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Note:-

1. All Questions are compulsory.
2. Numbers on the right indicate full marks.

Section A

Q.1. Select and write the correct answer.

(4)

1. If $A + B = \begin{bmatrix} 7 & 4 \\ 8 & 9 \end{bmatrix}$, $A - B = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$ then the value of A is

- A) $\begin{bmatrix} 3 & 1 \\ 4 & 3 \end{bmatrix}$ B) $\begin{bmatrix} 4 & 3 \\ 4 & 6 \end{bmatrix}$
C) $\begin{bmatrix} 6 & 2 \\ 8 & 6 \end{bmatrix}$ D) $\begin{bmatrix} 7 & 6 \\ 8 & 12 \end{bmatrix}$

2. If $\begin{bmatrix} x & 3x - y \\ zx + z & 3y - w \end{bmatrix} = \begin{bmatrix} 3 & 2 \\ 4 & 7 \end{bmatrix}$ then

- A) $x = 3, y = 7, z = 1, w = 14$ B) $x = 3, y = -5, z = -1, w = -4$
C) $x = 3, y = 6, z = 2, w = 7$ D) $x = -3, y = -7, z = -1, w = -14$

Q.2. Answer the following.

(3)

1. Classify the following matrices as a row, a column, a square, a diagonal, a scalar, a unit, an upper triangular, a lower triangular, a symmetric or a skew symmetric matrix.

$$\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

2. Classify the following matrices as a row, a column, a square, a diagonal, a scalar, a unit, an upper triangular, a lower triangular, a symmetric or a skew symmetric matrix.

$$\begin{vmatrix} 0 & 4 & 7 \\ -4 & 0 & -3 \\ -7 & 3 & 0 \end{vmatrix}$$

3. Classify the following matrices as a row, a column, a square, a diagonal, a scalar, a unit, an upper triangular, a lower triangular, a symmetric or a skew symmetric matrix.

$$\begin{bmatrix} 9 & \sqrt{2} & -3 \end{bmatrix}$$

Section B
Attempt any Four

Q.3 If $A = \begin{bmatrix} 1 & -2 \\ 5 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 1 & -3 \\ 4 & -7 \end{bmatrix}$ then find the matrix $A - 2B + 6I$, where I is a unit matrix of order 2. **(2)**

Q.4 Solve the following equations : (2)

$$\begin{vmatrix} x-1 & x & x-2 \\ 0 & x-2 & x-3 \\ 0 & 0 & x-3 \end{vmatrix} = 0$$

Q.5 If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ prove that $A^2 - 5A + 7I = 0$, where I is a unit matrix of order 2. (2)

Q.6 Evaluate the determinant along second column $\begin{vmatrix} 1 & -1 & 2 \\ 3 & 2 & -2 \\ 0 & 1 & -2 \end{vmatrix}$ (2)

Q.7 Jay and Ram are two friends in a class. Jay wanted to buy 4 pens and 8 notebooks; Ram wanted to buy 5 pens and 12 note books. Both of them went to a shop. The price of a pen and notebook which they have selected was ₹ 6 and ₹10. Using matrix multiplication find the amount required from each on of them. (2)

Q.8 If $f(a) = \begin{bmatrix} \cos \alpha & -\sin \alpha & 0 \\ \sin \alpha & \cos \alpha & 0 \\ 0 & 0 & 1 \end{bmatrix}$ find (i) $f(-a)$ (ii) $f(-a) + f(a)$ (2)

Section C
Attempt any Two

Q.9 If $A = \begin{bmatrix} 2 & -3 \\ 3 & -2 \\ -1 & 4 \end{bmatrix}$, $B = \begin{bmatrix} -3 & 4 & 1 \\ 2 & -1 & -3 \end{bmatrix}$ verify $(A + B^T)^T = A^T + B$ (3)

Q.10 Find x and y if $\begin{vmatrix} 4i & i^3 & 2i \\ l & 3i^2 & 4 \\ 5 & -3 & i \end{vmatrix} = x + iy$ where $i^2 = -1$ (3)

Q.11 Evaluate $A = \begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$ Also find minor and cofactor of elements in the 2nd row of determinant and verify. (3)

(a) $-a_{21} \cdot M_{21} + a_{22} \cdot M_{22} - a_{23} \cdot M_{23} = \text{value of } A$

(b) $a_{21} \cdot C_{21} + a_{22} \cdot C_{22} + a_{23} \cdot C_{23} = \text{value of } A$

Where M_{21}, M_{22}, M_{23} are minor of a_{21}, a_{22}, a_{23} and C_{21}, C_{22}, C_{23} are cofactor of a_{21}, a_{22}, a_{23} .

Section D
Attempt any One

Q.12 An amount of ₹ 5000 is put into three investments at the rate of interest of 6%, 7% and 8% per annum respectively. The total annual income is ₹ 350. If the combined income from the first two investments is ₹ 70 more than the income from the third. Find the amount of each investment. (4)

Q.13 Prove that : (4)

$$\begin{vmatrix} x+y & y+z & z+x \\ z+x & x+y & y+z \\ y+z & z+x & x+y \end{vmatrix} = 2 \begin{vmatrix} x & y & z \\ z & x & y \\ y & z & x \end{vmatrix}$$