Universitat Autònoma de Barcelona

2021/2022

Algebra II

Code: 100144
ECTS Credits: 6

Degree	Type	Year	Semester
2500097 Physics	FB	1	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

It is advisable to understand the main notions of the course Algebra I, specially those of Linear Algebra.

Objectives and Contextualisation

This subject is the second part of a set of two subjects devoted to aspects of Algebra of the Degree of Physics. The main objective of the course is to provide the student with the necessary algebraic tools to understand the other subjects of the degree. Another objective, no less important than the previous one, is to train the student in deductive thinking, so that she/he is then able to learn to use other mathematical tools not explicitly taught 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. Argue with logical rigor.
2. Describe and use tensioners and calculate the effect of coordinate changes.
3. Diagonalise endomorphisms and bilinear forms.
4. Express definitions and theorems rigorously.
5. Transmit orally and in writing, in a clear manner, the logical-mathematical reasoning that leads to problem resolution.
6. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments

7. Work with Euclidean and Hermitian metrics and their associated geometries.

Content

1. Diagonalization of matrices and endomorphisms

2. Bilinear forms

    2.1 Symmetric bilinear forms over real vector spaces. Euclidian inner podruct.

    2.2 Hermitian forms.

    2.3 Minkowski product.

    2.4 Orthogonal diagonalization of symmetric matrices: the Spectral Theorem. el Teorema espectral.

3. Lineal Geometry.

4. Multilinear Algebra

    4.1 Dual space.

    4.2 Tensors.

Methodology

The objectives will be achieved indirectly in the following way:

1. Learning the techniques of diagonalization of matrices and endomorphisms.

2. Learning the algebraic foundations of Euclidean geometry and, more generally, the symmetrical bilinear forms on the real ones.

3. Learning the algebraic foundations of Minkowski's geometry

4. Learning the techniques of multilinear algebra and, in particular, working with tensors.

And all this accompanied by the development of logical reasoning, which is encouraged 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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	29	1.16	1, 2, 3, 4, 6, 7
Problem sessions	21	0.84	1, 2, 3, 4, 6, 5, 7
Type: Autonomous			
Solving problems	45	1.8	1, 2, 3, 4, 6, 5, 7

Studying theoretical concepts	38	1.52	1, 2, 3, 4, 6, 5, 7	

Assessment

40% of the final score will be obtained after the completion of a partial test. Passing this test does not eliminate matter from the final exam.

45% of the final score will be obtained from the final exam

The remaining 15% will be calculated based on the submission of exercice sets.

Students who do not pass the subject after the final exam may submit to a resit exam, which will be worth 85% of the grade. Grade from submissions of exercices has no resit.

Only those students that have been submitted to the partial and final exams can do the resit exam.

After the final exam Honors may be already awarded.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
A mid-term exam.	40%	2	0.08	1, 3, 4, 6, 5, 7
Final exam	45%	2.5	0.1	1, 2, 3, 4, 6, 5, 7
Resit exam	85%	2.5	0.1	1, 2, 3, 4, 6, 5, 7
Submission of exercise sets	15%	10	0.4	1, 2, 3, 4, 6, 5, 7

Bibliography

R. Camps, E. Nart, G. Solanes, X. Xarles, Àlgebra lineal i multilineal.

Complementary bibliography

Lectures

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

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

Problemes

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

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

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

4. A. de la Villa, Problemas de Algebra, CLAGSA, Madrid, 1994

Software

- Sagemath: https://www.sagemath.org
- Maxima: https://maxima.sourceforge.io
- WxMaxima: https://wxmaxima-developers.github.io/wxmaxima/index.html