

SUBJECT TEACHING GUIDE

G1954 - Algebra and Geometry

Degree in Civil Engineering
First Degree in Civil Engineering

Academic year 2023-2024

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)		
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				
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Other lecturers	RUTH CARBALLO FIDALGO				

3.1 LEARNING OUTCOMES

- As a result of the follow-up of the subject, the students will be able to:

- Manage matrices and determinants properly.
- Solve systems of linear equations by various methods.
- Work with ease in vector spaces: implicit and parametric forms, basis and coordinates, linear independence/dependence, sum and intersection of subspaces, complementary subspace.
- Dominate the Euclidean space and the most important associated geometric concepts: calculation of distances, angles and areas, orthogonality, projections.
- Obtain different types of adjustment for a given point cloud .
- Solve (approximately) systems of incompatible equations by least squares.
- Manage the concept of linear application (kernel, image, associated matrix, etc.), with special emphasis on its use for the calculation of isometric transformations.
- Identify and classify quadratic forms.
- Identify the eigenspaces of an endomorphism and diagonalize its matrix whenever possible.
- Identify the characteristic elements of the conics, classify and canonize them.

For this, both analog means (notes, books, etc.) and adequate software for the numerical and/or graphic resolution of various elementary problems of Algebra and Geometry (MATLAB) will be used.

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. COURSE ORGANIZATION

CONTENTS

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

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Midterm exam (block 1)	Activity evaluation with Virtual Media	No	Yes	30,00
Midterm exam (block 2)	Activity evaluation with Virtual Media	No	Yes	40,00
Other evaluable evidence	Others	No	No	30,00
TOTAL				100,00
Observations				
<p>The final grade for the course results from a weighted average of the marks obtained in: The midterm exam covering block 1 (30%), the midterm exam covering block 2 (40%) and the 'other evaluable evidence' item (30%). However, to pass the subject (for which a minimum grade of 5 out of 10 will be required) it is mandatory to have obtained a minimum grade of 3 in both block 1 and block 2.</p> <p>Students who don't fulfill these conditions may go to the final exam in the ordinary call, in which each student will take the block (or blocks) that he/she considers necessary, thereby renouncing the mark that had been obtained in the corresponding midterm exam (or exams). In case that the grade for any of the two blocks is under 3 after the final exam in the ordinary call, the subject will be considered failed (even if the mark resulting from the weighted average of all evaluable items is above 5, in which case the final grade will be 4.9, according to UC's regulations).</p> <p>Students who have not passed the subject after the final exam in the ordinary call may go to the exam that will be held in the extraordinary call, for which the qualification obtained for the 'other evaluable evidence' item will be saved, but not that of blocks 1 and 2. This exam will cover the entire subject and will consist of a part with theoretical-practical questions and another part with problems to solve with MATLAB.</p>				
Observations for part-time students				
<p>For part-time students, the final grade will come determined exclusively by a final exam. In case the grade obtained in the ordinary call were below 5 (out of 10), they will have a second opportunity in the extraordinary call. In any of these cases, the exam will cover the entire subject and will constitute 100% of the final grade.</p>				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
<ul style="list-style-type: none"> - Apuntes proporcionados por los profesores - J. de Burgos Román; Álgebra Lineal y Geometría Cartesiana, Ed. McGraw-Hill, Interamericana: http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=166904 - J. Arvesú y otros; Problemas Resueltos de Álgebra Lineal. Ed. Thomson: http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=228756 - K. Donnelly; MATLAB manual: Computer Laboratory Exercises, Saunders College Publishing: http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=123290