UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program : Third Semester – Fall 2021

Roll No. .....

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

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

i. Define $T: R^3 \to R^3$ by $T(x_1, x_2, x_3) = (-x_3, x_1, x_1 + x_3)$. Find $N(T)$. Is T one-to-one?

ii. Check whether the first quadrant $W := \{(x, y): \ x, y \geq 0\}$ makes a subspace of R^2 or not.

iii. Find the reduced echelon form of the matrix

$$\begin{bmatrix} 1 & -2 & 3 & -1 \\ 2 & -1 & 2 & 2 \\ 3 & 1 & 2 & 3 \end{bmatrix}$$

iv. Show that Similar matrices having same eigenvalues.

v. Show that if $u \in V$ is orthogonal to every $v \in V$, then $u = 0$.

vi. Give an example of non-similar matrices having same characteristic polynomial.

Q.2. Solve the following: **(5x6=30)**

i. Determine the values of a for which the system of linear equations has no solution, exactly one solution and infinitely many solutions.

$x + y + 7z = -7$

$2x + 3y + 17z = -16$

$x + 2y + (a^2 + 1)z = 3a.$

ii. If possible, find the inverse of the matrix $\begin{bmatrix} 1 & 2 & -3 \\ 0 & -2 & 0 \\ -2 & -2 & 2 \end{bmatrix}$

iii. Find Eigen Values and Eigen vectors of $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$

iv. Find solution of the given system by Gauss-Jordan Elimination method. (

$2x_1 - x_2 - x_3 = 4$; $3x_1 - 2x_3 + 4x_2 = 11$; $3x_1 - 2x_2 + 4x_3 = 11$

v. Find an equation of the subspace W of R^3 spanned by v_1=(1, -3, 5), v_2=(-2, 6, -10).