

SNS College of Technology

Internal Assessment - I

23MAT101 - Matrices and Calculus

Answer key - (set - B)

Part - A

Answer all the questions

1) CE is $\lambda^3 - 18\lambda^2 + 99\lambda - 162 = 0$

2) Eigen values of $\text{Adj}(A)$ are

$4, 3, 12$

3) $\lambda_3 = 0, |A| = 0$

4) Matrix form = $\begin{bmatrix} 1 & -1 & 0 \\ -1 & 2 & 1 \\ 0 & 1 & 1 \end{bmatrix}$

5) Rank $r = 3$, Index $p = 2$

Signature = $2p - r = 1$, nature = Indefinite

Part - B

Answer all the questions

6) a) i) CE is $\lambda^3 - 3\lambda^2 + 2\lambda = 0$

Eigen values are $0, 1, 2$

Eigen vectors are $x_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, x_2 = \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix}, x_3 = \begin{bmatrix} 2 \\ 1 \\ 2 \end{bmatrix}$

ii) Applications of Eigen value

- * Image and signal processing
- * Wave transport
- * Aero electrostatic state space equations
- * Designing bridges

b) CE is $\lambda^3 - 2\lambda + 1 = 0$

$A^4 = \begin{bmatrix} -1 & 0 & 3 \\ 8 & 1 & -7 \\ -3 & 0 & 8 \end{bmatrix}, A^{-1} = \begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & -3 \\ 1 & 0 & -1 \end{bmatrix}$

7) a) CE is $\lambda^3 - 7\lambda^2 + 36 = 0$
 $\lambda = -2, 3, 6$ $x_1 = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}, x_2 = \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}, x_3 = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$

$D = \begin{bmatrix} -2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 6 \end{bmatrix}$

b) CE is $\lambda^3 - 4\lambda^2 + 3\lambda = 0$
 $\lambda = 0, 1, 3$ $x_1 = \begin{bmatrix} -1 \\ -1 \\ 1 \end{bmatrix}, x_2 = \begin{bmatrix} -1 \\ 0 \\ -1 \end{bmatrix}, x_3 = \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$

$D = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

Canonical form $\Rightarrow y_2^2 + 3y_3^2$

8) a) $x_{(2)} = \begin{bmatrix} 1080 \\ 240 \\ 120 \end{bmatrix}, x_4 = \begin{bmatrix} 600 \\ 648 \\ 72 \end{bmatrix}, x_{(6)} = \begin{bmatrix} 1519 \\ 36 \\ 194 \end{bmatrix}$

CE is $\lambda^3 - 1.38\lambda - 0.072 = 0$

$\lambda = 1.2$. Eigen vector = $\begin{bmatrix} 1 \\ 0.5 \\ 0.125 \end{bmatrix}$

Class 1 = 738 females

2 = 369 females

3 = 92 females

b) matrix form = $\begin{bmatrix} 2 & 1 & -1 \\ 1 & 1 & -2 \\ -1 & -2 & 1 \end{bmatrix}$

CE is $\lambda^3 - 4\lambda^2 - \lambda + 4 = 0$

$\lambda = -1, 1, 4$
 $x_1 = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}, x_2 = \begin{bmatrix} -2 \\ 1 \\ -1 \end{bmatrix}, x_3 = \begin{bmatrix} -1 \\ -1 \\ 1 \end{bmatrix}$

$D = \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 4 \end{bmatrix}$ Canonical form $\Rightarrow -y_1^2 + y_2^2 + 4y_3^2$

Nature = Indefinite, Rank = 3

Index = 2, Signature = 1