1. OVERVIEW

Subject area	Linear Algebra
Degree	Bachelor's Degree in Industrial Organisation Engineering
School/Faculty	Faculty of Science, Engineering and Design
Year	First
ECTS	6 CTS
Type	Compulsory
Language(s)	Spanish
Delivery Mode	On campus and Online
Semester	Second semester

2. INTRODUCTION

Linear Algebra is one of the compulsory subjects in the Degree in Industrial Organisation Engineering syllabus at the Universidad Europea de Valencia.

This subject forms part of the basic scientific learning all students must acquire in the Degree in Industrial Organisational Engineering and serves as a base for knowledge in any scientific discipline. For this reason, it is studied in the first year. It is one of the basic pillars which supports more specific subjects seen further on in the degree programme.

Students learn both core and specific mathematical skills needed for experimental science.

3. SKILLS AND LEARNING OUTCOMES

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

- CB01. 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.
- CB04. Students can apply their knowledge to their work or vocation in a professional manner and possess the skills which are usually evident through the forming and defending of opinions and resolving problems within their study area.

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):

- CE01. Ability to solve mathematical problems which may arise in engineering by applying core knowledge of linear algebra, geometry, differential and integral calculus, differential equations and partial derivatives, statistics and optimisation.

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

- On passing the course students will be able to suitably solve mathematical problems encountered in engineering projects, whether they involve algebra, calculus, statistics or optimisation.

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

Skills	Learning outcomes (RA, by the acronym in Spanish)
CB01, CB04, CT02, CT03, CT04, CT05, CT06, CE01	On passing the course students will be able to suitably solve mathematical problems encountered in engineering projects, whether they involve algebra, calculus, statistics or optimisation.

4. CONTENTS

The subject area is divided into four learning units, which are then divided into topics (the number of topics depends on the unit):

Calculus with matrices and determinants.

- Matrices. Properties.
- Types of matrices. Equivalent and similar.
- Range of matrices. Matrix inverses. Determinants.

Systems of linear equations

- Introduction.
- Rouché's theorem. Cramer's Rule for solving systems.
- Gaussian elimination for solving systems. Practical application for finding the inverse of a matrix.

Geometry: cones and quadratics.

- Introduction.
- Cones. Types.

- Quadratics. Types.

Vector spaces and linear applications Diagonalisation

- Vector spaces.
- Vector subspaces. Operations with subspaces.
- Dimension. Systems generators. Linear dependence and independence.
- Bases - coordinates of a vector in a basis, change of basis and dimension.
- Scalar product - rule and distance. Orthogonality. Vector product.
- Diagonalisation.

Introduction to complex numbers

- Complex numbers.
- Properties and operations.

Maths laboratory

- Using 'Maxima' software.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Master lecture / Web conference
- Problem-based learning (PBL)
- Project-based learning
- Collaborative learning
- Learning based on laboratory work (laboratory, workshop and simulation environments)
- Case study
- Gamification
- Field work

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 and practical seminars	30
Problem solving	22
Case studies	11
Online forum (debates and discussions)	8
Learning contract (definition of interests, needs and objectives)	2
Study of course content and additional material (self-study)	67
Online tutorials	8
Knowledge tests	2

TOTAL	150 h

7. ASSESSMENT

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

On campus:

Assessment system	Weighting
On Campus tests to evaluate objectives of theory/practical learning (exam-type objective tests, written compositions, oral presentations, case studies/problem solving, debates, simulation tests)	50%
Off-site tests to assess theory/practical learning (case studies/problem solving)	30%
Attitude assessment tests (attitude assessment rubrics, class participation)	10%
Self- and co-assessment (learning objectives).	10%

Online:

Assessment system	Weighting
On Campus tests to evaluate objectives of theory/practical learning (exam-type objective tests, written compositions, oral presentations, case studies/problem solving, debates, simulation tests)	60%
Off-site tests to assess theory/practical learning (case studies/problem solving)	25%
Attitude assessment tests (attitude assessment rubrics, class participation)	10%
Self- and co-assessment (learning objectives).	5%

8. BIBLIOGRAPHY

The recommended bibliography is indicated below:

- Álgebra lineal y sus aplicaciones / David C. Lay ; traducción Hugo A. Rincón Mejía ; revisión técnica Antonio Peláez López , Javier Alfaro Pastor. Disponible en la biblioteca de la UEV
- Manual de álgebra lineal / Francisco Muñoz ... [et al.]. Disponible en la biblioteca de la UEV
- W.S.I. Grossman. Algebra Lineal con Aplicaciones. McGraw-Hill
- J. Stewart: Cálculo : conceptos y contextos, Tercera Edición, Cengeage Learning Ed. 2006