

COURSE: VECTOR SPACES, SAMPLING THEORY & OPTIMIZATION
COURSE CODE: 21MAT31A
MODULE – 2: EIGEN VALUES AND EIGEN VECTORS

Q. No.	Questions	Marks	COs	BLs
1	Find the characteristic polynomial and the eigenvalue and corresponding eigenvectors of the matrix $A = \begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$.	6	5	1
2	Find the characteristic polynomial and the eigenvalue and corresponding eigenvectors of the matrix $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$.	6	5	1
3	Test whether $\lambda = 1$ an eigenvalue of matrix $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$? If so, find one corresponding eigenvector.	6	5	4
4	Find a basis for the eigenspace corresponding to eigenvalue $\lambda = 2$ for the matrix $A = \begin{bmatrix} 4 & -1 & 6 \\ 2 & 1 & 6 \\ 2 & -1 & 8 \end{bmatrix}$	6	4	1
5	Show that λ^{-1} is an eigenvalue of A^{-1} , If λ be an eigenvalue of an invertible matrix A	6	5	1
6	Find the characteristic polynomial and the eigenvalue of the matrix $A = \begin{bmatrix} 1 & 2 & 0 \\ -1 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$. Also, verify that eigenvalues of A^2 are squares of those of eigenvalues of matrix A .	7	5	5
7	Find the eigenspace of the matrix $A = \begin{bmatrix} 16 & -4 & -2 \\ 3 & 3 & -6 \\ 2 & -8 & 11 \end{bmatrix}$ for $\lambda = 5$.	6	4	1
8	Find the value of h in the matrix $A = \begin{bmatrix} 5 & -2 & 6 & -1 \\ 0 & 3 & h & 0 \\ 0 & 0 & 5 & 4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ such that the eigenspace for $\lambda = 5$ is two dimensional.	6	4	1
9	Test whether the matrix $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ is diagonalizable. If so, find P such that $P^{-1}AP$ is a diagonal matrix.	6	4	4
10	Test whether the matrix $A = \begin{bmatrix} 0 & i & i \\ i & 0 & i \\ i & i & 0 \end{bmatrix}$ is diagonalizable.	7	4	4

11	Find the matrix A , if the eigenvectors of a 3×3 matrix A corresponding to eigenvalues 1,1,3 are $[1,0,-1]^T$, $[0,1,-1]^T$ and $[1,1,0]^T$ respectively.	7	5	3
12	Find a formula for A^n , given that $A = PDP^{-1}$, where $A = \begin{bmatrix} 7 & 2 \\ -4 & 1 \end{bmatrix}$, $P = \begin{bmatrix} 1 & 1 \\ -1 & -2 \end{bmatrix}$ and $D = \begin{bmatrix} 5 & 0 \\ 0 & 3 \end{bmatrix}$.	7	2	3
13	Determine A^4 , where $A = \begin{bmatrix} -3 & 12 \\ -2 & 7 \end{bmatrix}$.	7	4	5
14	Examine that product of two orthogonal matrix of the same order is also an orthogonal matrix.	7	4	4
15	Examine that $ A = \pm 1$, if A is an orthogonal matrix.	7	4	4
16	Compute the orthogonal transform which transforms the quadratic form $Q = 3x_1^2 + 5x_2^2 + 3x_3^2 - 2x_2x_3 + 2x_1x_3 - 2x_1x_2$ to canonical form.	7	4	3
17	Compute the orthogonal transform which transforms the quadratic form $Q = x_1^2 + 3x_2^2 + 3x_3^2 - 2x_2x_3$ to canonical form.	7	4	3
18	Compute the canonical form which transforms the quadratic form $Q = 17x_1^2 + 17x_2^2 - 30x_1x_2$.	7	4	5
19	Compute the canonical form which transforms the quadratic form $Q = 3x_1^2 + 3x_3^2 + 4x_1x_2 + 8x_1x_3 + 8x_2x_3$.	7	4	3
20	Compute the canonical form which transforms the quadratic form $Q = 2x_1^2 + 2x_2^2 + 2x_1x_2$.	7	4	3