4. If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then

(i) $AB = 0$ (ii) $BA = 0$

(iii) AB and BA are not defined (iv) None of these

Ans. (iv)

5. If $A = \begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}$, $B = \begin{bmatrix} -3 & 1 \\ 2 & 0 \end{bmatrix}$, then AB is

(i) $\begin{bmatrix} 4 & 2 \\ 0 & 2 \end{bmatrix}$ (ii) $\begin{bmatrix} -4 & 2 \\ 1 & 2 \end{bmatrix}$ (iii) $\begin{bmatrix} -4 & 2 \\ 0 & 2 \end{bmatrix}$ (iv) $\begin{bmatrix} 4 & 2 \\ 1 & 2 \end{bmatrix}$ Ans. (iii)

6. Let A and B, be two matrices, then

(i) $AB = BA$ (ii) $AB \neq BA$ (iii) $AB < BA$ (iv) $AB > BA$ Ans. (ii)

7. In matrices:

(i) $(A + B)^2 = A^2 + 2\,AB + B^2$ (ii) $(A + B)^2 = A^2 + B^2$

(iii) $(A + B)^2 \neq A^2 + 2\,AB + B^2$ (iv) $(A + B)^2 = A^2 + 2\,BA + B^2$ Ans. (iii)

8. If $f(x) = x^2 + 3\,x + 4$, then $f(A) =$

(i) $A^2 + 3\,A + 4\,I$ (ii) $A^2 + 3\,A + 4$ (iii) $A^2 + 3\,A$ (iv) $(A + 4)(A + I)$

Ans. (i)

9. In matrix multiplication of two matrix A and matrix B,

(i) $AB = BA$ (ii) $AB \neq BA$ (iii) $AB = 2B$ (iv) None of these

Ans. (ii)

10. The value of the determinant $\begin{bmatrix} 1 & w & w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{bmatrix}$ where w is the cube root of unity equals

(i) 0 (ii) 1 (iii) w (iv) w^2 Ans.(i)

11. If Tp, Tq and Tr are the pth, qth, rth terms of an AP then $\begin{bmatrix} Tp & Tq & Tr \\ p & q & r \\ 1 & 1 & 1 \end{bmatrix}$ equals

(i) 1 (ii) –1 (iii) 0 (iv) None of these

Ans. (iii)

is called :

(*i*) Singular (*ii*) Unit matrix (*iii*) Inverse (*iv*) None of the above **Ans. (*iii*)**

16. If A is non-singular matrix of order $n \times n$ then $|\text{adj}(A)|$ is equal to

(*i*) 1 (*ii*) 0 (*iii*) $|A|^{n-1}$ (*iv*) None of these **Ans. (*iii*)**

17. Which of the following matrices is non-singular ?

(*i*) $\begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}$ (*ii*) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (*iii*) $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$ (*iv*) $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$ **Ans. (*ii*)**

18. If A is a skew-symmetric matrix of odd order, then the determinant of A is

(*i*) – 1. (*ii*) 0. (*iii*) 1. (*iv*) a real number. **Ans. (*ii*)**

19. If A and B are square matrices of equal order and λ, μ are numbers, then $\lambda A + \mu B$ is

(*i*) symmetric if A is symmetric and B is skew-symmetric

(*ii*) symmetric if A and B are both symmetric

(*iii*) symmetric if both A and B are skew-symmetric

(*iv*) symmetric if B is symmetric and A is skew-symmetric **Ans. (*ii*)**

20. If $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$, then $A^n =$

(*i*) $\begin{bmatrix} 1 & 1 \\ 0 & n \end{bmatrix}$ (*ii*) $\begin{bmatrix} 1 & 0 \\ n & 1 \end{bmatrix}$ (*iii*) $\begin{bmatrix} n & 0 \\ 1 & 1 \end{bmatrix}$ (*iv*) $\begin{bmatrix} 1 & n \\ 0 & 1 \end{bmatrix}$ **Ans. (*iv*)**

