A1033

Name.....

Register No.....

NAIPUNNYA INSTITUTE OF MANAGEMENT AND INFORMATION TECHNOLOGY (AUTONOMOUS)

FIRST SEMESTER (FYUG) DEGREE EXAMINATION NOVEMBER 2025

MATHEMATICS

MAT1MN105 - MATRIX THEORY

Time:Two Hours Maximum:70 marks

Section A

Answer all questions.

Each question carries 3 marks. Ceiling 24 marks

1. If A and B are n x n matrices, then prove that tr(A+B) = tr(A)+ tr(B). CO2

2. Construct a 2×2 matrix , $A = [a_{ij}]$, whose elements are given by $a_{ij} = \frac{i}{j}$.

CO1

3. Define linear independence of vectors.

CO2

4. Find the cofactors, minors and adjoint of the matrix A $= \begin{bmatrix} 7 & -1 \\ 1 & 5 \end{bmatrix}$ CO2

5. Find $A + B\ if,\ A = \begin{bmatrix} 1 & 3 & 0 \\ 4 & 2 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 & 3 \\ 3 & -1 & 0 \end{bmatrix}$.

CO1

6. Find the values of $x, y, z\ and\ t$ satisfying the matrix equation $\begin{bmatrix} x+3 & 2y+3 \\ z-2 & 2t-3 \end{bmatrix} = \begin{bmatrix} 0 & 7 \\ 8 & t \end{bmatrix}$.

CO1

7. Solve 2x-y=0 and 6x+5y=1. CO1

8. Show that $A = \begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}\ and\ B = \begin{bmatrix} 2 & -5 \\ 1 & 3 \end{bmatrix}$ are invertible. CO2

9. Find the column-row expansion of the product AB, for the matrices, $A = \begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}, B = \begin{bmatrix} 2 & 0 & 4 \\ -3 & 5 & 1 \end{bmatrix}$

CO2

10. Find the orthogonal projections of the vectors $\mathbf{e_1}$ = (1, 0) and $\mathbf{e_2}$ = (0, 1) on the line L that makes an angle θ with the positive x-axis in R^2. CO3

Section B

Answer all questions.

Each question carries 6 marks. Ceiling 36 marks

11. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$.

CO2

Turn Over

12. Solve by the following system of equations using Cramer's rule:

$$4x + 5y = 2$$
$$11x + y + 2z = 3$$
$$x + 5y + 2z = 1$$

CO2

13. Calculate the scalar triple product u · (v × w) of the vectors

$$u = 3i - 2j - 5k$$
$$v = i + 4j - 4k$$
$$w = 3j + 2k$$

CO3

14. Solve the linear system of equations, using Gauss-elimination method,

$$-x_1 + x_2 + 2x_3 = 2,$$
$$3x_1 - x_2 + x_3 = 6,$$
$$-x_1 + 3x_2 + 4x_3 = 4$$

CO1

15. Compute the inverse of A, where $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$.

CO2

16. Find all values of λ for which det(A) = 0, for the matrix

$$A = \begin{bmatrix} \lambda - 4 & 0 & 0 \\ 0 & \lambda & 2 \\ 0 & 3 & \lambda - 1 \end{bmatrix}$$

CO2

17. Using column operation to evaluate the determinant of $\begin{vmatrix} 1 & 0 & 0 & 3 \\ 2 & 7 & 0 & 6 \\ 0 & 6 & 3 & 0 \\ 7 & 3 & 1 & -5 \end{vmatrix}$.

CO1

18. Let **u** = (3, 2, -1), **v** = (0, 2, -3), and **w** = (2, 6, 7). Compute the indicated vectors

(a) **v × w**

(b) **(u + v) × w**

CO3

Section C

Answer any one question

The question carries 10 marks.

19. Solve the system of equations

$$x_1 - x_2 + x_3 = 4,$$
$$2x_1 + x_2 - 3x_3 = 0$$
$$and\ x_1 + x_2 + x_3 = 2.$$

CO1

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 find A^{-1}.

CO2

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