Q.P Code D133863	Total Pages 3	Name 672166
		Register No.

THIRD SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2025

(CUFYUGP)

MAT3CJ202 / MAT3MN200 Matrix Algebra

2024 Admission Onwards

Maximum Time :2 Hours	**Maximum Marks :70**

Section A

All Question can be answered. Each Question carries 3 marks (Ceiling: 24 Marks)

1	Mark on the graph the solution of the linear equations $2x+y=8, \quad -x+5y=10$.
2	For what values of h, k is the system $2x-y=h, \quad -6x-3y=k$ consistent?
3	Find the set of all solutions of $2x_1+3x_2+4x_3=0$.
4	Determine whether the set $\left\{\begin{bmatrix}1\\2\end{bmatrix}, \begin{bmatrix}3\\4\end{bmatrix}\right\}$ is linearly independent.
5	Determine whether the map $\mathbf{T}:\mathbb{R}^2\to\mathbb{R}^2, \quad \mathbf{T}\begin{bmatrix}a\\b\end{bmatrix}=\begin{bmatrix}a+2\\a-2\end{bmatrix}$ is linear.
6	Assume $\mathbf{T}$ is linear and $\mathbf{T}:\mathbb{R}^3\to\mathbb{R}^2$ with $\mathbf{T}(e_1)=(1,3)$, $\mathbf{T}(e_2)=(4,-7)$, $\mathbf{T}(e_3)=(-5,4)$. Find the standard matrix of $\mathbf{T}$.
7	Let $A=\begin{bmatrix}1&1&1\\1&2&3\\1&4&5\end{bmatrix}$. Find a 3×3 matrix B, not I or 0, such that $AB=BA$.
8	Determine whether $S=\left\{\begin{bmatrix}a\\b\\c\end{bmatrix}\in\mathbb{R}^3 : a+b+c=2\right\}$ is a subspace of $\mathbb{R}^3$.
9	Determine the eigenvalues of $A=\begin{bmatrix}3&-2\\1&-1\end{bmatrix}$.
10	Let A be a 3×3 matrix with eigenvalues $1,2,3$. Is A diagonalizable? Give reasons.

Section B

All Question can be answered. Each Question carries 6 marks (Ceiling: 36 Marks)

11	Let $A = \begin{bmatrix} 1 & 3 & 4 \\ -4 & 2 & -6 \\ -3 & -2 & -7 \end{bmatrix}$, $B = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$. Is $A\mathbf{x} = B$ consistent for all b_1, b_2, b_3? Explain
12	Suppose $\{\mathbf{v}_1, \mathbf{v}_2\}$ is linearly independent in $\mathbb{R}^n$. Show $\{\mathbf{v}_1, \mathbf{v}_1 + \mathbf{v}_2\}$ is also linearly independent.
13	Let $\mathbf{T} : \mathbb{R}^2 \to \mathbb{R}^2$ be linear with $\mathbf{T}(x_1, x_2) = (x_1 + x_2, 4x_1 + 5x_2)$. Find $\mathbf{x} = (x_1, x_2)$ such that $\mathbf{T}(\mathbf{x}) = (3, 8)$.
14	Find A^{-1} for $A = \begin{bmatrix} 3 & 3 & 3 \\ 2 & 3 & 1 \\ 2 & 5 & 1 \end{bmatrix}$.
15	Determine whether $\mathbf{w} = \begin{bmatrix} 1 \\ 3 \\ -4 \end{bmatrix}$ is in Nul(A) for $A = \begin{bmatrix} 3 & -5 & -3 \\ 6 & -2 & 0 \\ -8 & 4 & 1 \end{bmatrix}$.
16	Find the eigenvalues of $A = \begin{bmatrix} -2 & 0 & -2 \\ 0 & 4 & 0 \\ -2 & 0 & 5 \end{bmatrix}$.
17	Find the eigenvectors of $A = \begin{bmatrix} 7 & 4 \\ -3 & -1 \end{bmatrix}$.
18	Let $\mathbf{T} : \mathbb{R}^3 \to \mathbb{R}^3$ be the linear transformation that reflects each vector through the plane $x_2 = 0$. That is, $\mathbf{T}(\mathbf{x_1}, \mathbf{x_2}, \mathbf{x_3}) = (\mathbf{x_1}, -\mathbf{x_2}, \mathbf{x_3})$. Find the standard matrix of $\mathbf{T}$

Section C

Answer any ONE. Each Question carries 10 marks (1x10=10 Marks)

19	Let $A = \begin{bmatrix} 2 & 0 & 6 \\ -1 & 8 & 5 \\ 1 & -2 & 1 \end{bmatrix}$ and $b = \begin{bmatrix} 10 \\ 3 \\ 3 \end{bmatrix}$. Denote the columns of A by $\{\mathbf{a_1}, \mathbf{a_2}, \mathbf{a_3}\}$. Show that $b \in \mathbf{Span}\{\mathbf{a_1}, \mathbf{a_2}, \mathbf{a_3}\}$.
20	Diagonalize the matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}$, if possible.