21. If $r\begin{bmatrix} 5 \\ 2 \end{bmatrix} + s\begin{bmatrix} 6 \\ 3 \end{bmatrix} = \begin{bmatrix} 27 \\ 12 \end{bmatrix}$, then

(*i*) $r = 3, s = 2$ (*ii*) $r = 2, s = 3$ (*iii*) $r = 3, s = -2$ (*iv*) $r = -3, s = 2$ **Ans. (*i*)**

22. Given $A = \begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix}$, which of the following results is true ?

(*i*) $A^2 = I$ (*ii*) $A^2 = 2I$ (*iii*) $2A^2 = I$ (*iv*) $A^2 = A$ **Ans. (*i*)**

23. If $A = \begin{bmatrix} 0 & 1 \\ 2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 0 \\ 0 & 4 \end{bmatrix}$, then $|AB|$ is equal to

(*i*) –24 (*ii*) 24 (*iii*) Not defined (*iv*) None of these **Ans. (*i*)**

24. If the matrix $A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$, $C = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$ then

(*i*) $C = A\cos\theta - B\sin\theta$ (*ii*) $C = A\sin\theta + B\cos\theta$

(*iii*) $C = A\sin\theta - B\cos\theta$ (*iv*) $C = A\cos\theta + B\sin\theta$ **Ans. (*iv*)**

25. Let I be the unit matrix of order n and adj. $(2I) = 2^k I$. Then k equals

(*i*) 1 (*ii*) 2 (*iii*) $n - 1$ (*iv*) n. **Ans. (*iii*)**

26. Which of the following matrices is not invertible ?

(*i*) $\begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}$ (*ii*) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (*iii*) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ (*iv*) None of these **Ans.** (*i*)

27. With 1, ω, ω^2 as cube roots of unity, inverse of which of the following matrices exists ?

(*i*) $\begin{bmatrix} 1 & \omega \\ \omega & \omega^2 \end{bmatrix}$ (*ii*) $\begin{bmatrix} \omega^2 & 1 \\ 1 & \omega \end{bmatrix}$ (*iii*) $\begin{bmatrix} \omega & \omega^2 \\ \omega^2 & 1 \end{bmatrix}$ (*iv*) None of these **Ans.** (*iv*)

28. If A and B are two square matrices of same order then *adj* (AB) is

(*i*) $(Adj\ A)(Adj\ B)$ (*ii*) $(Adj\ B)(Adj\ A)$

(*iii*) A *adj* B + (*adj* A) B (*iv*) None of these **Ans.** (*ii*)

29. If $A\begin{bmatrix} 0 & 1 \\ 2 & -1 \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$, where $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then A is

(*i*) $\begin{bmatrix} 2 & 1 \\ 0 & 0 \end{bmatrix}$ (*ii*) $\begin{bmatrix} 0 & 1 \\ 2 & -1 \end{bmatrix}$ (*iii*) $\begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$ (*iv*) $\begin{bmatrix} 2 & 1 \\ -\frac{1}{2} & -\frac{1}{2} \end{bmatrix}$ **Ans.** (*iv*)

30. If $A\begin{bmatrix} 1 & 2 \\ 0 & -1 \end{bmatrix} = \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$, where $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then A is

(*i*) $\begin{bmatrix} 2 & 1 \\ 5 & -1 \end{bmatrix}$ (*ii*) $\begin{bmatrix} 2 & 5 \\ 1 & -1 \end{bmatrix}$ (*iii*) $\begin{bmatrix} 2 & -5 \\ -1 & 1 \end{bmatrix}$ (*iv*) $\begin{bmatrix} 0 & 5 \\ -1 & 1 \end{bmatrix}$ **Ans.** (*ii*)

31. If a matrix A satisfies a relation $A^2 + A - I = 0$, then

(*i*) A^{-1} exists (*ii*) A^{-1} does not exist

(*iii*) A^{-1} exists and is equal to $I + A$

(*iv*) A^{-1} exists and is equal to I, where I is an identity matrix **Ans.** (*iii*)

32. Matrix A has x rows and $x + 5$ columns. Matrix B has y rows and $11 - y$ columns. Both AB and BA exist. Which of the following values for x and y are possible ?

