BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC | **SEMESTER : I**
BRANCH: MATHS & COMPUTING | **SESSION : MO/2025**

SUBJECT: MA109 MATRIX THEORY

TIME: 3 Hours | **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.	Question	Marks	CO	BL
Q.1(a)	If $A = diag(1,2,3)$ and $B = diag(2,5,1)$ are diagonal matrices, then find A^{-1} and B^{-1}. Also show that $(AB)^{-1} = B^{-1}A^{-1}$.	[5]	CO1	2
Q.1(b)	Let $A = \begin{bmatrix} \frac{1}{3} - \frac{2}{3}i & \frac{2}{3}i \\ -\frac{2}{3}i & -\frac{1}{3} - \frac{2}{3}i \end{bmatrix}.$ Show that A is unitary matrix.	[5]	CO1	2
Q.2	Consider the system of equations: $x + 2y + z = 5;\ 2x + 3y + 4z = 11;\ 2x + 3y + a\,z = b.$ For what values of $a\ and\ b$ does the system have (i) no solution (ii) unique solution (iii) infinite number of solutions?	[10]	CO2	3
Q.3(a)	Using the Gauss elimination method, find the solution of the system of equations: $x + y + z = 2\ ;\ x - y + 2z = 7; x + 2y + 3z = 11.$	[5]	CO3	3
Q.3(b)	A mapping $T: V \to V$ defined by $T(x,y) = (x - y, x + y)$. Then show that T is a linear transformation.	[5]	CO3	3
Q.4(a)	If X is an eigenvector of a matrix A, then X cannot correspond to more than one eigenvalue of A.	[5]	CO4	4
Q.4(b)	Find the eigenvalues of the matrix $\begin{pmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{pmatrix}.$	[5]	CO4	4
Q.5(a)	Verify Cayley-Hamilton for given matrix: $A = \begin{pmatrix} 1 & 2 \\ 2 & -1 \end{pmatrix}$. Also, find A^{-1} and A^8.	[5]	CO5	3
Q.5(b)	Write the matrix of quadratic form $x^2 - 18xy + 5\,y^2$ and verify that it can be written as matrix products $X'AX$.	[5]	CO5	3

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