



National University of Engineering (UNI)
School of Civil Engineering
Syllabus 2026-II

1. COURSE

MA121. Linear Algebra I (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: MA121. Linear Algebra I
2.2 Semester	: 3 rd Semester.
2.3 Credits	: 5
2.4 Hours	: 3 HT; 4 HP;
2.5 Duration of the period	: 16 weeks
2.6 Type of course	: Mandatory
2.7 Learning modality	: Face to face
2.8 Prerequisites	: MA100. Basic Mathematics. (1 st Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

This course introduces the fundamental concepts of linear algebra, providing the mathematical foundations for the study of vector spaces, linear transformations, and systems of linear equations. It develops abstract thinking and problem-solving skills through matrices, determinants, and vectors. The course is fundamental for applications in science, engineering, and computing.

5. GOALS

- Understand the concepts of vector spaces and subspaces.
- Master matrix operations and determinants.
- Solve systems of linear equations using different methods.
- Apply linear transformations and compute eigenvalues and eigenvectors.

6. COMPETENCES

ABET-1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (Familiarity)

7. TOPICS

Unit 1: Matrices and Systems of Linear Equations (28 hours)	
Competences Expected: ABET-1	
Topics	Learning Outcomes
• LU, QR, and Cholesky factorizations for solving engineering linear systems • Singular Value Decomposition (SVD) and least squares solutions	• Solve systems of linear equations arising in structural, circuit, and fluid engineering problems [Usage] • Apply the SVD to solve over-determined systems in data fitting and signal processing [Usage]
Readings : [LLM16], [Str16], [AR14]	

Unit 2: Vector Spaces and Linear Transformations (22 hours)	
Competences Expected: ABET-1	
Topics	Learning Outcomes
• Vector spaces, subspaces, bases, and dimension • Linear transformations and their matrix representations in coordinate changes	• Formulate and interpret coordinate system transformations for engineering geometry problems [Assessment]
Readings : [LLM16], [Str16], [AR14]	

Unit 3: Eigenvalues and Inner Product Spaces (20 hours)	
Competences Expected: ABET-1	
Topics	Learning Outcomes
• Eigenvalues, eigenvectors, and diagonalization with applications to vibration and stability • Inner product spaces, orthogonality, and the Gram-Schmidt process	• Perform eigenvalue decomposition on symmetric matrices for modal analysis of mechanical structures [Assessment]
Readings : [LLM16], [Str16], [AR14]	

8. WORKPLAN

8.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

8.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

8.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

9. EVALUATION SYSTEM

***** EVALUATION MISSING *****

10. BASIC BIBLIOGRAPHY

- [AR14] Howard Anton and Chris Rorres. *Álgebra Lineal con Aplicaciones*. 11th. Limusa Wiley, 2014.
- [LLM16] David C. Lay, Steven R. Lay, and Judi J. McDonald. *Álgebra Lineal y sus Aplicaciones*. 5th. Pearson, 2016.
- [Str16] Gilbert Strang. *Introduction to Linear Algebra*. 5th. Wellesley-Cambridge Press, 2016.