(*i*) $x = 2, y = 6$ (*ii*) $x = 3, y = 8$ (*iii*) $x = 4, y = 4$ (*iv*) $x = 8, y = 3$ **Ans.** (*ii*)

33. If $I + A + A^2 + ... + A^K = 0$, then A^{-1} equal to

(*i*) A^K (*ii*) A^{K-1} (*iii*) A^{K+1} (*iv*) $I + A$ **Ans.** (*i*)

34. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ \alpha & 1 & 0 \\ \beta & \gamma & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 4 & 1 \end{bmatrix}$ then

(*i*) A is row equivalent to B only if $\alpha = 2, \beta = 3, \gamma = 4$

(*ii*) A is row equivalent to B only if $\alpha \neq 0, \beta \neq 0, \gamma = 0$

(*iii*) A is not equivalent to B

(*iv*) A is row equivalent to B for all values of α, β, γ **Ans.** (*i*)

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

OBJECTIVE TYPE QUESTIONS

Fill up the blanks:

1. The rank of $\begin{bmatrix} 4 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is equal to ....

Ans. 3

2. The rank of $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$ is equal to ....

Ans. 1

Choose the correct alternative:

3. The rank of the diagonal matrix $\begin{bmatrix} -1 & & & & & \\ & 0 & & & & \\ & & 1 & & & \\ & & & 0 & & \\ & & & & 0 & \\ & & & & & 4 \end{bmatrix}$ is

(*i*) 1, (*ii*) 2, (*iii*) 3, (*iv*) 4

Ans. (*iii*)

5. If A is a non-zero column vector, $(n \times 1)$, then the rank of matrix AA^T is

(i) 0, (ii) 1, (iii) $n-1$, (iv) n. **Ans.** (ii)

6. The rank of matrix $\begin{bmatrix} \mu & -1 & 0 \\ 0 & \mu & -1 \\ -1 & 0 & \mu \end{bmatrix}$ is 2, for μ equal

(i) any row number (iv) 3 (iii) 1 (iv) 2 **Ans.** (iii)

7. If P and Q are non-singular matrices, then for Matrix 'M', which of the following statements are correct ?

(i) Rank (PMQ) > Rank M

(ii) Rank (PMQ) = Rank M

(iii) Rank (PMQ) > Rank M **Ans.** (ii)

(iv) Rank (PMQ) = Rank M + Rank (PQ)

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8. Rank of singular matrix of order 4, can be at the most.

(i) 1 (ii) 2 (iii) 3 (iv) 4 **Ans.** (iii)

9. The value of μ for which the rank of the matrix $A = \begin{bmatrix} \mu & -1 & 0 & 0 \\ 0 & \mu & -1 & 0 \\ 0 & 0 & \mu & -1 \\ -6 & 11 & -6 & 1 \end{bmatrix}$ is equal to 3 is

(i) 0 (ii) 1 (iii) 4 (iv) –1 **Ans.** (ii)

10. If the rank of an $n \times n$ matrix A is $(n-1)$, then the system of equations $Ax = b$ has

(i) $(n-1)$ parameter family of solutions .

