Sinhgad College of Engineering, Pune 41

Engineering Mathematics I

Semester - I

Multiple Choice Questions on

Unit V and VI

Linear Algebra-Matrices, System of Linear Equations, Eigen Values and Eigen Vectors, Diagonaliztion

1)	The rank of matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$ is a) 2 b) 1 c) 3 d) 4
2)	The rank of $A = \begin{bmatrix} 1 & 2 & 3 \\ -4 & 0 & 5 \end{bmatrix}$ is a) 1 b) 3 c) 2 d) 0
3)	Adjoint of $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$ is a) $\begin{bmatrix} 6 & -5 & 1 \\ -6 & 8 & -2 \\ 2 & -3 & 1 \end{bmatrix}$ b) $A = \begin{bmatrix} 3 & -3 & 2 \\ 2 & 1 & 2 \\ -5 & 8 & -3 \end{bmatrix}$ c) $\begin{bmatrix} -2 & 5 & 4 \\ 5 & 7 & 5 \\ 7 & 5 & -2 \end{bmatrix}$ d) $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 4 \\ 1 & 3 & 9 \end{bmatrix}$

The rank of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ is a) 0 b) 2 c) 1 d) 3
The matrix $\begin{bmatrix} 8 & x & 0 \\ 4 & 0 & 2 \\ 12 & 6 & 0 \end{bmatrix}$ will be singular if $'x'$ is a) 4 b) 8 c) 6 d) 12
The rank of a matrix $A = \begin{bmatrix} 5 & -2 \\ 6 & 3 \\ 0 & 1 \end{bmatrix}$ is a) 1 b) 2 c) 3 d) None of these

The matrix $\begin{bmatrix} 2 & 1 & 3 \\ 3 & u & 1 \\ 1 & 4 & 5 \end{bmatrix}$ will be singular if u is equal to a) -2 b) 3 c) 4 d) -3
If the vectors $x_1 = (1, 1, -1, 1), x_2 = (1, -1, 2, -1)$ and $x_3 = (3, 1, 0, 1)$ are linearly independent then a) $2x_1 + x_2 = x_3$ b) $x_1 + 2x_2 = 3x_3$ c) $3(x_1 + x_2) = x_3$ d) None of these
Among the following, the pair of vectors orthogonal to each other is a) $[3, 4, 7], [3, 4, 7]$ b) $[1, 0, 2], [0, 5, 0]$ c) $[1, 0, 0], [1, 1, 0]$ d) $[1, 1, 1], [-1, -1, -1]$

If the matrix $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$ then the eigen values of A are a) 2,1,2 b) 4,5,2 c) 3,3,3 d) 3,2,5
If $A^2 = \begin{bmatrix} 56 & -40 \\ 20 & -4 \end{bmatrix}$ then the eigen values of A are a) 2 , 2 b) 5 , 8 c) 3 , 4 d) 4 , 6
The eigen vectors for the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$ is a) $\begin{bmatrix} 1 \\ 5 \end{bmatrix}, \begin{bmatrix} 2 \\ 6 \end{bmatrix}$ b) $\begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 4 \\ 3 \end{bmatrix}$ c) $\begin{bmatrix} 2 \\ 3 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \end{bmatrix}$ d) $\begin{bmatrix} 2 \\ 1 \end{bmatrix}, \begin{bmatrix} 3 \\ 3 \end{bmatrix}$

The eigen values for the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ are a) 2 , 1 , 1   b) -2 , 3 , 6 c) 2 , 4 , 5   d) -1 , -3 , -5
The eigen values for the matrix $A = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}$ are a) 2 , -1   b) 2 , 2 c) 2 , 3   d) 3 , 4
If $A^T = \begin{bmatrix} 8 & 2 \\ -4 & 2 \end{bmatrix}$ then the eigen values of A are a) 4 , 6   b) 2 , 2 c) 3 , 2   d) 1 , 2

The eigen vectors for the matrix $A = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 2 \end{bmatrix}$ are

a) $\begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}, \begin{bmatrix} 2 \\ 2 \\ 2 \end{bmatrix}$

b) $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$

c) $\begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}, \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$

d) $\begin{bmatrix} 3 \\ 1 \\ 1 \end{bmatrix}$

The eigen vectors for the matrix $A = \begin{bmatrix} -2 & 5 & 4 \\ 5 & 7 & 5 \\ 4 & 5 & -2 \end{bmatrix}$ are

a) $\begin{bmatrix} -1 \\ 1 \\ -1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}, \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$

b) $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}, \begin{bmatrix} -1 \\ 3 \\ 1 \end{bmatrix}$

c) $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} 2 \\ -1 \\ -1 \end{bmatrix}, \begin{bmatrix} 4 \\ 3 \\ 3 \end{bmatrix}$

d) None of this

The eigen values of a matrix $A = \begin{bmatrix} 14 & -10 \\ 5 & -1 \end{bmatrix}$ is a) 9 , 4   b) 3 , 2 c) 5 , 4   d) 1 , 1
The eigen values and the corresponding eigen vectors of a 2×2 matrix are given by eigen values $\lambda_1 = 8 , \lambda_2 = 4$ and eigen vectors $x_1 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$, $x_2 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$ then the matrix is a) $\begin{bmatrix} 6 & 2 \\ 2 & 6 \end{bmatrix}$ b) $\begin{bmatrix} 2 & 4 \\ 4 & 2 \end{bmatrix}$ c) $\begin{bmatrix} 4 & 6 \\ 6 & 4 \end{bmatrix}$ d) $\begin{bmatrix} 4 & 8 \\ 8 & 4 \end{bmatrix}$

