Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Examination, December 2023

Course: Linear Algebra (Minor) **Semester: I**
Program: B.Sc. (H) Physics/Chemistry/Geology **Time : 03 hrs.**
Course Code: MATH1057 **Max. Marks: 100**

Instructions: Attempt all questions.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Define Basis and dimension of vector space.	**4**	**CO2**
Q 2	Explain direct sum of subspace.	**4**	**CO2**
Q 3	Discuss linear combination of vectors and linear Span.	**4**	**CO2**
Q 4	Describe linear transformation of vector space.	**4**	**CO3**
Q 5	Explain range and null space of linear transformation.	**4**	**CO3**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Prove that the intersection of two subspaces W_1 and W_2 of a vector space $V(F)$ is also a vector space of $V(F)$.	**10**	**CO2**
Q 7	Show that the set of all positive rational numbers forms an abelian group under the composition $a * b = \frac{ab}{2}$.	**10**	**CO2**
Q 8	Let $T: R^2 \to R^3$ then show that mapping defined by $T(\alpha, \beta) = (\alpha + \beta, \alpha - \beta, \beta)$ is a linear mapping.	**10**	**CO3**
Q 9	Test for the consistency of the following system of equations and solve: $2x + 3y + 4z = 11, x + 5y + 7z = 15, 3x + 11y + 13z = 25$ **OR** Find the modal matrix P which diagonalizes the matrix $A = \begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$, verify $P^{-1}AP = D$ where D is the diagonal matrix.	**10**	**CO1**

SECTION-C (2Qx20M=40 Marks)			
Q 10	Examine the following vectors for linear dependence and the relation if it exists. $X_1 = (1,0,2,1), X_2 = (3,1,2,1), X_3 = (4,6,2,-4), X_4 = (-6,0,-3,-4)$. **OR** Find the characteristic equation of the matrix $$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$ And verify Cayley Hamilton Theorem.	**20**	**CO1**
Q 11	State Invertible linear transformation. Let U and V be vector spaces over the same field F and let T be the linear transformation from U into V then prove that T^{-1} is a linear transformation from V into U.	**20**	**CO3**