Program:	S.Y.B.Sc DS	**Semester:**	III	**Program Code:**	UGDS03
Course:	Linear Algebra			**Course Code:**	NUDS308

Duration: 1 Hour **Examination Pattern:** NEP-Autonomous - External. **Max. Marks:** 30

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Draw neat diagrams wherever necessary.
4. CO (Course Outcome), KL (Knowledge Level).

Examination:

REGULAR

Q. 1		**Attempt any TWO of the following.**	[10]	CO's	KL's
	(a)	Determine whether $W = \{(x, y, z, w) \mid x = y, z = w\}$ is a subspace of $\mathbb{R}^4$.		CO2	L3
	(b)	Determine whether $T: \mathbb{R}^3 \to \mathbb{R}^3$ is a linear transformation. $T(x, y, z) = (2x + 3y, y - z, x + y - 3z)$		CO2	L3
	(c)	Let $W = \{(x, y, z) \mid 2x + 3y = z, x = y + z\} \subseteq V = \mathbb{R}^3$ Find basis of W and dim(W)		CO2	L3
	(d)	State and prove Rank-Nullity Theorem.		CO2	L4
Q. 2		**Attempt any TWO of the following.**	[10]	CO's	KL's
	(a)	State any five fundamental properties of determinants.		CO1	L1
	(b)	Calculate eigen value and eigen vectors of $A = \begin{bmatrix} 3 & 1 & 1 \\ 1 & 3 & 1 \\ 1 & 1 & 3 \end{bmatrix}$		CO3	L3
	(c)	State and prove Pythagoras Theorem for vectors.		CO2	L4
	(d)	Using the Gram – Schmidt process, obtain an orthonormal basis for the Vectors $(1,1,1), (2,0,-1), (2,3,1)$		CO2	L3
Q. 3		**Attempt any TWO of the following.**	[10]	CO's	KL's
	(a)	For a linear transformation, $T: V \to W$, Show that Ker(T) is a subspace of V		CO2	L4
	(b)	For a linear transformation, $T: V \to W$, Show that (i) $T(0)=0$ (ii) for $v \in V$, $T(-v) = -T(v)$. (iii) for all $u, v \in V$, $T(u - v) = T(u) - T(v)$.		CO2	L4
	(c)	For $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 1 \\ 1 & 3 & 2 \end{bmatrix}$, calculate the eigenvalues and verify the following (i) Sum of eigenvalues = Trace(A), (ii) Product of eigenvalues = Determinant(A)		CO4	L5
	(d)	Let V be a vector space over a field F. Let $u, v \in V$. Then show that $\|u + v\|^2 + \|u - v\|^2 = 2(\|u\|^2 + \|v\|^2)$		CO2	L4

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