For the matrix $P = \begin{bmatrix} 3 & -2 & 2 \\ 0 & -2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$, one of the eigen value is equal to -2 then the corresponding eigen vector is

a) $\begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix}$ b) $\begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}$

c) $\begin{bmatrix} -3 \\ 2 \\ -1 \end{bmatrix}$ d) $\begin{bmatrix} 2 \\ 5 \\ 0 \end{bmatrix}$

Eigen values of a matrix $S = \begin{bmatrix} 3 & 2 \\ 2 & 3 \end{bmatrix}$ are 5 and 1 then the eigen values of the matrix S^2 is

a) 1 and 25 b) 5 and 1

c) 6 and 4 d) 2 and 10

The eigen value of $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ are

a) 0 , 0 , 0 b) 0 , 0 , 3

c) 0 , 0 , 1 d) 1 , 1 , 1

The eigen value of $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ are a) 0 , 0 , 0 b) 0 , 0 , 3 c) 0 , 0 , 1 d) 1 , 1 , 1
The minimum and maximum eigen values of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ are -2 and 6 respectively then the other eigenvalue is a) 5 b) 1 c) 3 d) -1

The eigen values of the matrix $\begin{bmatrix} 2 & -1 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & -2 & 0 \\ 0 & 0 & 1 & 4 \end{bmatrix}$ are

a) 2 , -2 , 1 , -1

b) 2 , 3 , 1 , 4

c) 2 , 3 , -2 , 4

d) None of these

The characteristic equation of the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ is

a) $\lambda^3 - 5\lambda^2 + 7\lambda - 3 = 0$

b) $\lambda^3 - 3\lambda^2 + 9 = 0$

c) $\lambda^2 - 5\lambda + 6 = 0$

d) None of these

For the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$ the eigen vectors are

a) $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} -2 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 3 \\ 6 \\ -5 \end{bmatrix}$

b) $\begin{bmatrix} 8 \\ 9 \\ 1 \end{bmatrix}, \begin{bmatrix} 6 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} 2 \\ 4 \\ 6 \end{bmatrix}$

c) $\begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

d) None of these

The eigen values of a matrix $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ are

a) 1 , 5 , 1

b) 2 , 2 , 1

c) 3 , 2 , 1

d) None of these

The minimum and maximum eigen values of the matrix

$A = \begin{bmatrix} 7 & 0 & -2 \\ 0 & 5 & -2 \\ -2 & -2 & 6 \end{bmatrix}$

are $3\ and\ 9$ then the other eigen value is

a) 6

b) 4

c) 5

d) None of these

The Eigen values of a lower triangular matrix are

a) its principal diagonal elements

b) 0,0,0 c) 1,1,1 d) none of these

The rank of matrix $A = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 2 & 3 & 4 & 5 \\ 0 & 1 & 2 & 3 \\ 0 & 1 & 2 & 3 \end{bmatrix}$ is equal to

a) 1 b) 4 c) 3 d) 2

If the characteristic equation of matrix A of order 2×2 is $\lambda^2+9\lambda-1=0$ hen by Cayley Hamilton theorem A^{-1} is equal to
a) A - 9   b) A + 9 I
c) – A – 9 I   d) A^2 – 9 A – I

Using Cayley Hamilton theorem to $A=\begin{bmatrix}1 & 2\\ 2 & -1\end{bmatrix}$ we get

a) $A^6=25I$	b) $A^7=8I$
c) $A^8=625I$	d) None of these

The system of linear equations $4x + 2y = 7$, $2x + y = 6$ has

a) Unique solution b) An infinite solution

c) No solution d) Exactly two distinct solution

For $c_1x_1 + c_2x_2 + c_3x_3 = 0$ where x_1, x_2, x_3 are non- zero vectors and c_1, c_2, c_3 are constants then are linearly independent if

a) $C_1 \neq 0 , C_2 \neq 0 , C_3 \neq 0$

b) $C_1 \neq 0 , C_2 \neq 0 , C_3 = 0$

c) $C_1 \neq 0 , C_2 = 0 , C_3 = 0$

d) $C_1 = 0 , C_2 = 0 , C_3 = 0$

If the characteristic equation for the matrix A is $\lambda^3 - 2\lambda^2 + \lambda = 0$ then the Eigen values of the matrix are

a) 0,1,1 b) 0,-1,-1

c) 0,2,2 d)none of these

Eigen vectors corresponding to distinct Eigen values of real symmetric matrix are A are

a) linearly dependent b) equal

c) orthogonal d) none of these

If an Eigen value of a square A is $\lambda = 0$ then

a) A is nonsingular

b) A is orthogonal

c) A is singular

d) none of these

The characteristic equation for the square matrix A is

a) $|A + \lambda I| = 0$

b) $|A^2 - \lambda I| = 0$

c) $|A - \lambda I| = 0$

d) none of these

For matrix $A=\begin{bmatrix}-1 & 0 & 0\\ 2 & -3 & 0\\ 1 & 4 & 2\end{bmatrix}$, the Eigen values of A^2 are a) -1 , -9 , -4 b) 1 , 9 , 4 c) -1 , -3 , 2 d) 1 , 3 ,-2
If A is any non-zero matrix of order 2×2 with trace of A = -1 and $\|A\| = -2$ then the Eigen values Of A are a) 2 , -1 b) -3 , 2 c) -2 , -1 d) -2 , 1

For what values of b, the matrix $A=\frac{1}{13}\begin{bmatrix} b & -5 \\ 5 & b \end{bmatrix}$ is an orthogonal matrix
a) ± 5 b) ± 13 c) ± 12 d) ± 16