Department of Mathematics and Physics

Course Title	Introduction to Linear Algebra
Course Code	MAT-125
Section No	TBA
Semester	
Course Coordinator	Mohammad Monir Uddin (monir.uddin@northsouth.edu)

Instructor & Department Information

Instructor's Name	
Office Room	
Office Hours	
Office Phone	
Email Address	
Links	

Course & Section Information

Prerequisites	None
Class Time	TBA
Location	TBA
Course Credit Hours	3:0
Text Book	Elementary Linear Algebra By Howerd Anton (9th Edition)
Reference Book	Introduction to Linear Algebra By Gilbert Strang (Third Edition)

Marks Distribution:

Class Performance	5%
Attendance	5%
Assignments	5%
Quizzes	10%
Mid-Term I	20%
Mid-Term II	20%
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

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.

Course Objectives

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 theEuclidean 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

Upon successful completion of this course, students will be able to:

- **(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: Psychomotor 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	**C2, C3, C4**	Lectures, notes	Quiz, Assignment, Midterms, Final Exam

	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.	**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

Class Schedule

Lecture	Topics	Article no. in the text book	Assessment tools	Learning Outcomes
1	Matrices and Matrix Operations, Inverse; Rules of Matrix Arithmetic, Diagonal, Triangular and Symmetric Matrices	1.3, 1.4, 1.7	Quiz1, Discussions	CO-1
2	Matrices and Matrix Operations, Inverse; Rules of Matrix Arithmetic, Diagonal, Triangular and Symmetric Matrices	1.3, 1.4, 1.7	Quiz 1, Discussions	CO-1
3	Elementary Matrices and a Method for Finding inverse of Matrix	1.5	Assignment I, Midterm-I	CO-1
4	Elementary Matrices and a Method for Finding inverse of Matrix	1.5	Discussions	CO-1
5	Determinant by Cofactor Expansion	2.1	Quiz 1, Midterm-I	CO-1
6	Evaluating Determinants by Row Reduction	2.2	Midterm-I	CO-1
7	Properties of Determinant Function	2.3	Midterm-I, Assignment I	CO-1
8	**Midterm I**			
9	Introduction to System of Linear Equations, Gaussian Eliminations	1.1, 1.2	Discussions, Quiz 1	CO-2
10	Gaussian Eliminations	1.2	Midterm-II, Assignment II	CO-2
11	Further Results on Systems of Equations and Invertibility, Euclidean n-space	1.6, 4.1	Discussions	CO-2, CO-3
12	Linear Transformation and properties	4.2	Midterm-II, Assignment II	CO-1
13	Real Vector Spaces	5.1	Midterm-II	CO-3
14	Subspaces	5.2	Midterm-II	CO-3
15	Linear Independence and Dependence	5.3	Midterm-II	CO-3

16	**Midterm II**			
17	Basis, Dimension, Solution Space and Null Space	5.4	Quiz 3, Final Exam	CO-3
18	Row Space, Column Space and Null Space	5.5	Quiz 3, Final Exam	CO-3
19	Rank and Nullity	5.6	Final Exam	CO-3
20	Eigenvalues and Eigenvectors	7.1	Final Exam	CO-3
21	Diagonalization	7.2	Final Exam	CO-3
22	Applications of Linear Algebra	11.2	Discussions, Assignment III	CO-4
23	Applications of Linear Algebra	11.3	Discussions, Assignment III	CO-4
24	Applications of Linear Algebra	11.7	Discussions, Assignment III	CO-4
Final Exam (Declared by the Controller of Examinations)				

Note: The instructor reserves the right to make changes to the syllabus if necessary.

List of additional readings

- **Chapter 3: Vectors in 2-Space and 3-Space:** Introduction to Vectors, Norm of a Vector; Vector Arithmetic, Dot Product; Projections, Lines and Planes in 3-Space
- **Chapter 6: Inner Product Spaces:** Inner Products, Angle and Orthogonality in Inner Products, Orthonormal Bases; Gram-Schmidt Process, Orthogonal Matrices; Change of Basis.

Classroom Rules of Conduct

1. Electronic devices e.g**. cell phone**, **laptop, notepad, iPad, iPod, mp3, etc**are strictly prohibited in the class.

2. It is imperative that the students maintain absolute discipline in class.Students are also expected to arrive on time for the class, as frequent late attendance will not be accepted.

3. **Academic Integrity Policy:** Department of Mathematics and Physics does not tolerate academic dishonesty by its students. At minimum, students must not be involved in cheating, copyright infringement, submitting the same work in multiple courses, significant collaboration with other individuals outside of sanctioned group activities, and fabrications.

Students are advised that violations of the Student Integrity Code will be treated seriously, with special attention given to repeated offences.

Please Refer to NSU Student Handbook, Sections: “Disciplinary Actions” and “Procedures and Guidelines”.

Exams & Make Up Policy

Three quizzes will be taken (best **Two** out of **Three** will be considered). **NO makeup for quizzes or midterms will be taken under any circumstances.** If a student misses any of the Midterm exams due to the circumstances beyond their control (official valid documents are required) and informed beforehand (if possible), reasonable arrangement may be considered. There will be **no extra question** in the Midterm and Final exams, so that students should have to answer all the questions given in the exam script.

Cell phones are **prohibited** in exam sessions.

Attendance Policy

Students are required and expected to attend all classes regularly and on time and participate in class discussions. North South University mandates to fail students who are absent 25% or more from their classes, even if such absences are excusable. It is the responsibility of the student to become aware of other course-related announcements missed during an absence.

Please Refer to NSU Student Handbook, Section: "Study Principles and Policies"

Communication Policy

All communications should take place using the instructor's **email**. Announcements in class will override any statement made here or in any other handouts. It is the student's responsibility to be aware of any announcements made in classes.

Appropriate Use Policy

All members of the North South University community must use electronic communications in a responsible manner. The University may restrict the use of its computers and network systems for electronic communications subject to violations of university policies/codes or local laws or national laws. Also, the university reserves the right to limit access to its networks through university-owned or other computers, and to remove or limit access to material posted on university-owned computers.

Students Complaints Policy

Students at North South University have the right to pursue complaints related to faculty, staff, and other students. The nature of the complaints may be either academic or non-academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.