(ii) one parameter family of solutions

(iii) no solution **Ans.** (i)

(iv) a unique solution

11. The rank of matrix $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 0 & 5 & 6 & 0 \\ 0 & 0 & 3 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ is

(i) 4 (ii) 3 (iii) 1 (iv) 0 **Ans.** (i)

Indiacte True or False for the following:

12. The rank of the matrix $\begin{bmatrix} 1 & 2 & 5 & 6 \\ 2 & 4 & 10 & 12 \\ -1 & -2 & -5 & -6 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ is 1. **Ans.** True

13. The rank of the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ is 2. **Ans.** True

14. The rank of a matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is 2. **Ans.** False

15. The rank $\begin{bmatrix} 100 & 90 & 20 \\ 10 & 2 & 2 \\ 0 & 0 & 1 \end{bmatrix}$ is 1.

Ans. False

16. The rank of matrix A and A' are equal.

Ans. True

17. The rank of matirx A and 100 A are not equal.

Ans. False

18. The rank of $\begin{bmatrix} 1 & 2 & 0 & -2 & -4 \\ 2 & 3 & 4 & 5 & 6 \\ 3 & 5 & 4 & 3 & 2 \end{bmatrix}$ and $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ are not equal.

Ans. False

Match the following:

19. Rank of

(*i*) $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$	(*a*) 2
(*ii*) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$	(*b*) 3
(*iii*) $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$	(*c*) 0
(*iv*) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$	(*d*) 1
(*v*) $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$	(*e*) 4

Ans. (*i*) → (*d*),
(*ii*) → (*a*),
(*iii*) → (*b*),
(*iv*) → (*c*),
(*v*) → (*e*)

10. The following system of equations given

$x + 2y + z = 0$

$2x + ay + az = 2$

$x + y + 2z = 1$

The value of a, for which nontrivial solution exists is

(*i*) $a = 3$ (*ii*) $a = 6$ (*iii*) $a \neq 3$ (*iv*) $a \neq 6$ **Ans.** (*iii*)

11. The solution of the equations

$5x + 3y + 3z = 48$

$2x + 6y - 3z = 18$

$8x - 3y + 2z = 21$ is

(*i*) $x = 3, y = 5, z = 6$ (*ii*) $x = 0, y = 5, z = 3$

(*iii*) $x = 3, y = 0, z = 6$ (*iv*) $x = 3, y = 5, z = 0$ **Ans.** (*i*)

12. The system of equations

$x - y + z = -\lambda$

$x + y + z = \lambda$

$-x + y - z = \lambda$ has

(*i*) unique solution (*ii*) infinitely many solutions

(*iii*) no solution (*iv*) None of these **Ans.** (*ii*)

13. The solution of the simultaneous equations

$x + y + z = 3, \quad 2x + y - z = 2 \quad \text{and} \quad 3x + 2y + 2z = 7$ is

(*i*) $x = 0, y = 1, z = 2$ (*ii*) $x = 1, y = 1, z = 1$

(*iii*) $x = y = z = 0$ (*iv*) $x = 1, y = 2, z = 3$ **Ans.** (*ii*)

14. The solution of the simultaneous equations

$2x + y + z = 7, \quad 3x + y + z = 8 \quad \text{and} \quad 5x + 6x - z = 14$ is

(*i*) $x = 1, y = 2, z = 3$ (*ii*) $x = 0, y = 1, z = 2$

(*iii*) $x = 2, y = 3, z = 2$ (*iv*) $x = 2, y = 3, z = 4$ **Ans.** (*i*)

15. Let $v_1 = (1, 1, 0, 1)$, $v_2 = (1, 1, 1, 1)$, $v_3 = (4, 4, 1, 1)$ and $v_4 = (1, 0, 0, 1)$ be elements or R_4. The set of vectors $\{v_1, v_2, v_3, v_4\}$ is

(*i*) linearly independent (*ii*) linearly dependent

(*iii*) null (*iv*) none of these **Ans.** (*ii*)

16. The system of equations $2x - y = 3$, $x - 3y = 4$ and $x + 2y = 1$ has

(*i*) a unique solution (*ii*) infinitely many solutions

(*iii*) no solution (*iv*) none of these **Ans.** (*iii*) atch the following

3. In the system of equation $AX = B$ and $A, B = C$

(a) If the rank of $A \neq$ rank of C	(p) consistent with unique solution
(b) If the rank of A = rank of C = number of unknowns	(q) Infinite solutions consistent with
(c) If the rank A = rank of $C <$ No. of unknowns	(r) have a solution
(d) The solution of $AX = 0$ is always	(s) Inconsistant

