Total : 9 Marks (expected) [MCQ(1)-1 Mark, Assertion-Reason(1)-1 Mark, SA(1)-3 Marks, CBQ(1)-4 Marks]

Level - 1 & 2

SECTION—A

MCQ Type Questions (1 mark each):

1. A and B are two matrices such that $AB = A$ and $BA = B$ and $B^2 = B^K$ then K equal to

   Ⓐ 1   Ⓑ –1   Ⓒ 2   Ⓓ –2

   [**Hint:** matrix multiplication and its properties]

2. $(AB)^T =$

   Ⓐ $B^T A^T$ Ⓑ $A^T B^T$ Ⓒ $A^T B$ Ⓓ $B^T A$

   [**Hint:** Properties of transposes]

3. If $A = \begin{pmatrix} 0 & 7 \\ 0 & 0 \end{pmatrix}$ and $f(x) = 1 + x + x^2 + \; + x^{20}$ then $f(A) =$

   Ⓐ 0 Ⓑ $\begin{bmatrix} 1 & 7 \\ 0 & 0 \end{bmatrix}$ Ⓒ $\begin{bmatrix} 1 & 7 \\ 0 & 1 \end{bmatrix}$ Ⓓ $\begin{bmatrix} 0 & 7 \\ 1 & 1 \end{bmatrix}$

   [**Hint:** observe the patter $\begin{bmatrix} 0 & x \\ 0 & 0 \end{bmatrix}$]

4. If A be a square matrix, then A^2 will be

   Ⓐ symmetric matrix   Ⓑ skew symmetric matrix

   Ⓒ diagonal matrix   Ⓓ none of these

   [**Hint:** Depends on A]

5. If the matrix A is both symmetric and skew-symmetric then

   Ⓐ A is a diagonal matrix   Ⓑ A is a zero matrix   Ⓒ A is a square matrix   Ⓓ none of these

   [**Hint:** null matrix]

6. If $A = (a_{ij})$ is a 2×2 matrix whose elements are $a_{ij} = \frac{1}{2}(\hat{i} + 2j)^2$, then A will be

   Ⓐ $\begin{bmatrix} \frac{9}{2} & \frac{25}{2} \\ 8 & 18 \end{bmatrix}$ Ⓑ $\begin{bmatrix} 9 & \frac{15}{2} \\ 8 & 18 \end{bmatrix}$ Ⓒ $\begin{bmatrix} \frac{9}{2} & \frac{25}{2} \\ 8 & 9 \end{bmatrix}$ Ⓓ $\begin{bmatrix} \frac{9}{2} & \frac{15}{2} \\ 4 & 18 \end{bmatrix}$

   [**Hint:** construction of matrix when a_{ij} is given]

7. If $\begin{bmatrix} 2x - y & 5 \\ 3 & y \end{bmatrix} = \begin{bmatrix} 6 & 5 \\ 3 & -2 \end{bmatrix}$ then the value of x is

   Ⓐ 0   Ⓑ 1   Ⓒ 2   Ⓓ 3

   [**Hint:** Equality of matrices]

Developed by AEP

Very Short Answer Type Questions (2 marks each)

8. Cite one example to show that the matrix multiplication, is ingeneral, is not commutative
[**Hints:** $AB \neq BA$]

9. If $A = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$, prove that $A - A^T$ is a skew-symmetric matrix.

[**Hints:** $A^T = -A$ skew symmetric matrix]

10. If a matrix has 18 elements, what are the possible orders it can have? What, if it has 5 elements?
[**Hints:** write 18 as a product of two natural numbers]

11. If A and B be two matrices such that $A + B$ and AB are both defined, show that A and B are both square matrices of the same order.
[**Hints:** use the concept when product and addition are defined]

12. If two matrices A and B of orders $2 \times m$ and $3 \times n$ respectively are comfortable for the product AB or order $p \times 4$, find the values of m, n and p.
[**Hints:** condition that product is defined]

13. Evaluate : $\begin{bmatrix} x & y & z \end{bmatrix} \times \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix} \times \begin{bmatrix} x \\ y \\ z \end{bmatrix}$

