



National University

Of Computer & Emerging Sciences
Karachi



Course Outlines of BS (CS) Degree Program

Course Instructor	Dr. Fahad Riaz, Dr. Khusro Mian, Mr. Jamil Usmani, Ms. Fareeha Sultan, Ms. Alishba Tariq, Mr. Muhammad Amjad.	Semester	Fall
Batch/Section(s)	Batch 2023	Year	2024
Course Title	MT 1004-Linear Algebra	Credit Hours	3
Prerequisite(s)	No	Course TA	

Text Book(s)	
Title of book	Elementary Linear Algebra, 12 th edition
Author(s)	Howard Anton and Anton Kaul

Reference Book(s)	
Title of book	Linear Algebra and its Application
Author(s)	Gilbert Strang
Title of book	Coding the Matrix: Linear Algebra through Applications to Computer Science
Author(s)	Philip N Klein

Course Description
Elementary operations on matrices, Gaussian and Gauss Jordan elimination, Elementary matrices and matrix factorization, determinants and their properties, vector spaces, subspaces and spanning sets, Linear Independence, Dimensions, Rank of a matrix, Linear transformation, Eigenvalues and Eigenvectors, Inner Product and Orthogonal basis, Diagonalization and Orthogonal Diagonalization, Application of linear algebra

S. No.	Course Learning Outcomes (CLO)	Domain	Taxonomy Level	PLO
1.	Interpreting and finding the solutions of linear equations in detail.	Cognitive	2	2
2.	Understanding the core concepts of Euclidean vector spaces and matrix transformations.	Cognitive	2	
3.	Applying the basic linear algebra concepts in computer science.	Cognitive	3	

Tentative Weekly Lectures Schedule:

Weeks	Contents/Topics	Remarks	Exercises	CLO's	Tools
Week 1	Introduction, System of Linear equations, Elementary row operation		1.1 (1-20)	1	Q1, A1, M1, F
Week 2	Solving system of Linear equations: Gaussian Elimination and Gauss Jordan methods Matrix Operations Elementary Matrices, Methods for finding Inverse, Invertible Matrices,	Assignment 1	1.2 (1-26) 1.5 (1-6, 11-18) 1.6 (1-20)		
Week 3	Diagonal, triangular, and symmetric matrices, Matrix Transformations		1.7 (1-10, 19-28) 1.8 (1-24, 27-41) (CLO 2)		
Week 4	Application no 1: Network Analysis Determinants and their properties, Minors, Cofactors, Inverse using cofactors, Cramer's Rule	Quiz 1	1.10 (1-4) (CLO 3) 2.1 (1-32) 2.2 (1-23) 2.3(1-29,31,32)		
Week 5	General Vector Space Subspaces		4.1 (1,2,9,11, 12) Example: 1-5,7 4.2 (1-5, 19) Example: 1-6,13		
Week 6	1 st Mid Term Exam				
Week 7	Spanning Sets Linear Independence		4.3 (1-20) 4.4 (1-15)	2	Q2, A2, M2, F
Week 8	Coordinates and Bases Dimensions Change of basis	Quiz 2	4.5 (1-22) 4.6 (1-8,10,12-13,15-20) 4.7 (1-19)		
Week 9	Bases for row, column, and null spaces, Rank and Nullity	Assignment 2	4.8 (1-19,21-30) 4.9 (1-14,19-36)		
Week 10	Eigenvalues and Eigenvectors Diagonalization		5.1 (1-16) 5.2 (1-20)		
Week 11	2 nd Mid Term Exam				
Week 12	Inner product spaces, Orthogonal and orthonormal bases, Gram-Schmidt Process;	Assignment 3	6.1 (1-26) 6.2 (1-12, 17-19)	2	Q3, A3, P, F
Week 13	QR-Decomposition. Orthogonal Matrices		6.3 (1-14, 27-31, 44-49) 7.1 (1-6) (CLO 1)		
Week 14	Orthogonal Diagonalization, Quadratic Forms	Quiz 3	7.2 (1-18) (CLO 1) 7.3 (1-8)(CLO 1)		
Week 15	Application no 2: Single Value Decomposition Markov Chains	Presentation	9.4 5.5	3	
Week 16	Revision				

Marks Distribution:

Particulars	% Marks
1. Quizzes and Assignments / Presentations	20
2. First Mid Exam	15
3. Second Mid Exam	15
4. Final Exam	50
Total:	100