



### Course Outlines of BS (CS) Degree Program

<b>Course Instructor</b>	Dr. Nazish Kanwal, Ms. Javeria Iftikhar, Ms. Asma Masood	<b>Semester</b>	Spring
<b>Batch/Section(s)</b>	Batches 2022 & 2021	<b>Year</b>	2023
<b>Course Title</b>	MT 1004-Linear Algebra	<b>Credit Hours</b>	3
<b>Prerequisite(s)</b>	No	<b>Course TA</b>	

#### Text Book(s)

<b>Title of book</b>	Elementary Linear Algebra, 12 <sup>th</sup> edition
<b>Author(s)</b>	Howard Anton and Anton Kaul

#### Reference Book(s)

<b>Title of book</b>	Linear Algebra and its Application
<b>Author(s)</b>	Gilbert Strang
<b>Title of book</b>	Linear Algebra and its Application
<b>Author(s)</b>	David C. Lay, Steven R. Lay, Judi J. McDonald
<b>Title of book</b>	Coding the Matrix: Linear Algebra through Applications to Computer Science
<b>Author(s)</b>	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	

I = Introduction, R = Reinforcement, E = Evaluation. A = Assignment, Q = Quiz, M = Midterm, F=Final.

#### Tentative Weekly Lectures Schedule:

Weeks	Contents/Topics	Remarks	Exercises	CLO's	Tools
<b>Week 1</b>	Introduction, System of Linear equations, Elementary row operation		1.1 (1-20)	1	Q1, A1, M1, F

Week 2	<b>Solving system of Linear equations:</b> Gaussian Elimination and Gauss Jordan methods <b>Matrix Operations</b> Elementary Matrices, Methods for finding Inverse, Invertible Matrices,	Assignment 1	1.2 (1-30) 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 <sup>st</sup> Mid Term Exam (25 <sup>th</sup> February 2023 to 1 <sup>st</sup> March 2023)				
Week 7	Spanning Sets Linear Independence		4.3 (1-22) 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 (1-21)		
Week 11	2 <sup>nd</sup> Mid Term Exam				
Week 12	Inner product spaces, Orthogonal and orthonormal bases, Gram-Schmidt Process;	Assignment 3	6.1 (1-28) 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 (1-10, 13-15) Example:4	3	
Week 16	Revision				

### Marks Distribution:

Particulars	% Marks
1. Quizzes (at least 3)	10
2. Assignments (at least 2)	10
4. First Mid Exam	15
5. Second Mid Exam	15
6. Final Exam	50
<b>Total:-</b>	<b>100</b>

## **Important Instructions to be followed for this Course**

- Be in the classroom on time. Any student who arrives more than 5 min late in the class would be marked LATE. Anybody coming to class more than 15 minutes late will be marked ABSENT.
- Turn off your cell phones or any other electronic devices before entering the class.
- Maintain the decorum of the classroom all the time.
- Avoid a conversation with your classmates while the lecture is in progress.
- Use parliamentary language in the classroom as well as in assignments. Refrain from using impolite, vulgar or abusive language in the classroom as well as in class presentations and assignments.
- Submit your assignments on time, no assignment will be accepted after the deadline.
- There would be no re- take of any quiz.

## **Instructions / Suggestions for satisfactory progress in this course:**

- On average, most students find at least three hours outside of class for each class hour necessary for satisfactory learning.
- Chapters should be read and homework should be attempted before class.
- Do not get behind. You are encouraged to work with other students. Plus, I am always available during office hours to help you.
- The homework assigned is a minimum. You may always work extra hours on your own.
- Use the few minutes you usually have before the start of each class to review the prior meetings' notes and homework. This will save us valuable in-class time to work on new material.
- Develop a learning habit rather than memorizing.
- Work in groups, whenever appropriate.
- Apply the learned principles and gain knowledge.
- Be creative in thinking, but stick to the topic assigned for discussions, assignments and presentations.
- Always bring your textbooks with you in the class.

**Note:** Students are welcome all the time to get help from the Teacher.

Signature: \_\_\_\_\_

Date:17-01-2023