UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program : Third Semester – Spring 2023

Roll No. ....

Paper: Mathematics A-III **Course Code: MATH-201** **Time: 3 Hrs.** **Marks: 60**

THE ANSWERS MUST BE ATTEMPTED ON THE ANSWER SHEET PROVIDED

Q.1. Solve the following: **(6x5=30)**

i) Show that for any square matrix A. $A + A^t$ is symmetric and $A - A^t$ is skew symmetric.

ii) If A is a matrix over $\mathbb{R}$ and $AA^t = 0$, show that A=0.

iii) Using row operation find A^{-1} if $A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 4 & 1 \\ 1 & 3 & 0 \end{bmatrix}$.

iv) Show that T is linear . Also check is it one one? $T(x_1, x_2, x_3) = (x_1 - x_2, x_3)$.

v) Let U and W be 2-dimensional subspaces of $\mathbb{R}^3$. Show that $U \cap W \neq \{0\}$

vi) Suppose u, v & w are linearly independent vector. Prove that $u + v - 2w, u - v - w, u + w$ are linearly independent.

Solve the following: **(5x6=30)**

Q.No 2 **Solve** the system of equation

$$x_1 - x_2 + 2x_3 = 0 ; \quad 4x_1 + x_2 + 2x_3 = 1 ; \quad x_1 + x_3 + x_2 = -1$$

Q. No 3 For $T(x_1, x_2, x_3) = (x_2, -x_1, -x_3)$. Find matrix of linear transformation with respect to standard basis for $\mathbb{R}^3$ also find $R(T) and\ N(T)$.

Q.No 4 If A is $n \times n$ nilpotent matrix, show that $I_n - A$ is nonsingular.

Q. No 5 Find the bases for the subspace of $\mathbb{R}^3$ that is spanned by the vectors:
$(1, 1, -4)$, $(2, 0, 2)$ & $(2, -1, 3)$

Q. No 6 Find eigenvalue and eigenvectors of the matrix $A = \begin{bmatrix} 1 & 1 \\ -2 & 4 \end{bmatrix}$.