Hall Ticket No | | | | | | | | | | |

Course Code: AHSD02

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

B.TECH I SEMESTER CIE – I EXAMINATIONS, NOVEMBER – 2023

Regulation: BT23

MATRICES AND CALCULUS

Time: 2 Hours **(COMMON TO ALL BRANCHES)** **Max Marks: 20**

Answer any FOUR questions

All parts of the question must be answered in one place only

1. (a) Determine the value of k, such that the matrix $\begin{pmatrix} 4 & 4 & -3 & 1 \\ 1 & 1 & -1 & 0 \\ k & 2 & 2 & 2 \\ 9 & 9 & k & 3 \end{pmatrix}$ has rank 3.

[BL: Apply| CO: 1|Marks: 2]

(b) For what values of a , b the following equations x + y + z = 6 , x + 2y + 3z = 10, x + 2y + a z = b have unique, infinite and no solutions. [BL: Apply| CO: 1|Marks: 3]

2. (a) From the following matrix , find the rank of given matrix by using normal form.

$$\begin{bmatrix} 4 & 3 & 2 & 1 \\ 5 & 1 & -1 & 2 \\ 0 & 1 & 2 & 3 \\ 1 & -1 & 3 & -2 \end{bmatrix}$$

[BL: Apply| CO: 1|Marks: 2]

(b) For what values of λ the following equations $(\lambda-1)x+(3\lambda+1)y+2\lambda z=0$, $(\lambda-1)x+(4\lambda-2)y+(\lambda+3)z=0$, $2x+(3\lambda+1)y+3(\lambda-1)z=0$ have a non trivial solution [BL: Apply| CO: 1|Marks: 3]

3. (a) Determine the modal matrix P for

$$A = \begin{bmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{bmatrix}$$

[BL: Apply| CO: 2|Marks: 2]

(b) Verify Cayley-Hamilton theorem and find the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$.

[BL: Apply| CO: 2|Marks: 3]

4. (a) Diagonalize the matrix $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ by similarity transformation and hence find A^4.

[BL: Apply| CO: 2|Marks: 2]

(b) Determine the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ and find A^{-1} , A^4

[BL: Apply| CO: 2|Marks: 3]

5. (a) Show that the Rolle's theorem is applicable for the function $f(x) = e^x sinx$ in the interval $[0, \pi]$.

[BL: Apply| CO: 3|Marks: 2]

(b) Show that the Lagrange's mean value theorem is applicable for the function $f(x) = x^3 - x^2 - 5x + 3$in the interval $[0, 4]$.

[BL: Apply| CO: 3|Marks: 3]

– ∘ ∘ ◯ ∘ ∘ –