

## SUBJECT TEACHING GUIDE

G1954 - Algebra and Geometry

Degree in Civil Engineering

First Degree in Civil Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Civil Engineering First Degree in Civil Engineering			Type and Year	Core. Year 1 Core. Year 1
Faculty	School of civil Engineering				
Discipline	BASIC MATHEMATICS FOR ENGINEERING				
Course unit title and code	G1954 - Algebra and Geometry				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Knowledge Field					
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION				
Name of lecturer	RODRIGO GARCIA MANZANAS				
E-mail	rodrigo.manzanas@unican.es				
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 4. DESPACHO (S4015)				
Other lecturers	RUTH CARBALLO FIDALGO				

#### 4. OBJECTIVES

- Interpret and communicate the studied concepts with mathematical rigor.
- Critically argue opinions based on abstract logical reasoning.
- Apply correctly the theoretical knowledge acquired to solve problems in the fields of Algebra and Geometry , both by hand and by means of computer tools.
- Consolidate the minimum knowledge of Algebra and Geometry that allows to face with guarantees the future study of other fundamental subjects of the degree.

## 6. SUBJECT PROGRAM

### CONTENTS

1	<p><b>BLOCK 1</b></p> <p>Lesson 1: Matrices</p> <ul style="list-style-type: none"> <li>- Operations with matrices and determinants</li> <li>- Inverse matrix and elementary matrices</li> <li>- Echelon reduced form of a matrix</li> <li>- Matrix factorization</li> </ul> <p>Lesson 2: Systems of linear equations</p> <ul style="list-style-type: none"> <li>- Matrix form of a system</li> <li>- Classification of systems</li> <li>- Resolution of systems by different methods</li> </ul> <p>Lesson 3: Vector spaces</p> <ul style="list-style-type: none"> <li>- Vectors</li> <li>- Vector space and subspace</li> <li>- Implicit and parametric forms</li> <li>- Intersection and sum</li> <li>- Linear dependence and independence</li> <li>- Basis and coordinates</li> <li>- Complementary subspace</li> </ul>
2	<p><b>BLOCK 2</b></p> <p>Lesson 4: Euclidean space</p> <ul style="list-style-type: none"> <li>- Scalar product</li> <li>- Distance and angle between vectors, lines and planes</li> <li>- Affine space and reference systems</li> <li>- Orthogonal subspace and orthogonal projections</li> <li>- Basis orthonormalization</li> <li>- Approximation of a transcendent function by a polynomial</li> <li>- Approximate solution of incompatible systems by least squares</li> <li>- Fit to a point cloud</li> </ul> <p>Lesson 5: Linear applications</p> <ul style="list-style-type: none"> <li>- Kernel and image</li> <li>- Classification of linear applications</li> <li>- Matrix of a linear application</li> <li>- Isometries: Reflections and rotations</li> <li>- Quadratic forms: Identification and classification</li> </ul> <p>Lesson 6: Diagonalization of endomorphisms</p> <ul style="list-style-type: none"> <li>- Eigenvalues and eigenvectors</li> <li>- Eigenspaces</li> <li>- Diagonalization process</li> <li>- Diagonalization of conics: The ellipse, the hyperbola and the parabola</li> </ul>

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
EX-B1: Midterm exam (BLOCK 1)	Written exam	No	Yes	35,00
EX-B2: Midterm exam (BLOCK 2)	Written exam	No	Yes	45,00
EC: Other evaluable evidence	Work	No	No	20,00
<b>TOTAL</b>				<b>100,00</b>
Observations				
<p>The final grade for the subject will be the result of averaging, weighted:</p> <ul style="list-style-type: none"> <li>• EX-B1, with a weight of 35%</li> <li>• EX-B2, with a weight of 45%</li> <li>• EC, with a weight of 20%</li> </ul> <p>Obtaining a minimum grade of 3.0 in both EX-B1 and EX-B2 is essential to pass. Otherwise, the subject will be considered failed (even if the weighted average of EX-B1, EX-B2, and EC is higher than 5.0, in which case a grade of 4.9 will be awarded).</p> <p>Note: In the extraordinary call, EX-B1 and EX-B2 can be recovered, but the grade obtained during the semester for the EC section will be kept.</p>				
Observations for part-time students				
<p>Part-time students who request it at the beginning of the semester will be evaluated based on a single exam, which will cover the entire syllabus and constitute 100% of the subject's grade. Those who do not pass the ordinary call can go to the extraordinary one.</p>				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
<p>- Apuntes proporcionados por los profesores</p> <p>- J. de Burgos Román; Álgebra Lineal y Geometría Cartesiana, Ed. McGraw-Hill, Interamericana: <a href="http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=166904">http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=166904</a></p> <p>- J. Arvesú y otros; Problemas Resueltos de Álgebra Lineal. Ed. Thomson: <a href="http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=228756">http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=228756</a></p> <p>- K. Donnelly; MATLAB manual: Computer Laboratory Exercises, Saunders College Publishing: <a href="http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=123290">http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=123290</a></p>