1. OVERVIEW

Subject area	Linear Algebra
Degree	Bachelor's Degree in Data Science
School/Faculty	Faculty of Science, Engineering and Design
Year	First
ECTS	6 ECTS
Type	Core
Language(s)	Spanish
Delivery Mode	On campus
Semester	2

2. INTRODUCTION

Linear algebra is one of the basic disciplines of mathematics. Its methods have been widely used in geometry and analysis. In fact, many applications of linear algebra show the relationship between abstract concepts and real-life problems. It has direct relevance in the field of data science (matrix calculus), while also serving as a strong base for other more specific fields of study.

In this subject, students will learn aspects related to calculus with matrices and determinants, systems of linear equations, diagonalisation, vector spaces, conic sections and quadratics, as well as an introduction to complex numbers.

This subject therefore provides a suitably profound and solid mathematical base offering both analytical and graphical analysis skills which can be applied in further areas of study.

3. SKILLS AND LEARNING OUTCOMES

Basic skills (CB, by the acronym in Spanish):

- CB1: Students have shown their knowledge and understanding of a study area originating from general secondary school education, and are usually at the level where, with the support of more advanced textbooks, they may also demonstrate awareness of the latest developments in their field of study.

- CB4: Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences

Cross-curricular skills (CT, by the acronym in Spanish):

- CT02: Independent learning: skills for choosing strategies to search, analyse, evaluate and manage information from different sources, as well as to independently learn and put into practice what has been learnt.

- CT03. Teamwork: ability to integrate and collaborate actively with other people, areas and/or organisations to reach common goals.

- CT04. Written/spoken communication: ability to communicate and gather information, ideas, opinions and viewpoints to understand and be able to act, spoken through words or gestures or written through words and/or graphic elements.

- CT05. Analysis and problem-solving: be able to critically assess information, break down complex situations, identify patterns and consider different alternatives, approaches and perspectives in order to find the best solutions and effective negotiations.

- CT06. Adapting to change: be able to accept, consider and integrate different perspectives, adapting your own approach as required by the situation at hand, and to work effectively in ambiguous situations.

Specific skills (CE, by the acronym in Spanish):

- CE1. Ability to solve mathematical problems which may arise in data engineering and science by applying linear algebra, geometry, differential and integral calculus, discrete mathematics and optimisation.

Learning outcomes (RA, by the acronym in Spanish):

- RA1: Successfully solve maths problems which may arise in data engineering and science projects, whether they involve algebra, calculus, statistics or optimisation.

- RA2: Use and apply computer statistical analysis, numerical and symbolic calculus, graphic visualisation, optimisation and others, in order to experiment in mathematics and solve problems.

The following table shows how the skills developed in the subject area match up with the intended learning outcomes:

Skills	Learning outcomes
CB1, CB4, CT02, CT03, CT04, CT05, CT06, CE1	RA1: Successfully solve maths problems which may arise in data engineering and science projects, whether they involve algebra, calculus, statistics or optimisation.
CB1, CB4, CT02, CT03, CT04, CT05, CT06, CE1	RA2: Use and apply computer statistical analysis, numerical and symbolic calculus, graphic visualisation, optimisation and others, in order to experiment in mathematics and solve problems

4. CONTENT (minimum)

1. Calculus with matrices and determinants.
2. Systems of linear equations.
3. Geometry: cones and quadratics.
4. Vector spaces and linear applications.
5. Diagonalisation.
6. Introduction to complex numbers.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Collaborative learning: students learn to work with other people (colleagues and professors) to find creative, comprehensive and constructive solutions to questions and problems that arise from the given case studies, using relevant knowledge and available resources in relation to each subject.

- Problem-based learning: students face problems they must solve either working as a team or individually.

- Master Lecture: presentations by the professor using the appropriate technological tools to facilitate understanding of the subject matter.

- Gamification: students learn through game-based activities.

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus/online:

Learning activity	Number of hours
Master lectures	30
Problem solving and case studies	22
Practical seminars and debates/discussions	21
Learning contract (definition of interests, needs and objectives)	1
Autonomous learning	68
Tutorials	8
TOTAL	**150**

7. ASSESSMENT

The assessment methods, plus their weighting in the final grade for the subject area, are as follows:

On campus/online:

Assessment system	Weighting
On campus tests to evaluate objectives of theory/practical learning (exam-type objective tests, written compositions, spoken presentations, case studies/problem solving, debates, simulation tests)	65%
Off-site tests to assess theory/practical learning (case studies/problem solving)	25%
Attitude assessment tests (attitude assessment rules, class participation)	5%
Self- and co-assessment (learning contract, learning outcomes)	5%

On the Virtual Campus, when you open the subject area, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

PLAGIARISM RULES

In accordance with the Disciplinary Regulations for Universidad Europea students:

• Plagiarism of all or part of any kind of intellectual work is considered to be a very serious offence.

• If any student commits the very serious offence of plagiarism or cheating to pass an assessment test, they will be disqualified from the corresponding exam, and their absence and the reason for this absence will be filed in their academic record.

8. BIBLIOGRAPHY

The reference publication to accompany this subject area is:

- L.M. Merino González, E. Santos Aláez. Álgebra Lineal con métodos elementales (2021). Ed. Paraninfo.

The recommended bibliography is indicated below:

- R. Courant. Introducción al Cálculo y al Álgebra Lineal (2015), Vol 1. Ed. Limusa.
- J.I. Barragues Fuentes. Álgebra Lineal (2010). Ed. Pearson
- T.M. Apóstol. Álgebra Lineal (1976). Ed. Reverte