Q.P Code	D 112648	Total Pages: 3	Name
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FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2024

(CUFYUGP)

MAT1MN105-MATRIX THEORY

2024 Admissions

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

Section A

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

1	Solve $2x - y = 0$ $6x + 5y = 1$
2	Find all values of k for which the augmented matrix $\begin{bmatrix} k & 2 & 3 \\ -1 & 4 & 5 \end{bmatrix}$
3	Let $A = \begin{bmatrix} 1 & 2 & 4 \\ 6 & 1 & 1 \\ 1 & 3 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 4 & 5 \\ 7 & 1 & 1 \\ 8 & 9 & 0 \end{bmatrix}$. Check whether $tr(AB) = tr(A).tr(B)$
4	Let $A = \begin{bmatrix} 4 & 3 \\ 2 & 1 \end{bmatrix}$ Show that $(A^2)^T = \left(A^T\right)^2$
5	Let A and B be two 2×2 symmetric matrices. Show that if $A + B$ is also symmetric
6	Use the arrow technique to evaluate the determinant $\begin{vmatrix} 7 & 4 & 1 \\ 0 & 6 & 4 \\ 9 & 5 & 2 \end{vmatrix}$
7	Determine whether the statement "If the sum of the second and fourth row vectors of a 6×6 matrix A is equal to the last row vector, then $det(A) = 0$"is true or false, and justify your answer
8	Let $\mathbf{u} = (1, 2, -3, 5, 0), \mathbf{v} = (0, 4, -1, 1, 2)$, and $\mathbf{w} = (7, 1, -4, -2, 3)$. Find the components of $(3\mathbf{u} - \mathbf{v}) - (2\mathbf{u} + 4\mathbf{w})$
9	Show that $\mathbf{u} = (-2, 3, 1, 4)$ and $\mathbf{v} = (1, 2, 0, -1)$ are orthogonal vectors in $\mathbb{R}^4$.
10	Let $\mathbf{u} = (1, 2, -2)$ and $\mathbf{v} = (3, 0, 1)$. Show that $\mathbf{u} \times \mathbf{v}$ is Perpendicular to $\mathbf{u}$ and to $\mathbf{v}$

Section B

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

11	Change the matrix $\begin{bmatrix} 2 & 5 & 9 & 3 & 10 \\ 6 & 7 & 2 & 6 & 1 \\ 9 & 1 & 0 & 2 & 1 \end{bmatrix}$ to reduced row echelon form
12	Find all values of k, if any, that satisfy the equation $$\begin{bmatrix} k & 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 2 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} k \\ 1 \\ 1 \end{bmatrix} = \mathbf{0}$$
13	Using Row Operations to find A^{-1}, $$A = \begin{bmatrix} 1 & 3 & 1 \\ 4 & 5 & 2 \\ 7 & 3 & 2 \end{bmatrix}$$
14	Determine whether the homogeneous system has nontrivial solutions $$x_1 + 6x_2 + 4x_3 = 0$$ $$2x_1 + 4x_2 - x_3 = 0$$ $$-x_1 + 2x_2 + 5x_3 = 0$$
15	Using Column Operations to evaluate the determinant of $\begin{bmatrix} 1 & 0 & 0 & 3 \\ 2 & 7 & 0 & 6 \\ 0 & 6 & 3 & 0 \\ 7 & 3 & 1 & -5 \end{bmatrix}$
16	Using Cramer's rule solve: $$x + y + z = 9$$ $$2x + 5y + 7z = 52$$ $$2x + y - z = 0$$
17	Let $\mathbf{u} = (2, -1, 3)$ and $\mathbf{v} = (4, -1, 2)$. Find the vector component of $\mathbf{u}$ along $\mathbf{v}$ and the vector component of $\mathbf{u}$ orthogonal to $\mathbf{v}$.
18	Find vector and parametric equations of the plane $x - y + 2z = 5$.

Section C

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

19 Test for consistency and solve

$$x + 2y - 5z = -9$$
$$3x - y + 2z = 5$$
$$2x + 3y - z = 3$$
$$4x - 5y + z = -3$$

20 Decide whether the matrix $\begin{bmatrix} 1 & 3 & 1 & 1 \\ 2 & 5 & 2 & 2 \\ 1 & 3 & 8 & 9 \\ 1 & 3 & 2 & 2 \end{bmatrix}$ is invertible, and if so, use the adjoint method to find its inverse.