1. BASIC INFORMATION

Course	Algebra
Degree Program	Bachelor's Degree in Mechanical Engineering
School	School of Architecture, Engineering, Science and Computing
Year	First year
ECTS	6
Credit type	Basic
Languages/s	English
Mode	On-Campus
Semester	First semester
Academic year	2025-2026
Coordinating professor	Niurka Barrios Bermúdez
Professors	Janaina Cejudo Sanches

2. PRESENTATION

'Algebra' is one of the basic first-year subjects, worth 6 ECTS, of the University Degree in Industrial Systems Engineering. It belongs to the Mathematic module made up of the following subjects:

- Algebra.
- Calculus I.
- Calculus II.
- Statistics for engineering

Algebra provides basic knowledge and tools that are necessary for a large part of Degree subjects. It develops Mathematic attitudes, such as a critical point of view, the need for verification or the assessment of precision. It will allow us to study the theoretical and practical concepts of Linear Algebra, which will be essential in later subjects that require the use of matrices and algebraic transformations. In addition, we will encourage to reason and to apply the mathematical methodology in multiple aspects of professional training.

3. LEARNING OUTCOMES

Skills

SK1: Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial differential equations; numerical methods; numerical algorithmics; Statistics and optimization.

Subject-Specific Skills:
• Solve operations using complex numbers
• Use the basic principles of matrix algebra
• Solving systems of linear equations
• Relating the principles of linear algebra to matrix algebra: vector spaces, linear applications
• Apply the techniques of linear algebra to geometric and physical problems related to engineering
• Handle different coordinate systems (bases), expressing linear transformations with respect to them.

Competences

CP14: Integrate analysis with critical thinking in a process of evaluating different ideas or professional possibilities and their potential for error, based on evidence and objective data that lead to effective and valid decision-making.

4. CONTENT

- Introduction to Complex Numbers
- Matrices, determinants, systems of linear equations
- Diagonalization
- Vector spaces. Linear Applications
- Geometry
- Introduction to Differential Equations

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Master class
- Problem based learning

6. LEARNING ACTIVITIES

Next, the types of training activities that will be carried out and the student's dedication in hours to each of them, both inside and outside of class, are identified. The course policy on the use of artificial intelligence (AI) in each activity is also indicated.

Campus-based mode:

Learning activity	Total time	In-class Time	Use of AI
Master classes	10 hours	10 hours (100%)	Permitted
Practical seminars	20 hours	20 hours (100%)	Not permitted
Problem solving	50 hours	20 hours (40%)	Not permitted
Autonomous study	60 hours	0 hours (0%)	Permitted
Debates and panel discussions	5 hours	5 hours (100%)	Permitted
Face-to-face assessment test	5 hours	5 hours (100%)	Not permitted
TOTAL	**150 hours**	**60 hours (40%)**	**60 hours**

More details on the policy for the use of AI through the virtual campus platform will be published once the course has started.

7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

Campus-based mode:

Assessment system	Weight min. %	Weight max.%
Face-to-face assessment test	50	70
Case/problem	20	50
Performance evaluation	5	5

When you access the course on the *Canvas,* you'll find a description of the assessment activities you have to complete, as well as the delivery deadline and assessment procedure for each one.

7.1. Ordinary exams period

Assessment system	Weigth %	Mandatory to pass
Individual working sessions (Units 2,3,4,5 and 6)	30%	No
Group Project	20%	No
Intermediate Exam of Units 1, 2, 3 and 4 (non-eliminatory)	10%	No
Integrative Final Exam (Includes the entire syllabus)	40%	YES

To pass the course in the first exam period, you must obtain:

- A score of 5,0 out of 10 or greater in the final test.
- An average final score (according to the previous table) equal or greater than 5,0 out of 10.
- 50% attendance.

