# Linear Algebra

**Academic Year: ( 2019 / 2020 )** **Review date: 25-11-2019**

**Department assigned to the subject: Mathematics Department**

**Coordinating teacher: VICENTE MAJUA, JULIO IÑIGO DE**

**Type: Basic Core ECTS Credits : 6.0**

**Year : 1 Semester : 1**

**Branch of knowledge: Engineering and Architecture**

## OBJECTIVES

By the end of this content area, students will be able to have:

1. Knowledge and understanding of the mathematical principles of linear algebra underlying Industrial Electronics and Automation Engineering;
2. The ability to apply their knowledge and understanding to identify, formulate and solve mathematical problems of linear algebra using established methods;
3. The ability to select and use appropriate tools and methods to solve mathematical problems using linear algebra;
4. The ability to combine theory and practice to solve mathematical problems of linear algebra.

## DESCRIPTION OF CONTENTS: PROGRAMME

Lecture 0. Introduction to Complex Numbers.
0.1. Definition. Sum and Product.
0.2. Conjugate, Modulus and Argument.
0.3. Complex Exponential.
0.4. Powers and Roots of Complex Numbers.

Lecture 1. Systems of Linear Equations.
1.1. Introduction to Systems of Linear Equations.
1.2. Row Reduction and Echelon Forms.
1.3. Vector Equations.
1.4. The Matrix Equation Ax=b.
1.5. Solution Sets of Linear Systems.

Lecture 2. Matrix Algebra.
2.1. Matrix Operations.
2.2. The Inverse of a Matrix.
2.3. Block-Partitioned Matrices.
2.4. Determinants.

Lecture 3. Vector Spaces.
3.1. Vector Spaces and Subspaces.
3.2. Linearly Independent Sets and Bases.
3.3. Coordinate Systems and Dimension.
3.4. Linear Transformations

Lecture 4. Eigenvalues and Eigenvectors.
4.1. Introduction to Eigenvalues and Eigenvectors.
4.2. The Characteristic Equation.
4.3. Diagonalization of Square Matrices.

Lecture 5. Orthogonality and Least Squares.
5.1. Inner Product, Norm, and Orthogonality.
5.2. Orthogonal Sets.
5.3. Orthogonal Projections.
5.4. The Gram-Schmidt Method.
5.5. Least-Squares Problems.

Lecture 6. Symmetric Matrices.
6.1. Diagonalization of Symmetric Matrices.

## LEARNING ACTIVITIES AND METHODOLOGY

The teaching methodology will include:
- Theory classes in large groups, where basic theoretical knowledge and skills will be presented. To facilitate their development, a textbook (Linear Algebra and its Applications, by David C. Lay, 4th edition) will be followed closely. The chronogram of the course will be available to the students, allowing them to prepare the classes in advance.
- Solving exercises by the student, which will serve as self-assessment and to acquire the necessary skills.
- Problem solving classes in small groups, where exercises proposed to students will be explained and discussed.
- Using the electronic resources that the teacher will make available to students in the Aula Global platform.
- Tutorial sessions, individual and voluntary, in which students will have the possibility to consult the teacher their doubts and questions on the subject. The time and place of these sessions will be set by the teacher at the beginning of the course.

## ASSESSMENT SYSTEM

- Continuous evaluation: It will be carried out through partial exams, which will test the acquisition by the student of the basic concepts and skills of the subject. Its percentage in the final grade will be 40%. At the beginning of the course, the teacher will inform the students about the number of exams to be performed, as well as their exact dates and contents.

- Final exam: It will test the global knowledge and understanding of the subject by the student. Its percentage in the final grade will be 60%.

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| **% end-of-term-examination:** | 60 |
| **% of continuous assessment (assigments, laboratory, practicals…):** | 40 |

## BASIC BIBLIOGRAPHY

- David C. Lay  Linear Algebra and its Applications, 4th Edition, Prentice-Hall, 2012

## ADDITIONAL BIBLIOGRAPHY

- B. Noble and J. W. Daniel Applied linear algebra, 3rd ed, Prentice-Hall, 1988
- D. Poole Linear algebra : a modern introduction, 4th ed, Cengage Learning, 2015
- G. Strang Linear algebra and its applications, 4th ed, Cengage Learning, 2006