Q.P Code	D 113038	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	Determine whether the statement "If the number of equations in a linear system exceeds the num- ber of unknowns, then the system must be inconsistent."is true or false, and justify your answer.
2	Find all values of k for which the augmented matrix $\begin{bmatrix} 3 & -4 & k \\ 4 & 8 & 2 \end{bmatrix}$ corresponds to a consistent linear system.
3	Find the value of k, if $\begin{bmatrix} 16 & k \\ k & 4 \end{bmatrix}$ is nonsingular
4	Using Row Operations to find A^{-1}, $A = \begin{bmatrix} 1 & 2 \\ 7 & 3 \end{bmatrix}$
5	If $A = \begin{bmatrix} 3 & 5 & 4 \\ 0 & 1 & 5 \\ 0 & 0 & 6 \end{bmatrix}$, then what can you say about the diagonal entries of A^{-1}
6	Find all the minors and cofactors of the matrix $\begin{bmatrix} 3 & 6 & 2 \\ 0 & 9 & 8 \\ 12 & 0 & 3 \end{bmatrix}$
7	Find the determinant of $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & -5 & 7 \\ 0 & 6 & 3 & 5 \\ 0 & 0 & 0 & -11 \end{bmatrix}$
8	Find the values of k for which the matrix A $\begin{bmatrix} 1 & k & 2 \\ 3 & 2 & k \\ 2 & 1 & 0 \end{bmatrix}$ is invertible.
9	Let P be the point (2, 3, -2) and Q the point (7, -4, 1). Find the midpoint of the line segment connecting the points P and Q.
10	Let $\mathbf{v} = (1, -2, 3)$ and $\mathbf{u} = (-2, 4, 5)$. Find the distance and angle between them.

Section B

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

11	Change the matrix $\begin{bmatrix} 2 & 3 & 6 & 0 \\ 2 & 1 & 8 & 2 \\ 1 & 0 & 2 & 4 \\ 3 & 2 & 4 & 0 \end{bmatrix}$ to reduced row echelon form
12	Solve the matrix equation for a, b, c and d $$\begin{bmatrix} a-b & a+b \\ 3d+c & 2d-c \end{bmatrix} = \begin{bmatrix} 8 & 1 \\ 7 & 6 \end{bmatrix}$$
13	Solve by matrix method $$5x_1 - 3x_2 = -1$$ $$2x_1 + x_2 = 3$$
14	Determine whether the homogeneous system has nontrivial solutions $$4x + y + 2z = 0$$ $$-3x + 2y + 4z = 0$$ $$8x - y - 2z = 0$$
15	Using Row Reduction to evaluate the determinant of $\begin{bmatrix} 0 & 1 & 5 \\ 3 & -6 & 9 \\ 2 & 6 & 1 \end{bmatrix}$
16	Without evaluating the determinants directly, show that $$\begin{vmatrix} a_1 & b_1 & a_1+b_1+c_1 \\ a_2 & b_2 & a_2+b_2+c_2 \\ a_3 & b_3 & a_3+b_3+c_3 \end{vmatrix} = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$
17	Find the area of the parallelogram determined by the vectors $\mathbf{u} = (3, -1, 4)$ and $\mathbf{v} = (6, -2, 8)$.
18	Find the distance between the parallel planes $2x - y - z = 5$ and $-4x + 2y + 2z = 12$

Section C

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

19 Solve by Gaussian Elimination method

$$3x_1 + 3x_2 + 3x_3 = -3$$
$$-x_1 - 5x_2 - 2x_3 = 3$$
$$-4x_2 + x_3 = 0$$

20 Let $a = (a_1, a_2, a_3), b = (b_1, b_2, b_3), c = (c_1, c_2, c_3)$, and $d = (d_1, d_2, d_3)$. Show that

$$(a + d)(b \times c) = a(b \times c) + d(b \times c)$$