NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES
LAHORE CAMPUS

Spring-2024

Outline of Linear Algebra (BSE)

DEPARTMENT OF SCIENCES & HUMANITIES

Department	Department of Sciences & Humanities	**Dept. Code**	S & H
Course Title	Linear Algebra	**Course Code**	MT1004
Pre-requisite(s)	-	**Credit Hrs.**	3
Moderator			
Course Instructors	Dr. Saeeda Zia		

Course Objective	The objective is to impart training to the students in this very important branch of Mathematics. Students are expected to learn about system of linear equations, vector spaces, inner products, Eigen values and linear transformations. Attempt will be made to introduce the students to postulational and axiomatic approach in Mathematics. This course also emphasizes the application of linear algebra in science and real life.

No.	Assigned Program Learning Outcome (PLO)	Level	Tool
01	An ability to identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural science and engineering sciences.	R	

I = Introduction, R = Reinforcement, E = Evaluation.
A = Assignment, Q = Quiz, M = Midterm, F = Final, L = Lab, P = Project, W = Written Report.

No.	Course Learning Outcome (CLO) Statements	Tools
01	• Convert real life problems into system of linear equations and perform elementary row operations to solve them.	Q1,A1
02	• Use concept of elementary matrices to evaluate the inverse of square matrices and solving the system of linear equations.	A1,M1

03	• Evaluate the determinant of matrix and solving system of equations using properties and/or operations on determinants.	A1,M1
04	• Analyse vectors and their properties in 2-space, 3-space and n-space	Q2,M1
05	• Recognize vector spaces and/or subspaces and compute their bases and its dimension.	Q2,F
06	• Perform Eigen Value analysis and use it to diagonalize a matrix and/or find its powers.	A2, M2
07	• Identify inner product spaces and/or perform Gram Schmidt process/QR decomposition using inner products.	M2,Q3,F
08	• Express a linear transformations graphically and matrices and using their properties to solve engineering problems.	A3,F

Text Book(s)	**Title**	Elementary Linear Algebra
	Author	Howard A. Anton (12th Edition)
	Publisher	
Ref. Book(s)	**Title**	Linear Algebra with Applications
	Author	Bernard Kolman (Latest Edition)

Week	Course Contents	Chapter	CLO
01	**System of Linear Equations And Matrices** 1.1 Introduction to linear system 1.2 Gaussian Elimination 1.3 Matrices and Matrix operations	1	01
02	1.4 Inverses; Algebraic properties of Matrices 1.5 Elementary Matrices and Method of finding matrix inverse	1	01
03	1.6 More on linear systems and Invertible Matrices 1.7 Diagonal, Triangular and Symmetric matrices	1	08
04	**Determinants** 2.1 Determinants by Cofactor Expansion 2.2 Evaluating Determinants by row reduction 2.3 Properties of Determinants; Cramer's rule	2	02
05	**MID TERM-I**		
06	**Euclidean Vector Spaces** 3.1 Vectors in 2-space, 3-space and n-space 3.2 Norm, Dot Product, and Distance in R^n 3.3 Orthognality of vectors 3.4 The Geometry of Linear Systems 3.5 Cross Product	3	04
07	**General Vector Spaces** 4.1 Real Vector Spaces 4.2 Subspaces	4	05

08	4.3 Linear Independence / Dependence 4.4 Coordinates and Basis for a vector space 4.5 Change of Basis	4	05
09	4.6 Row space, Column Space and Null Space 4.7 Rank and Nullity 4.9 Basic Matrix Transformations in R^2 and R^3	4	05, 08
10	**Eigenvalues and Eigen vectors** 5.1 Eigenvalues and Eigenvectors 5.2 Diagonalization of matrices	5	06
11	**Inner Product Spaces** 6.1 Inner product spaces 6.2 Angle and Orthognality in Inner product Spaces	6	07
12	6.3 Gram-Schmidt Process, QR- Decomposition		
13	**MID TERM II**		
14	**General Linear Transformations** 1.8 Matrix Transformations 4.9 Basic Matrix Transformations in R^2 & R^3 8.1 General Linear Transformations 8.2 Compositions and Inverse Transformations	8	08
15	8.3 Isomorphism 8.4 Matrices For General Linear Transformations 8.5 Similarity	8	08
	FINAL EXAM		

Evaluation Procedure & Marks Distribution: It can vary according to class instructor.

Assessment Tools	Total No. of	Weightage
Quizzes	3 (At least)	10%
Assignments+ Homework	3(At least)	10%
Mid Term Exam	2	30%
Final Exam	1	50%

Note: Relative Grading Policy will be followed for this course.