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

CLASS: IMSc **SEMESTER : I**
BRANCH: MATHEMATICS AND COMPUTING **SESSION: MO/2022**

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.

			CO	**BL**
Q.1(a)	Determine whether the matrix $A=\begin{bmatrix}0&3&2&1\\0&0&2&2\\0&0&0&3\\0&0&0&0\end{bmatrix}$ is nilpotent.	[5]	CO2	BT4
Q.1(b)	Show that if A is a 2×2 orthogonal matrix then each of the two rows is a unit vector and the dot product of the two rows equals zero.	[5]	CO1	BT4
Q.2(a)	Find the reduced row echelon form of the matrix $\begin{bmatrix}5&20&-18\\3&12&-14\\-4&-16&13\end{bmatrix}$	[5]	CO1	BT1
Q.2(b)	Find the rank of the matrix $\begin{bmatrix}-2&1&1&15\\6&-1&-2&-36\\1&-1&-1&-11\\-5&-5&-5&-14\end{bmatrix}$	[5]	CO1	BT1
Q.3(a)	Solve the following system of linear equations by Gauss Elimination method: $4x-2y-7z=5$, $-6x+5y+10z=-11$, $-2x+3y+4z=-3$, $-3x+2y+5z=-5$	[5]	CO1	BT3
Q.3(b)	Find the matrix of the linear transformation $T: R^3 \to R^3$ with respect to the standard ordered basis for R^3: $T(x,y,z)=(-6x+4y-z,-2x+3y-5z,3x-y+7z)$	[5]	CO1	BT1
Q.4(a)	Determine whether the matrix $\begin{bmatrix}0&1&0\\1&0&0\\0&0&1\end{bmatrix}$ is diagonalizable.	[5]	CO2	BT4
Q.4(b)	Find the minimal polynomial for the matrix $\begin{bmatrix}3&3&0\\3&3&0\\0&0&6\end{bmatrix}$	[5]	CO1	BT1
Q.5(a)	Find A^{-2} for the matrix $\begin{bmatrix}1&2&0\\2&-1&0\\0&0&-1\end{bmatrix}$ using Cayley Hamilton Theorem.	[5]	CO1	BT1
Q.5(b)	Determine the nature of quadratic form generated by the matrix $A=\begin{bmatrix}1&0\\0&2\end{bmatrix}$	[5]	CO2	BT4

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