

SUBJECT TEACHING GUIDE

G423 - Algebra and Geometry

Degree in Mechanical Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Mechanical 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	G423 - Algebra and Geometry				
Number of ECTS credits allocated	6	Term	Semester based (2)		
Web	https://personales.unican.es/carballor/				
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	RUTH CARBALLO FIDALGO				
E-mail	ruth.carballo@unican.es				
Office	E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 1. DESPACHO PROFESORES (1045)				
Other lecturers	VALVANUZ FERNÁNDEZ QUIRUELAS EMMA MERINO CUE				

3.1 LEARNING OUTCOMES
- The students have to show that they know and understand the subject under an area of study starting from the general approach at high-school, advanced on the basis of textbooks at the appropriate level and addind to this up-to-date results on the subject.
- Solve, by means of Mathematics, different types of practical problems.
- Get the required level of Linear Algebra and Geometry to use its knowledge as a tool for the study of other key subjects of the degree.

4. OBJECTIVES

Reach a good command on the properties and the work with matrices and determinants.
 Solve linear systems of equations with various methods.
 Operate with vectors, basis, subspaces and coordinates.
 Operate with linear transformations.
 Operate with eigenvalues, eigen subspaces and diagonalization when possible.
 Operate with orthogonal decomposition and interpretation of various geometric transformations in 2D and 3D domain.
 Operate with basic affine transformations.
 Use MATLAB at a level that is high enough to enable the resolution of the problems covered by the course .

6. SUBJECT PROGRAM

CONTENTS

1	Vectors and matrix operations. Systems of linear equations. Introduction to linear transformations.
2	Determinants
3	Vector spaces. Subspaces. Change of basis. Addition of subspaces.
4	Linear transformations. Change of basis. Geometric transformations.
5	Eigenvalues and eigenvectors. Diagonalization. Geometric Transformations.
6	Basic geometry of vectors, lines and planes in the ordinary 2D and 3D space. Inner product: distances and angles. Cross product.
7	Euclidean space R^n . Orthogonality . Orthogonal decomposition and orthogonal projection. Least-square solution of a liner system of equations. Orthogonal diagonalization of symmetric matrices.
8	Some examples of affine transformations.

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
35%. March-April. Comprise the first half of the course. a) exam including theory and exercises. b) exam consisting on the resolution of exercises using MATLAB. The mark is the average of a and b with weights of 60 and 40 per cent respectively.	Written exam	No	Yes	35,00
Weight: 55%. May-June. Comprise all the course. a) exam including theory and exercises. b) exam consisting on the resolution of exercises using MATLAB. The mark is the average of a and b with weights of 60 and 40 per cent respectively.	Written exam	Yes	Yes	55,00
Weight: 10%. Date: any time during the term. Continuous assessment through exercises proposed in class to be handed in at the end of the class. The dates can be previously announced or not (always announced if the exercise is to be solved with MATLAB).	Others	No	Yes	10,00
TOTAL				100,00
Observations				
<p>The marks, from 0 to 10, are splitted as follows: EP (partial exam), EF (final exam) and S (continuous assessment). The grade, C, of the 'Convocatoria Ordinaria' is obtained with the rule: If $EF \geq 3.0$ then $C = \max(EF, 0.55*EF + 0.35*EP + 0.10*S)$. Else if $(0.55*EF + 0.35*EP + 0.10*S) \geq 4.9$ then $C=4.9$. Else $C = \max(EF, 0.55*EF + 0.35*EP + 0.10*S)$. The course is passed if $C \geq 5$. The students that did not pass can retake the exam EE, with a duration of 3.5 hours. There are two options: a) EE is an exam of the same type as EF, and the grade C of the 'Convocatoria extraordinaria' is obtained using the same rule as above, changing EF to EE. b) Take an exam EE with 50% of the mark for each half of the course, and have then $C=EE$. For both options EE comprises a part without MATLAB with 60% weight and a part with MATLAB with 40% weight. The course is passed if $C \geq 5$.</p>				
Observations for part-time students				
Same as for the rest of the students				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Temario teórico-práctico desarrollado por Ruth Carballo Fidalgo, en la página web de la asignatura.

En la BUC:

Hernández, E.; Vázquez Gallo, M.J.; Zurro Moro, M.J. Álgebra y Geometría. 3ª edición. Pearson Educación. 2012. ISBN 9788478291298 en papel. ISBN 9788415552147 libro electrónico.

Lay, D.C.; Lay, S.R.; McDonald J.J. Algebra lineal y sus aplicaciones. 5ª ed. Pearson Educación de México, 2016. ISBN 9786073237451 en papel.

Lay, D.C.; Lay, S.R.; McDonald J.J. Linear algebra and its applications. 5ª ed. Global edition. Pearson. 2016. ISBN 9781292092249 libro electrónico

Leon, S.J. Linear Algebra with Applications. 9ª edición. Pearson. 2015. ISBN 9781292070605 libro electrónico.

Leon, S.J.; de Pillis, L.G. Linear algebra: with applications. 10ª ed. Pearson Education, 2021. ISBN 9781292354866 en papel.