

JK Lakshmipat University, Jaipur
Institute of Engineering and Technology
 Mid Term (Make-up) Examination, May 2025
 B. Tech., Semester II, 2024-25

Roll No.....

AS1114: Linear Algebra and
Differential Equations

Time: 1.5 hours

Max. Marks: 20

Instructions to students:

1. Do not write anything other than your roll number on the question paper.
2. Mention all the assumptions for your answers clearly.
3. Calculator is not allowed.

Q. 1	a. Show that the transformation T defined by $T(x, y) = (4x - 2y, x)$ is not linear. b. A nilpotent matrix N is a square matrix such that $N^k = O$, for some positive integer k . Comment on the determinant of a nilpotent matrix. c. $Ax = b$ is an inconsistent system of equations, where A is a 5×7 real matrix. The highest possible rank of A is _____. Explain. d. Construct an example such that A and B are not null matrices but AB and BA are null matrices. e. Choose h and k such that the system $x + 3y = 2, 2x + hy = k$ has no solution: _____ unique solution: _____	1 × 5 (CO 1,2)
Q. 2	The set $V = \mathbb{R}^+ \cup \{0\}$ along with operations $u \oplus v = u + v, c \odot v = c^2v$ is not a vector space. List two properties that fail to hold.	2.0 (CO 2)
Q. 3	Solve the given initial value problem: $x^2y'' - 4xy' + 6y = 0, y(1) = 1, y'(1) = 0.$	3.0 (CO 4)
Q. 4	Given that the matrix $A = \begin{bmatrix} 2 & 4 & 3 \\ -4 & -6 & -3 \\ 3 & 3 & 1 \end{bmatrix}$ has distinct eigenvalues 1 and -2, determine whether the matrix is diagonalizable. If it is, diagonalize it.	2.0 (CO 1,3)
Q. 5	Solve the non-homogeneous differential equation by the method of variation of parameters. Give a general solution. $y'' - 2y' + y = x^{-3}e^x.$	4.0 (CO 4)
Q. 6	Find an integrating factor and hence solve the given differential equation: $(x^4 + y^2)dx - xy \cdot dy = 0.$	4.0 (CO 4)

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