



National University of Engineering (UNI)
School of Computer Science
Syllabus 2027-I

1. COURSE

BMA101. Linear Algebra (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: BMA101. Linear Algebra
2.2 Semester	: 1 st Semester.
2.3 Credits	: 4
2.4 Hours	: 3 HT; 2 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	: None

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Linear algebra is a fundamental mathematical tool shared by computer science and engineering disciplines, providing the foundations for structural analysis, circuit networks, control systems, data processing, and algorithm design. This course provides a solid foundation in the concepts and techniques of elementary and advanced linear algebra, with emphasis on its application in scientific and engineering contexts.

5. GOALS

- Understand the fundamental concepts of linear algebra, including vector spaces, linear transformations, and matrix theory.
- Apply linear algebra techniques to solve systems of equations and eigenvalue/eigenvector problems arising from scientific and engineering contexts.
- Develop skills in abstract reasoning and logical thinking to address mathematical problems.

6. COMPETENCES

AG-C07) Computing Knowledge: Applies knowledge of mathematics, science, and computing. (Familiarity)

7. TOPICS

Unit 1: Matrices and Systems of Linear Equations (19 hours)	
Competences Expected: AG-C07	
Topics	Learning Outcomes
- Matrix algebra: addition, scalar multiplication, matrix multiplication, transpose, types of matrices, and the inverse of a matrix - Solving systems of linear equations via Gaussian elimination and Gauss-Jordan; row echelon form, rank, and consistency of systems - Determinants: definition, properties, Cramer's rule, and geometric interpretation - Matrix decompositions: LU, QR, and singular value decomposition (SVD)	- Identify types of matrices and perform basic matrix algebra operations, including computing the inverse of a matrix [Familiarity] - Solve systems of linear equations using Gaussian elimination or Gauss-Jordan, determining the rank and consistency of the system [Usage] - Apply Cramer's rule and the LU, QR, and SVD decompositions to solve linear systems and factor matrices [Assessment]
Readings : [Strang2016], [Lay2016]	

Unit 2: Vector Spaces and Linear Transformations (14 hours)	
Competences Expected: AG-C07	
Topics	Learning Outcomes
- Vector spaces and subspaces; bases, dimension, and linear independence - Linear maps, kernel and image, rank-nullity theorem, and matrix representations	- Identify whether a set with given operations forms a vector space and determine a basis [Familiarity] - Determine the kernel, image, and matrix representation of a linear map, verifying the rank-nullity theorem [Usage] - Apply linear transformations to model and solve problems involving change of basis and composition of maps [Assessment]
Readings : [Strang2016], [Lay2016]	

Unit 3: Eigenvalues, Inner Product Spaces, and Quadratic Forms (15 hours)	
Competences Expected: AG-C07	
Topics	Learning Outcomes
- Eigenvalues and eigenvectors; diagonalization and the spectral theorem - Inner product spaces, orthogonality, Gram-Schmidt process, and least squares - Quadratic forms and definiteness: classification as positive, negative, or indefinite via eigenvalues	- Identify the eigenvalues and eigenvectors of a matrix and determine whether it is diagonalizable [Familiarity] - Compute the diagonalization of matrices via the spectral theorem and apply the Gram-Schmidt process to obtain orthogonal bases [Usage] - Apply least squares methods and the classification of quadratic forms via eigenvalues to solve approximation and optimization problems [Assessment]
Readings : [Strang2016], [Lay2016]	

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

Theory Sessions:

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

Lab Sessions:

In order to verify their competences, several activities including active learning and roleplay will be developed during lab sessions.

Oral Presentations:

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

Reading:

Throughout the course different readings are provided, which are evaluated. The average of the notes in the readings is considered as the mark of a qualified practice. The use of our virtual campus allows each student to access the course information, and interact outside the classroom with the teacher and with the other students.

The final grade NF depends on the following grades:

- PE : Partial Exam.
- FE : Final Exam.
- P : Permanent Evaluation (Average of practical work and graded assignments).

The final grade NF is calculated as follows:

$$NF = \frac{PE + FE + P}{3}$$

10. BASIC BIBLIOGRAPHY