Ans. (a) → (s)
(b) → (p)
(c) → (q)
(d) → (r)

4. The symultaneous equations

$$a_1x + b_2y + c_1 = 0$$
$$a_2x + b_2y + c_2 = 0$$

(i) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	(p) No solution
(ii) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$	(q) Unique solution
(iii) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	(r) Infinity many solutions
(iv) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	(s) None of these

Ans. (i) → (r)
(ii) → (s)
(iii) → (p)
(iv) → (q)

Fill up the blanks.

25. The solution of the following system of equations $x + 2y + 3z = 6$

$2x + y - z = 2$

$x - 3y + 5z = 3$ is

$x = 1$, $y =$ ——— and $z =$ ———

Ans. $y = 1, z = 1$

OBJECTIVE TYPE QUESTIONS

Tick (√) the correct answer:

1. If λ_1, λ_2 and λ_3 are the eigen values of the matrix

$$\begin{bmatrix} -2 & -9 & 5 \\ -5 & -10 & 7 \\ -9 & -21 & 14 \end{bmatrix}$$ then $\lambda_1 + \lambda_2 + \lambda_3$ is equal to

(*i*) –16 (*ii*) 2 (*iii*) – 6 (*iv*) –14 **Ans.** (*ii*)

2. The matrix $A = \begin{bmatrix} 1 & 0 \\ 2 & 4 \end{bmatrix}$ is given and the eigen values of $4A^{-1} + 3A + 2I$ are

(*i*) 6, 15 (*ii*) 9, 12 (*iii*) 9, 15 (*iv*) 7, 15 **Ans.** (*iii*)

3. If a square matrix A has an eigen value λ, then an eigen value of the matrix $(kA)^T$ where $k \neq 0$ is a scalar, is

(*i*) λ / k (*ii*) k / λ (*iii*) $k\lambda$ (*iv*) None of these **Ans.** (*iii*)

4. For the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ the sum of the eigen values is

(*i*) –1 (*ii*) 0 (*iii*) 3 (*iv*) 5 **Ans.** (*i*)

5. A 3 × 3 real matrix has an eigen value i then its other two eigen values can be

(*i*) 0, 1 (*ii*) –1, i (*iii*) $2i$, $-2i$ (*iv*) 0, $-i$ **Ans.** (*iv*)

6. Let A be a square matrix. Then $\lambda = 0$ is an eigen value of A if and only if

(*i*) A is non-singular (*ii*) A is of even order

(*iii*) A is of odd order (*iv*) A is singular **Ans.** (*iv*)

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7. The matrix A is defined as $A = \begin{bmatrix} -1 & 0 & 0 \\ 2 & -3 & 0 \\ 1 & 4 & 2 \end{bmatrix}$. The eigen values of A^2 are

(*i*) –1, –9, –4 (*ii*) 1, 9, 4

(*iii*) –1, –3, 2 (*iv*) 1, 3, –2 **Ans.** (*ii*)

8. If the matrix $A = \begin{bmatrix} -1 & 2 & 3 \\ 0 & 3 & 5 \\ 0 & 0 & -2 \end{bmatrix}$ then the eigen values of $A^3 + 5A + 8I$, are

(*i*) –1, 27, –8 (*ii*) 1, 3, –2 (*iii*) 2, 50, –10 (*iv*) 2, 50, 10 **Ans.** (*iii*)

9. Let P be a real square matrix of order n and n is odd. Then

(*i*) at least one eigen value of A is real (*ii*) one eigen value of A is zero

(*iii*) one eigen value of A is 1 (*iv*) A has no real eigen values **Ans.** (*i*)

