A= $\begin{pmatrix} 1 & 3 & k+2 \\ 2 & 4 & 8 \\ 3 & 5 & 10 \end{pmatrix}$ is singular, then k=4.
Reason (R) : If A is a singular matrix, then $| A |$ =0.
(a) Both(A) and (R) are true and (R) is the correct explanation of (A).
(b) Both(A) and (R) are true and (R) is not the correct explanation of (A)

(c) (A) is true and (R) is false
(d) (A) is false and (R) is true

SECTION – B
Questions 7 to 8 carry 2 mark each.

7. If B is skew symmetric matrix, check where the matrix (ABA^T) is symmetric or skew symmetric .

8.If $\begin{bmatrix} 9 & -1 & 4 \\ -2 & 1 & 3 \end{bmatrix}$ = A + $\begin{bmatrix} 1 & 2 & -1 \\ 0 & 4 & 9 \end{bmatrix}$, then find the matrix A.

SECTION – C
Questions 9 to 10 carry 3 mark each.

9. Express $\begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$ as the sum of symmetric and skew symmetric matrices.

10. If A is a skew symmetric matrix of order 3 ,then prove that det A = 0 .

SECTION – D
Questions 11 carry 4 mark each.

11. Ashish wants to purchase a rectangular plot from his neighbour to construct a house. He asked about the dimensions of the plot , his neighbour told that if the length is decreased by 20m and breadth is increased by 30 m ,the area will increase by 1400m^2 , but If the length is decreased by 50m and the breadth is increased by 50m, then the area will remain the same.
Based on the information given above, answer the following questions
(i) Let $x \; and \; y$ denote the length and breadth of the plot, find equations in terms of x .
(ii) Represent the information in matrix form.
(iii) If A = $\begin{bmatrix} 3 & -2 \\ 1 & -1 \end{bmatrix}$, Find AA^T.
OR
If P = $\begin{bmatrix} 1 & -1 \\ 3 & -2 \end{bmatrix}$ and Q = $\begin{bmatrix} 200 \\ 50 \end{bmatrix}$ Find PQ and QP.

SECTION – E
Questions 12 to 13 carry 5 mark each

12. If A = $\begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$, then prove that A^3 − 6A^2 + 9A − 4 I = O.

13. Use the product of matrix $\begin{pmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{pmatrix} \begin{pmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{pmatrix}$, to solve the system of equations.

x + 3z = 9
x + 2y - 2z = 4
2x- 3y + 4z = -3

OR

Find A^{-1}, if A= $\begin{pmatrix} 1 & 2 & 1 \\ 2 & 3 & -1 \\ 1 & 0 & 1 \end{pmatrix}$ Hence , solve the following system of equations:

x + 2y + z = 5 ; 2x + 3y = 1 ; x − y + z = 8
_____**End**_____