

## SUBJECT TEACHING GUIDE

### G320 - ALGEBRA

#### Degree in Chemical Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Chemical 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	G320 - ALGEBRA				
Number of ECTS credits allocated	6	Term	Semester based (2)		
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					

### 3.1 LEARNING OUTCOMES

- At the end of the course the student will be able to:

- Manage matrices and determinants properly.
- Solve systems of linear equations by various methods.
- Dominate the concepts of vector space and Euclidean vector space.
- Manipulate linear applications skillfully.
- Diagonalize an endomorphism, when possible.

For this, both analogue (notes, books, etc.) and digital (MATLAB) means 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 field of Algebra , both by hand and by means of computer tools.
- Consolidate the minimum knowledge of Algebra that allows to face with guarantees the future study of other fundamental subjects of the degree.

## 6. COURSE ORGANIZATION

### 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>- Vector space and subspace</li> <li>- Implicit and parametric forms</li> <li>- Intersection and sum of subspaces</li> <li>- Linear dependence and independence</li> <li>- Bases and coordinates</li> <li>- Complement 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</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>- Basic isometries</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</li> </ul>

## 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
Final exam	Activity evaluation with Virtual Media	Yes	Yes	0,00
<b>TOTAL</b>				<b>100,00</b>
<b>Observations</b>				
<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 whose final grade is less than 5 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).</p> <p>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 these situations, the final grade will be that of the block with the lowest qualification.</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>				
<b>Observations for part-time students</b>				
<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

- Apuntes proporcionados por los profesores
- J. de Burgos Román; Álgebra Lineal, Ed. McGraw-Hill: <http://catalogo.unican.es/cgi-bin/abnetopac/?TITN=102714>
- 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>