10. Two of the eigen values of a 3 × 3 matrix, whose determinant equals 4, are –1 and +2 the third eigen value of the matrix is equal to

(*i*) –2 (*ii*) –1 (*iii*) 1 (*iv*) 2 **Ans.** (*i*)

11. The matrix A has eigen values $\lambda_i \neq 0$. Then $A^{-1} - 2I + A$ has eigen values

(*i*) $1 + 2\lambda_i + \lambda_i^2$ (*ii*) $\frac{1}{\lambda_i} - 2 + \lambda_i$ (*iii*) $1 - 2\lambda_i + \lambda_i^2$ (*iv*) $1 - \frac{2}{\lambda_i} + \frac{1}{\lambda_i^2}$

Ans. (*ii*)

12. The eigen values of a matrix A are 1, –2, 3. The eigen values of $3I - 2A + A^2$ are

(*i*) 2, 11, 6 (*ii*) 3, 11, 18 (*iii*) 2, 3, 6 (*iv*) 6, 3, 11 **Ans.** (*i*)

13. If A is a singular hermitian matrix, then the least eigen value of A^2 is

(*i*) 0 (*ii*) 1 (*iii*) 2 (*iv*) None of these

20. The product of the eigen values of the matrix

$$A=\begin{pmatrix}1 & 0 & 0\\ 0 & 3 & -1\\ 0 & -1 & 3\end{pmatrix} \text{ is}$$

(*i*) 3 (*ii*) 8 (*iii*) 1 (*iv*) – 1 **Ans.** (*ii*)

21. If $A=\begin{bmatrix}-1 & 2 & 3\\ 0 & 3 & 5\\ 0 & 0 & -2\end{bmatrix}$, then the eigen value of A^2 are

(*i*) 1, 2, 3 (*ii*) –1, 2, 3 (*iii*) 1, 4, 9 (*iv*) – 1, 4, 9 **Ans.** (*iii*)

22. The eigenvalues of the matrix $\begin{bmatrix}1 & 1 & -2\\ -1 & 2 & 1\\ 0 & 1 & -1\end{bmatrix}$ are

(*i*) –1, 2 and 1 (*ii*) 0, 1 and 2 (*iii*) –1, –2 and 4 (*iv*) 1, 1 and–1

Ans. (*i*)

Considering the following choose the correct alternative:

$A=\begin{bmatrix}1 & 0 & 0\\ 2 & 1 & 0\\ 3 & 2 & 1\end{bmatrix}$ if U_1, U_2 and U_3 are columns matrices satisfying.

$AU_1=\begin{bmatrix}1\\0\\0\end{bmatrix}, AU_2=\begin{bmatrix}2\\3\\0\end{bmatrix}, AU_3=\begin{bmatrix}2\\3\\1\end{bmatrix}$ and U is 3 × 3 matrix whose columns are U_1, U_2, U_3 then answer the following equations.

23. The value of $|U|$ is

(*i*) 3 (*ii*) –3 (*iii*) $\frac{3}{2}$ (*iv*) 2 **Ans.** (*i*)

[**Hint :** Let U_1 be $\begin{bmatrix}x\\y\\z\end{bmatrix}$ so that

$$\begin{bmatrix}1 & 0 & 0\\ 2 & 1 & 0\\ 3 & 2 & 1\end{bmatrix}\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}1\\0\\0\end{bmatrix} \quad \Rightarrow \quad \begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}1\\-2\\1\end{bmatrix}$$

Similarly, $U_2=\begin{bmatrix}2\\-1\\-4\end{bmatrix}$, $U_3=\begin{bmatrix}2\\-1\\-3\end{bmatrix}$

Hence, $U=\begin{bmatrix}1 & 2 & 2\\ -2 & -1 & -1\\ 1 & -4 & -3\end{bmatrix}$ and $|U| = 3$.

