National University

Of Computer & Emerging Sciences
Karachi

Course Outlines of BS (CS) Degree Program

Course Instructor	Ms. Alishba Tariq, Mr. Abdul Basit, Dr. Fahad Riaz, Ms. Javeria Iftikhar, Mr. Nadeem khan, Mr. Osama Bin Ajaz, Mr. Shahid Ashraf , Ms. Urooj.	**Semester**	Fall
Batch/Section(s)	Batch 2021	**Year**	2022
Course Title	MT 1004-Linear Algebra	**Credit Hours**	3
Prerequisite(s)	No	**Course TA**	

Text Book(s)	
Title of book	Elementary Linear Algebra, 12th 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)		
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)	**1**	Q1, A1, M1, F
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	**1st 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	**2nd 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**