North South University
Department of Mathematics and Physics

MAT125: Introduction to Linear Algebra

Course Name: Introduction to Linear Algebra
Course Code: MAT 125.14
Credit Hours : 3 Credits
Pre-requisite : MAT 130
Term : **SUMMER 2024**

Instructor	Dr M Abdur Rab(AuR)
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Office Time	3:00PM-4:20PM(RA)
Course Short Description:	This is an introductory course in linear algebra. The course will introduce the basic concepts and techniques of linear algebra, along with the insights of its wide applications in physics, economics and social sciences, natural sciences, and engineering. The course will require the development of theoretical results, which will require the use of mathematical rigor, algebraic manipulation, and geometry. This course covers, but is not limited to, the study of systems of linear equations, matrices, determinants, vectors and vector spaces, basis and dimension of vector spaces, linear transformations, eigenvalues and eigenvectors, and their applications. Computer software will be used to enhance the learning of the topics and techniques covered.

Objective of the Course

1. To understand the fundamental properties of matrices including determinants, inverse matrices, matrix factorizations, eigenvalues, eigenvectors along with their application, and linear transformations.

2. Understanding the basic concepts of the system of linear equations, apply the matrix calculus to solve linear systems of equations.

3. To comprehend the Euclidean n-space, vector spaces, subspaces, linear span, and determine the basis and dimension of vector spaces.

4. Solving problems using computer programming and graphing calculators to gain an insight into the applicability of linear algebra.

Course Learning Outcomes:

(CO-1)	Demonstrate the ability to understand the basic properties of matrices including determinants, inverse matrices, matrix factorizations, eigenvalues, eigenvectors, and linear transformations, the applications of eigenvectors including the investigation of the diagonalizability of matrices.
(CO-2)	Explain the fundamental concepts of the system of linear equations using geometry and graphs; and apply the matrix calculus to solve linear systems of equations.
(CO-3)	Comprehend the concept of Euclidean n-space, vector spaces, subspaces, linear span, and determine the basis and dimension of vector spaces.
(CO-4)	Develop problem solving ability using computer programming and graphing calculators and have an appreciation of the wide application of this discipline within the scientific field.

Mapping of Course Outcomes

CLOs	Course Outcomes (CO)	Bloom's taxonomy domain/level *(C: Cognitive P: sychomotor A:Affective)*	Delivery methods and activities	Assessment tools
CO-1	Demonstrate the ability to understand the basic properties of matrices including determinants, inverse matrices, matrix factorizations, eigenvalues, eigenvectors, and linear transformations, the applications of eigenvectors including the investigation of the diagonalizability of matrices.	**C1, C2, C3, C4**	Lectures, notes	Quiz, Assignment, Midterms, Final Exam
CO-2	Explain the fundamental concepts of the system of linear equations using geometry and graphs; and apply the matrix calculus to solve linear systems of equations.	**C2, C3, P2**	Lecture, notes, group discussion	Assignment, Class participation, Quiz, Midterms
CO-3	Comprehend the concept of Euclidean n-space, vector spaces, subspaces, linear span, and determine the basis and dimension of vector spaces.	**C1, C2, C3**	Lecture, notes	Discussion, Quiz, Midterms, Final Exam
CO-4	Develop problem solving ability using computer programming and graphing calculators and have an appreciation of the wide application of this discipline within the scientific field.	**C2, C3, C6, P3**	Lecture, notes, group discussion	Assignment, Discussion, Class participation

Note: C2, C3, C4, and P2 indicate different subdomains of Bloom's Taxonomy. Please visit departmental website for details.

Marks Distribution:

Attendance	10%
Assignments	10%
Quizzes	20%
Mid-Term	25%
Final Exam	35%

Grading Policy:

Numerical Scores	Letter Grade	Grade Points
93 & above	A	4.0
90 - 92	A-	3.7
87 – 89	B+	3.3
83 – 86	B	3.0
80 – 82	B-	2.7
77 – 79	C+	2.3
73- 76	C	2.0
70 – 72	C-	1.7
67 - 69	D+	1.3
60 - 66	D	1.0

Mapping of Course Outcomes
Class Schedule

Lecture	Topics	Article no. in the text book	Assessment tools	Learning Outcomes
1	Matrices and Matrix Operations, Inverse; Rules of Matrix Arithmetic,	1.3, 1.4, 1.7	Quiz1, Discussions	CO-1
2	Diagonal, Triangular and Symmetric Matrices, Matrices and Matrix Operations,	1.3, 1.4,	Quiz 1, Discussions	CO-1
3	Inverse; Rules of Matrix Arithmetic, Diagonal, Triangular and Symmetric Matrices	1.7	Assignment I, Midterm	CO-1
4	Elementary Matrices and a Method for Finding inverse of Matrix, Elementary Matrices and a Method for Finding inverse of Matrix	1.5	Assignment I, Midterm	CO-1
5	Determinant by Cofactor Expansion	2.1	Quiz 1, Midterm	CO-1
6	Evaluating Determinants by Row Reduction	2.2	Midterm	CO-1
7	Properties of Determinant Function	2.3	Midterm, Assignment I	CO-1
8	Introduction to System of Linear Equations, Gaussian Eliminations	1.1, 1.2	Discussions, Quiz 2	CO-2
9	Gaussian Eliminations (No solution and Unique solution)	1.2	Midterm, Assignment II	CO-2
10	Gaussian Eliminations (many solutions),Solution of Homogeneous system of Linear Equations	1.2	Midterm, Assignment II	CO-2
11	Further Results on Systems of Equations and Invertibility,	1.2	Midterm, Assignment II	CO-2
12	Euclidean n-space and properties, Euclidean n-space and Gramsmith Orthogonalization	1.6	Discussions Midterm	CO-2, CO-3
13	Midterm Exam			
14	Linear Transformation	4.2	Final, Assignment II	CO-1
15	Linear Transformation and properties, General Linear Transformations, Kernel and Range,	4.2 , 4.3	Final, Assignment II	CO-1
16		8.1, 8.2,	Final, Assignment II	CO-2, CO-3
17	Inverse Linear Transformations, Matrices of General Linear Transformations	8.3, 8.4	Final, Assignment II	CO-2, CO-3
18	Real Vector Spaces, Subspaces	5.1	Quiz 3	CO-1
19		5.2	Final	CO-3
20	Linear combination,Linear Independence and Dependence	5.3	Final	CO-3
21	Basis, Dimension, Solution Space and Null Space	5.4	Quiz 3, Final Exam	CO-3
22	Fundamental Subspace of Linear Algebra (Row Space, Column Space and Null Space)	5.5	Quiz 3, Final Exam	CO-3
23	Fundamental Subspace of Linear Algebra (Row Space, Column Space and Null Space)	5.5	Quiz 3, Final Exam	CO-3
24	Rank and Nullity	5.6	Final Exam	CO-3
25	Eigenvalues and Eigenvectors	7.1	Quiz 4	CO-3
29	Diagonalization	7.2	Final Exam	CO-3
26	Algebraic and Geometric Multiplicity	7.2	Final exam, Assignment III	CO-3
27	Cheley Hamilton Theorem (CHT) and its applications	7.3	Final exam, Assignment III	CO-3
28	Applications of Linear Algebra	11.2, 11.3	Discussions, Assignment Iv Final exam	CO-4
29	Applications of Linear Algebra	11.6, 11.7	Discussions, Assignment Iv Final exam	CO-4
30	Applications of Linear Algebra	11.16	Discussions, Assignment Iv Final exam	CO-4
Final Exam (Declared by the Controller of Examinations)				