When the minimum required to carry out the weighted average of the evaluable activities is not met (the minimum is not reached in the 2 first previous points), the final grade will be:

- the weighted average if its value is less than or equal to 4,0
- 4,0 if the value of the weighted mean is greater than 4,0
- If the attendance requirement is not met, the student will can only pass in the extraordinary period

The grade in the first exam period will be considered as **NP** (Not Presented) when the student has not delivered any evaluable activity of those that are part of the weighted average.

7.2. Extraordinary exams period

To pass the course in the second exam period, you must obtain:

- A score of 5,0 out of 10 or greater in the final test.
- An average final score (according to the previous table) equal or greater than 5,0 out of 10

When the minimum required to carry out the weighted average of the evaluable activities is not met (the minimum is not reached in any of the previous points), the final grade will be:

- the weighted mean if its value is less than or equal to 4,0
- 4,0 if the value of the weighted mean is greater than 4,0

The grade in the second exam period will be considered as **NP** (Not Presented) when the student has not delivered any new evaluable activity in relation to the previous ordinary period.

Students must compensate all the evaluable assignments they did not successfully passed in the ordinary session or all the necessary ones to achieve a weighted average over 5,0 out of 10.

8. SCHEDULE

The subject is organized in units of contents, each of which will require in-depth study of the topics listed in **section 4**. The number of activities to be carried out and/or their weeks of completion are approximate, and may be modified based on the teaching development of the subject. Such changes will be notified to the student in a timely manner through the Virtual Campus.

Week	Unit	Deliverables and/or assessment tests
1	1	Initial knowledge test/Presentation of the project Unit 1
2	2, 3	
3		
4		
5	4	Individual/collaborative activity 1
6		
7		
8		
9	5	Individual/collaborative activity 2
10		**Midterm exam**
11		
12		Delivery of Project Report Unit 1
13		Presentation Project Unit 1
14	6	Individual/collaborative activity 3
15		
16		
17		Individual/collaborative activity 4
18	All	**Final exam**

This schedule may be subject to changes for logistical reasons relating to the activities. The student will be notified of any change as and when appropriate.

9. BIBLIOGRAPHY

The main reference work for this subject is:

- LAY D. C., *Linear Algebra and its Applications*. Addison Wesley, 2006.
- C. ALSINA, E. TRILLAS. *Lecciones de Algebra y Geometría*. Barcelona, Gustavo Gil, 1984.
- P. SANZ, F.J. VÁZQUEZ, P. ORTEGA. *Álgebra Lineal*. Prentice Hall, 2002.
- L. MERINO, E. SANTOS. *Álgebra Lineal con Métodos Elementales*. Ed. Paraninfo 2016.
- STRANG G., *Linear Algebra and its Applications*. Cengage Learning, 4th Edition, 2005.

10. EDUCATIONAL GUIDANCE, DIVERSITY AND INCLUSION UNIT

From the Educational Guidance, Diversity and Inclusion Unit we offer support to our students throughout their university life to help them reach their academic achievements. Other main actions are the students inclusions with specific educational needs, universal accessibility on the different campuses of the university and equal opportunities.

From this unit we offer to our students:

1. Accompaniment and follow-up by means of counselling and personalized plans for students who need to improve their academic performance.
2. In terms of attention to diversity, non-significant curricular adjustments are made in terms of methodology and assessment for those students with specific educational needs, pursuing an equal opportunities for all students.
3. We offer students different extracurricular resources to develop different competences that will encourage their personal and professional development.
4. Vocational guidance through the provision of tools and counselling to students with vocational doubts or who believe they have made a mistake in their choice of degree.

Students in need of educational support can write to us at: orientacioneducativa@universidadeuropea.es

11. ONLINE SURVEYS

Your opinion matters!

The Universidad Europea encourages you to participate in several surveys which help identify the strengths and areas we need to improve regarding professors, degree programs and the teaching-learning process.

The surveys will be made available in the “surveys” section in virtual campus or via e-mail.

Your assessment is necessary for us to improve.

Thank you very much for your participation.