BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: IMSC | **SEMESTER: IV**
BRANCH: MATHS & COMPUTING | **SESSION: SP/2025**

SUBJECT: MA206R1 LINEAR ALGEBRA

TIME: 02 Hours | **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Show that the subset $W = \{(x, y, 0) : x, y \in R\}$ of a vector space $V_3(R)$ is a subspace of $V_3(R)$.	[2]	CO1	1
Q.1(b)	Determine whether the vectors $\{(1, 0, 1), (1,1, 0), (1,1, 1)\}$ form a basis for the vector space $V_3(R)$.	[3]	CO1	2
Q.2(a)	Find the basis and dimension of the subspace W spanned by the vectors $\{(1, 0, 1, 1), (1, 1,1, 1), (1,0,0,0)\}$.	[2]	CO1	2
Q.2(b)	Find the basis and dimension of the subspaces: $W_1 = \{(x, y, z): y - 2z = 0\}$ and $W_2 = \{(x, y, z,): x + y - z = 0\}$ of a vector space $R^4(R)$.	[3]	CO1	2
Q.3(a)	Show that mapping $T: R^2 \to R^3$ defined by: $T(x, y) = (x + 1, 2y, x + y)$, is not a linear transformation.	[2]	CO2	3
Q.3(b)	Let $V(R)$ be a vector space of integrable functions on real R. Prove tha a mapping $T: V \to \mathrm{R}$ defined by $T(\mathrm{f}) = \int_a^b f(x)dx,\ f \in V \text{ and } a, b \in R,$ is linear transformation.	[3]	CO2	3
Q.4	A linear transformation $T: R^2 \to R^3$ defined by: $T(x, y) = (x + y, x - y, y)$. Find a basis and dimension of (i) its range space (ii) It's null space. (iii) Also verify $Rank(T) + Nullity(T) = Dim(V)$.	[5]	CO2	3
Q.5	Let $T: R^2 \to R^2$ be linear operator which is given by $T(x, y) = (4x - 2y, 2x + y)$. Find the matrix of linear transformation T with respect to the basis $B = \{(1,1), (1,0)\}$.	[5]	CO3	3

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