Course guide
320092 - AL - Algebra

Last modified: 11/07/2024

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: JULIAN PFEIFLE

Others: LYDIA CADEVALL

PRIOR SKILLS

Contents of math matters of high school, specially linear equations systems and matricial operations.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE01-ESAUD. Ability to solve mathematical problems that may arise in engineering. Aptitude to apply knowledge of linear algebra, geometry, differential and integral calculus, differential and partial differential equations, numerical methods, numerical algorithms, statistics, and optimization. (Basic training module)

Transversal:
CT06 N1. Self-directed learning - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Basic:
CB1. That students have demonstrated possession and understanding of knowledge in a field of study that is based on general secondary education, and is typically found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

TEACHING METHODOLOGY

- Sessions of exposure and work of the contents.
- Sessions of exercices resolution and practical work.
- Autonomous work of study and realization of exercises.
- Preparation and realization of evaluable activities individually and/or in group.
- Exercices resolution manually and computer aided

LEARNING OBJECTIVES OF THE SUBJECT

To know and to understand the concepts and results of linear algebra and Boolean algebra of the course program.
Application of basic methods of analytical calculation and computer tools to solve exercises and problems.
To know some cases of use of the course contents to model engineering problems.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours medium group	30,0	20.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

Complex numbers

Description:
1. Binomical amd polar forms. Graphic representation
2. Operations. Roots. Conjugation
3. Euler's formula

Specific objectives:
- Know the concept of complex number, its different forms and graphical representation
- Knowing how to do the basic operations
- Know and know how to use Euler's formula

Full-or-part-time: 25h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

Set theory and propositional logic

Description:
1. Sets and propositions. Axioms and properties
2. Set operations. Venn diagrams
3. Connectors. Truth tables

Specific objectives:
- Use the language of propositional logic to describe mathematical problems.
- Perform set operations and simply them using Venn diagrams and algebraic laws.
- Use propositional truth tables.
- Recognise the common structure of set algebra and propositional algebra.

Related activities:

Full-or-part-time: 25h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

Binary Boolena Algebra

Description:
1. Definition and properties
2. Circuits and logic gates
3. Boolean functions. Canonical forms
4. Simplification. Karnaugh method

Specific objectives:
- Understand the general structure of Boolean algebra and the specific structure of binary Boolean algebra.
- Use the properties of Boolean functions to modify their expression, construct the corresponding value table and calculate the min-max canonical forms.
- Use the Karnaugh map method to simply Boolean expressions.
- Understand the functions of different logic gates.

Related activities:

Full-or-part-time: 25h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

Matrix calculus

Description:
1. Matrices. Operations Range: Gauss method. Determinants
2. Systems of linear equations: Gauss and Gauss-Jordan methods. Indeterminate Compatible Systems: General Solution.

Specific objectives:
Work with matrices, determinants and systems of linear equations

Full-or-part-time: 25h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

Vector sapces

Description:
1. The concept of space and subspace. Generated space.
2. Linear independence. Bases and dimension.
3. Change of basis.
4. Dot product. Orthogonal projection.

Specific objectives:
- Understand the specific concepts and techniques applicable to vector spaces, in particular Rn spaces: vector subspaces, set of generators of a subspace, linear dependence and independence, bases.
- Understand the change of basis technique.

Related activities:

Full-or-part-time: 25h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

Linear transformations and diagonalization. Diagonalisation

Description:
1. Concept and properties of linear application
2. Matrix characterizations
3. Core. Range theorem
4. Values and eigenvectors. Diagonalization
5. Orthogonal projection. Orthogonal transformations

Specific objectives:
- Know the concept of linear transformation. Know how to calculate its core.
- Know and know how to work with the various matrix representations.
- Know the concept of orthogonal transformation and its matrices
- Know how to calculate the values and eigenvectors of a matrix, and use the diagonalization technique.

Related activities:

Full-or-part-time: 25h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

ACTIVITIES

Theoretical classes

Description:
33 / 5.000
Presentation of concepts and examples

Material:
Slides

Full-or-part-time: 69h
Self study: 45h
Theory classes: 24h

Practical classes

Description:
Solving problems manually, individually and in groups. Teacher's guide and independent realization.

Specific objectives:
To solve problems

Material:
Problems lisst

Related competencies :
CE01-ESAUD. Ability to solve mathematical problems that may arise in engineering. Aptitude to apply knowledge of linear algebra, geometry, differential and integral calculus, differential and partial differential equations, numerical methods, numerical algorithms, statistics, and optimization. (Basic training module)
CT06 N1. Self-directed learning - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 75h
Self study: 45h
Practical classes: 30h

Exams

Description:
Face-to-face individual exams

Specific objectives:

Material:

Delivery:

Related competencies :
CE01-ESAUD. Ability to solve mathematical problems that may arise in engineering. Aptitude to apply knowledge of linear algebra, geometry, differential and integral calculus, differential and partial differential equations, numerical methods, numerical algorithms, statistics, and optimization. (Basic training module)
CT06 N1. Self-directed learning - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 6h
Theory classes: 6h

GRADING SYSTEM

- First Control: 20%
- First Partial Exam: 30%
- Second Control: 20%
- Second Partial Exam: 30%

Retake: If the First Partial Exam is suspended but the Second Partial Exam is passed, the grade of the first Partial Exam will become a 5.

Reassessment:
- An overall grade between 2 and 5 is required.
- If the grade of the Reevaluation is equal to or higher than 5, the final grade will be a 5; and if it is less than 5 it will replace the initial only if it is greater.

BIBLIOGRAPHY

Basic:
- Anton, H. Introducción al álgebra lineal. Limusa, 2003.
- Grimaldi, R. Matemáticas discreta y combinatoria: una introducción con aplicaciones. Addison-Wesley Iberoamericana, 1997.
- Arvesú, J.; Marcellán, F.; Sánchez, J. Problemas resueltos de álgebra lineal. Madrid: Paraninfo, 2015. ISBN 9788428335263.
- Lipschutz, Seymour. Álgebra lineal. 2ª ed. Madrid: McGraw-Hill, 1992.

Complementary:
- Grossman, Stanley I.; Flores Godoy, J. Álgebra lineal [on line]. 8a ed. México D. F. [etc.]: McGraw-Hill, 2019 [Consultation: 10/06/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5808932. ISBN 1456271857.
- Hernández Rodríguez, E.; Vàzquez Gallo, M. J.; Zurro Moro, M. A. Álgebra lineal y geometría [on line]. 3a ed. Madrid: Pearson, 2012 [Consultation: 10/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1210. ISBN 9788478291298.
- Rojo, Jesús; Martin, Isabel. Ejercicios y problemas de álgebra lineal. Madrid: McGraw-Hill, 1994.
- Johnsonbaugh, R. Matemáticas discretas [on line]. Prentice Hall, 2005 [Consultation: 20/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4677.
- Veerarajan, T. Matemáticas discretas con teoría de gráficas y combinatoria. McGraw-Hill, 2008.

RESOURCES

Other resources:
Theory presentations
Lists of exercises
Scripts for practices with the computer software
Atenea questionnaires