UAB
Universitat Autònoma de Barcelona

Algebra I

Code: 100143
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500097 Physics	FB	1

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Although this subject has no special prerequisites, it is recommended to have a clear understanding of the contents of mathematics in high school.

Objectives and Contextualisation

This subject is the first part of a set of two subjects dedicated to aspects of Algebra of the Degree in Physics. The main objective of the subject is to provide the student with algebraic tools (they will be consolidated in the second part) necessary to understand the rest of the subjects of the degree. Another objective, no less important than the previous one, is to train the student in deductive thinking, so that later he is able to learn to use other mathematical tools not explicitly learned in the degree.

Competences

- Develop strategies for analysis, synthesis and communication that allow the concepts of physics to be transmitted in educational and dissemination-based contexts
- Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
- Use mathematics to describe the physical world, selecting appropriate tools, building appropriate models, interpreting and comparing results critically with experimentation and observation

Learning Outcomes

1. Analyse and solve systems of linear equations.
2. Argue with logical rigor.
3. Calculate and use determinants.
4. Carry out with ease the introduction of coordinates through the use of vector space bases.
5. Express definitions and theorems rigorously.
6. Identify the structures of the group, ring, body and space vector.
7. Transmit orally and in writing, in a clear manner, the logical-mathematical reasoning that leads to problem resolution.
8. Use basic techniques for the factoring and calculation of polynomial roots.
9. Use complex numbers with ease.
10. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
11. Use linear applications and express these via matrices.
12. Use the basic language of set theory.
13. Use the basic techniques of scaling matrices with ease.

Content

1. Algebraic structures.
1.1 Sets.
1.2 Groups.
1.3 Complex numbers and polynomials.
2. Linear algebra.
2.1 Matrices. Determinants.
2.2 Vector spaces.
2.3 Linear maps.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problem class	21	0.84	10
Theory lessons	29	1.16	2, 5, 10
Type: Autonomous			
Problem handouts	20	0.8	7, 10
Problem solving	50	2	1, 3, 4, 5, 6, 8, 9, 11, 13
Study of the theory	21	0.84	10

The objectives of the subject will be obtained indirectly in the following way:

1. Learning the language of mathematics formalized in set theory (without entering into the foundations).

2. Learning to manipulate basic algebraic structures: groups, rings, fields, vector spaces; and also

homomorphisms between these structures.

3. Learning the techniques of matrix manipulation, computing determinants, the arithmetic of polynomials, the calculation of their roots, and their applications in the study of linear Algebra.

And all this accompanied by the development of logical reasoning, which is expected by teaching the demonstrations of many of the theorems of the course.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
First partial exam	40%	2	0.08	2, 5, 6, 7, 8, 9, 10, 12
Problem handouts	15%	1	0.04	1, 4, 6, 8, 11, 12, 13
Second chance examination	85%	3	0.12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13
Second partial exam	45%	3	0.12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13

This subject will be evaluated by means of two partial exams and several deliveries of problems proposed by the

40% of the mark of the first partial exam P1,
45% of the mark of the second partial exam P2 and
15% of the mark from problems handaouts E.

In other words that is,
Final Mark = 0.15 * E + 0.4 * P1 + 0.45 * P2

In order to pass the subject, the student must obtain a final grade of more than 5 and must have a mark of the first partial and second partial exams greater than 3 (out of 10).

In case the student does not pass the subject with the previous evaluations, or wants to improve the note (renouncing the one already obtained), he can attend a second chance examination, in which the two partials will be evaluated together.
In order to be able to submit to this exam, the student must have previously submitted to the partial tests.

A student will be considered not presented if he does not appear in any of the partial tests.

The dates of the different evaluation tests or the deadlines for the delivery of problems will be announced properly.

Unique evaluation

The student doing unique evaluation will take a final exam of all the course of theory and problems, with the possibility of a personal interview with the professors. This will take place on the same day, hour and place as the exams of the second partial of the continued evaluation.

*If the final mark is less than 5, the student will have another opportunity with a recovery exam, whose date will be determined by the coordination of the degree. In this exam the student can recover 100% of the mark of the subject.*This exam will take place at the same day, hour and place as the recovery exams of the continued evaluation.

Bibliography

In addition to the books that are suggested below, the Faculty of Science has an exceptional bibliographical fund where students can find multiple texts that cover and complement the contents of the subject.

Main books.

F. Cedó i A. Reventós, Geometria plana i àlgebra lineal, Manuals de la UAB, 39, 2004.

J. Dorronsoro y E. Hernández, Números, grupos y anillos, Addison-Wesley/ Universidad Autónoma de Madrid, Madrid, 1996.

E. Hernández, Álgebra Lineal y Geometría, Addison-Wesley, 2012.

A. Kostrikin and Y. Manin, Linear Algebra and Geometry, Gordon and Breach Science Publishers, Amsterdam, 1989.

L. Merino y E. Santos, Álgebra Lineal con métodos elementales, Ediciones paraninfo, 2006.

E. Nart, Notes d'àlgebra lineal, Materials de la UAB, 130

Books for problem solving

F. Cedó i V. Gisin, Àlgebra Bàsica, Manuals de la UAB, 1997.

J. García Lapresta, M. Panero, J. Martínez, J. Rincón y C. Palmero, Tests de Álgebra lineal, Editorial AC, Madrid, 1992.

J. Rojo y I. Martín, Ejercicios y Problemas de Álgebra Lineal, Mc. Graw-Hill, Madrid 1994.

Software

We will use some free software.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	2	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	morning-mixed

(TE) Theory	2	Catalan	first semester	morning-mixed