University of Sargodha

BS 3rd Term Examination 2019

Subject: I.T **Paper: Linear Algebra (MATH-3215)**

Time Allowed: 2:30 Hours **Maximum Marks: 80**

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

(2*16)

Q.1. Write short answers of the following in 2-3 lines each.

i. Define zero vector space.

ii. Compute u+v and ku for u= (-1,2), v= (3,4), and k=3.

iii. Define Linearly independent.

iv. Show that a finite set that contains 0 is linearly independent.

v. Explain why the following form linearly dependent set of vectors.
$u_1 = (-1, 2, 4)$ and $u_2 = (5, -10, -20)$

vi. Write standard basis for $\mathbb{R}^n$.

vii. Define dimension of a vector space.

viii. Define row space.

ix. What is the relation between rank, nullity and dimension of a vector space.

x. Define characteristic equation.

xi. Find eigen values of the matrix $A = \begin{bmatrix} 3 & 0 \\ 8 & -1 \end{bmatrix}$

xii. Define unit vector.

xiii. Define orthogonal vectors.

xiv. If u and v are orthogonal vectors in a real inner product space, then
$$\|u + v\|^2 = \|u\|^2 + \|v\|^2$$

xv. Find the cosine of the angle between the vectors w.r.t Euclidean inner product
$$u = (1, -3), v = (2, 4)$$

xvi. Determine whether the vectors are orthogonal w.r.t the Euclidean inner product
$$u = (-1, 3, 2), v = (4, 2, -1)$$

Subjective Part (3*16)

Q.2. (a) State and prove Cauchy Schwarz Inequality.
(b) State and prove Triangle Inequality.

Q.3. (a) Show that the vectors
$v_1 = (1,2,1), v_2 = (2,9,0), v_3 = (3,3,4)$
form a basis for $\mathbb{R}^3$
(b) Write the procedure for diagonalizing an nxn matrix.

Q.4. Find the inverse of
$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 3 \\ 1 & 8 & 8 \end{bmatrix}$$

Q.5. (a) Evaluate det(A) where $A = \begin{bmatrix} 0 & 1 & 5 \\ 3 & -6 & 9 \\ 2 & 6 & 1 \end{bmatrix}$

(b) Evaluate the expression<2v-w,3u+2w>

Q.6. (a) If u, v, and w are vectors in a real inner product space V, and if k is any scalar, then
$$\|u + v\| \le \|u\| + \|v\|$$

(b) Use Cramer's rule to solve
$$x_1 + 2x_3 = 6$$
$$-3x_1 + 4x_2 + 6x_3 = 30$$
$$-x_1 - 2x_2 + 3x_3 = 8$$