[Hint : Moreover adj. $U = \begin{bmatrix} -1 & -2 & 0 \\ -7 & -5 & -3 \\ 9 & 6 & 3 \end{bmatrix}$.

Hence, $U^{-1} = \frac{adj\, U}{3}$ and sum of the elements of $U^{-1} = 0$]

25. The value of $[3\ 2\ 0]\ U \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix}$ is

(*i*) 5 (*ii*) $\frac{5}{2}$ (*iii*) 4 (*iv*) $\frac{3}{2}$ **Ans.** (*i*)

[Hint : The value of $[3\ 2\ 0]\ U \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix}$

$$= [3\,2\,0] \begin{bmatrix} 1 & 2 & 2 \\ -2 & -1 & -1 \\ 1 & -4 & -3 \end{bmatrix} \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix} = [-1\ 4\ 4] \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix} = -3+8=5]$$

Fill up the blanks.

26. If the eigen values of the matrix A are 1, 2, 3 then, the eigen values of $(A. I^2)$ are .... **Ans.** 1, 2, 3

27. The eigen values of A are 2,. 3, 4 then the eigen values of A^2 are ..... **Ans.** 4, 9, 16

28. The eigen values of A are 2, 3, 1 then the eigne values of $A^2 + A$ are ..... **Ans.** 6, 12, 2

29. If the eigen values of A are 1, 1, 1 then the eigen values of $A^2 + 2A + 3I$ are..... **Ans.** 6, 6, 6

30. If the eigen values of A are 4, 6, 9 then the eigen values of A^{-1} are ...... **Ans.** $\frac{1}{4}, \frac{1}{6}, \frac{1}{9}$

Indicate True of False for the following:

31. The elements of modal matrix are the eigen vectors of the corresponding eigen values. **Ans.** True

32. $P^{-1} AP$ = The diagonal matrix. **Ans.** True

33. $A^6 = PD^6 P^{-1}$ **Ans.** True

34. If $A = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix}$ then $A^{100} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ **Ans.** False

35. If $A = \begin{bmatrix} 1 & -2 & -3 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$, then $A^{-1} = \begin{bmatrix} 1 & 1 & 1 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ **Ans.** False

36. Conjugate of 2 is 2. **Ans.** True

37. Conjugate of i is $-i$. **Ans.** True

38. If the eigen value of A is 2, then the eigen value of $A^3 + 2A^2 + A + I$ is 10. **Ans.** False

Fill up the blanks:

39. The characteristic roots of a skew hermitian matrix is eighter...... or .... **Ans.** 0, Pure imaginary

40. The modulus of each characteristic roots of a unitary matrix is .... **Ans.** unity

41. If λ is an eigen value of an orthogonal matrix, then the other eigen value of the same orthogonal matrix is .... **Ans.** $\frac{1}{\lambda}$

42. The characteristic roots of a Hermitian matrix or all........ **Ans. real**

43. The characteristic root of a triangular matrix is .... **Ans.** Diagonal element

44. If a characteristic roots of a matrix is zero, then the matrix is .... **Ans.** Singular

45. If A and P be square matrices of the same type and if P is investible, then the matrices A and $P^{-1}AP$ have .... characteristic roots. **Ans.** Same

Match the following:

46. (*i*) The eigen vectors X of a matrix A, is not — (*a*) $X_1' X_2 = 0$

(*ii*) Two eigen vectors X_1 and X_2 are called orthogonal if — (*b*) $\sqrt{\lambda_1^2 + \lambda_2^2 + \lambda_3^2}$

(*iii*) Normalised form of vectors $\begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \end{bmatrix}$ is obtained on dividing each element by — (*c*) unique

(*iv*) Every square matrix satisfies its own — (*d*) Characteristic equation

Ans. (*i*) $\rightarrow$ (*c*)

(*ii*) $\rightarrow$ (*a*)

(*iii*) $\rightarrow$ (*b*)

(*iv*) $\rightarrow$ (*d*)