[**Hints:** Matrix multiplication]

14. If $A = \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}$ and $A^2 - 4A + 3I_2 = 0$ then find A^{-1}.

[**Hints:** use $AB = BA = I$]

SECTION—C

Short Answer Type Questions (3 marks each)

15. If A and B are two matrices such that $AB = 0$, can we deduce that either A or B is a zero matrix? Illustrate by an example.
[**Hints:** condition of $AB = 0$]

16. Find the value of x such that $\begin{bmatrix} 1 & x & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix} \times \begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0$

[**Hints:** Matrix multiplication]

17. If $A = \begin{pmatrix} 1 & 2 \\ -1 & -2 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 3 \\ -3 & 1 \end{pmatrix}$, then show that, $(A + B)^2 \neq A^2 + 2AB + B^2$.

[**Hints:** $AB \neq BA$]

18. If $P = \begin{pmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{pmatrix}$ then show that $P^2 = P$.

[**Hints:** $P \cdot P = ?$]

19. If $P = \begin{pmatrix} 1 & -3 & -4 \\ -1 & 3 & 4 \\ 1 & -3 & -4 \end{pmatrix}$ then show that $P^2 = 0$.

[**Hints:** $P \cdot P$]

20. If $A = \begin{pmatrix} i & -i \\ -i & i \end{pmatrix}$ and $B = \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ then show that $A^8 = 128B$.

[**Hints:** first find A^2, write B in terms of i]

21. A, B, C are matrices of order 2×2 with $AB = AC$. Does it imply that $B = C$? Give an example in support of your conclusion.

[**Hints:** use concept of right cancellation]

SECTION—D

Long Answer Type Questions (5 marks each)

22. If $A = \begin{pmatrix} 1 & 2 & x \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 1 & -2 & y \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ and $AB = I_3$, then find the value of $x + y + 1 = ?$

[**Hints:** product of matrices]

23. If $A = \begin{pmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{pmatrix}$ then $A^{100} = \begin{pmatrix} 1 & 0 \\ 10 \times \lambda & 1 \end{pmatrix}$, find the value of λ.

[**Hints:** pattern identification in product]

24. If $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ and $E = \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$ prove that,

$(2I + 3E)^3 = 8I + 36E$.
[**Hints:** Matrix multiplication]

25. Express the matrix $A = \begin{pmatrix} 4 & 2 & -1 \\ 3 & 5 & 7 \\ 1 & -2 & 1 \end{pmatrix}$ as the sym of a symmetric and a skew-symmetric matrix.

[**Hints:** Properties of symmetric and skew symmetric matrices]

26. If $A = \begin{pmatrix} 1 & x & -2 \\ 2 & 2 & 4 \\ 0 & 0 & 2 \end{pmatrix}$ and $A^2 + 2I_3 = 3A$ find x; here I_3 is the unit matrix of order 3.

[**Hints:** Equality of matrices & matrix multiplication]

27. If $A = \begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$ and $f(x) = x^2 - 2x - 3$, show that $f(A) = 0$.

[**Hints:** Calculate : $A^2 - 2A - 3I_2$]

28. If $A = \begin{pmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{pmatrix}$ then prove that, $AA' = I$. Hence find A^{-1}.

[**Hints:** $A^T = (a_{ij})^T$]

A N S W E R

SECTION—A

1. Ⓐ   **2.** Ⓐ   **3.** Ⓒ   **4.** Ⓓ   **5.** Ⓑ   **6.** Ⓐ   **7.** Ⓒ

SECTION—B

3. 1×18, 18×1, 2×9, 9×2, 3×6, 6×3 and 5×1, 1×5 **5.** m = 3, n = 4, p = 2

6. $ax^2 + by^2 + cz^2 + 2hxy + 2fyz + 2gzx$ **7.** $\dfrac{1}{3}\begin{pmatrix} 2 & 1 \\ 1 & 2 \end{pmatrix}$

SECTION—C

16. –14, –2

SECTION—D

22. 1   **23.** 5   **26.** 0   **28.** $\begin{pmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{pmatrix}$