

SUBJECT TEACHING GUIDE

G414 - Algebra and Geometry

Degree in Industrial Technologies Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Industrial Technologies Engineering			Type and Year	Core. Year 1
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Mathematics Basic Training Module				
Course unit title and code	G414 - Algebra and Geometry				
Number of ECTS credits allocated	6	Term	Semester based (2)		
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION				
Name of lecturer	SARA PEREZ CARABAZA				
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Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 4. DESPACHO (S4018)				
Other lecturers	VALVANUZ FERNÁNDEZ QUIRUELAS				

3.1 LEARNING OUTCOMES

- Solve mathematical problems in the field of engineering.
- Apply the methods of algebra and geometry, as well as algebraic and numerical methods for solving problems in Industrial Engineering.

4. OBJECTIVES

Interpret and communicate mathematical concepts studied in the field of Algebra with mathematical rigor, ensuring a clear and precise understanding of the theories and methods.

Correctly apply the theoretical knowledge acquired for problem-solving in the field of Algebra, both manually and through the use of computer tools.

Consolidate fundamental Algebra knowledge that enables the future study of other fundamental subjects of the degree, preparing students for subsequent academic and professional challenges.

Understand and apply the geometric interpretation of algebraic concepts, such as systems of equations, orthogonal projections, and isometries, focusing on the ability to analyze and address problems from a spatial and visual perspective that improves the student's understanding of the problem.

6. SUBJECT PROGRAM

CONTENTS

1	<p>BLOCK I</p> <p>TOPIC 1: MATRICES Types of matrices. Determinants and inverse matrix: Operations and Properties. Rank. Row operations and elementary matrices. Row echelon form. Gauss and Gauss-Jordan elimination methods.</p> <p>TOPIC 2: Systems of Linear Equations Matrix form. Classification of systems. Geometric interpretation. Equivalent systems. Solution methods. LU factorization.</p>
2	<p>BLOCK II</p> <p>TOPIC 3: VECTOR SPACES Definition of vector space and subspace. Implicit and parametric forms. Linear dependence and independence. Generating systems and bases. Coordinates. Change of basis. Operations with vector subspaces. Supplementary subspace.</p> <p>TOPIC 4: EUCLIDEAN SPACE Dot product. Norm and angle between vectors. Orthogonal and orthonormal bases. Orthogonal complement subspace. Orthogonal projection. Gram-Schmidt orthogonalization. Approximate solution of inconsistent systems by least squares.</p>
3	<p>BLOCK III</p> <p>TOPIC 5: LINEAR TRANSFORMATIONS Definition. Standard matrix. Kernel and image. Dimension theorem. Types of transformations. Composition of transformations. Inverse matrix. Matrix of a transformation in any bases.</p> <p>TOPIC 6: ENDOMORPHISMS AND DIAGONALIZATION Definition of eigenvalues and eigenvectors. Characteristic polynomial. Eigenspaces. Similar matrices. Diagonalization of endomorphisms.</p>

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Block I. This exam consists of theoretical-practical questions and MATLAB problem-solving exercises.	Others	No	Yes	25,00
Block II. This exam consists of theoretical-practical questions and MATLAB problem-solving exercises.	Others	No	Yes	35,00
Block II. This exam consists of theoretical-practical questions and MATLAB problem-solving exercises.	Others	Yes	Yes	30,00
For the assessment of this section, different tasks will be proposed throughout the semester (tests, written exercises, MATLAB exercises, etc.), without prior notice.	Others	No	No	10,00
TOTAL				100,00
Observations				
Students who have not passed the course after the ordinary session will have the opportunity to take the exams of the failed blocks in the extraordinary session.				
Observations for part-time students				
Part-time students will have the option to choose between completing the same assessment as full-time students or opting to only take the exams of the three blocks.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
Ruth Carballo Fidalgo. Lecciones de Álgebra y Geometría https://personales.unican.es/carballor/LeccionesAlgebrayGeometriaRuthCarballoFidalgoDpto_MACC_UC.pdf
Grossman, S.I., "Álgebra Lineal", Ed. MacGraw-Hill. https://catalogo.unican.es/cgi-bin/abnetopac?TITN=436173
Larson R., Edwards B.H., Falvo D.C. 2004. Álgebra Lineal Pirámide. ISBN: 84-368-1878-4. http://catalogo.unican.es.unican.idm.oclc.org/cgi-bin/abnetopac/?TITN=226698