UAB
Universitat Autònoma de Barcelona

Basics of Mathematics

Code: 106801
ECTS Credits: 6

2025/2026

Degree	Type	Year
Nanoscience and Nanotechnology	FB	1

Contact

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Teaching groups languages

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

Prerequisites

This subject is autonomous in the topics covered. However, it is recommended to have basic skills with algebraic calculations and basic notions of differential calculus in one variable.

Objectives and Contextualisation

The aim of the subject is knowledge and skill in the use of the basic tools of linear algebra and their applications. It focuses on the study of linear transformations, diagonalization of endomorphisms and their applications. Included are fundamental calculus tools such as complex numbers and matrix calculus.

Learning Outcomes

1. CM06 (Competence) Identify the mathematical nature of certain physical and chemical phenomena, in order to abstract the essential variables that describe them.
2. CM07 (Competence) Solve real-world problems that occur in the field of science and technology using mathematical tools and methods.
3. KM08 (Knowledge) Identify the elementary mathematical models and tools used in calculus, linear algebra and differential equations.
4. SM09 (Skill) Express oneself clearly using basic mathematical language.
5. SM10 (Skill) Solve simple problems related to matrix calculus, linear equations and first order differential equations.
6. SM12 (Skill) Use graphical and numerical methods to explore, describe and interpret data.

Content

1. Complex numbers

Complex numbers and their properties. Trigonometric form and polar form. Operations with complex numbers. Roots of complex numbers. Fundamental theorem of algebra

2. Matrices

Solving systems of linear equations. Addition, product, and transpose of matrices. Elementary transformations. Rank of a matrix. Invertible matrices. Determinants

3. Vector spaces

Definition and examples. Linear dependence and independence. Vector subspaces and systems of generators. Basis, coordinates, and dimension. Basis of the intersection and of sum of subspaces. Change-of-basis matrix.

4. Linear transformations

Definition and examples. Matrix representation. Composition. Dependence of the matrix with respect to a base change. Kernel, image and rank. Computing basis of kernels and images.

5. Diagonalization

Eigenvectors and eigenvalues of an endomorphism. Characteristic polynomial. Diagonalization criterion. Spectral theorem

6. Applications of diagonalization

Sequences with linear recurrences. Linear differential equations and systems of first order linear differential equations.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Computer sessions	6	0.24	
Exercise resolution classes	10	0.4	
Theory classes	36	1.44	
Type: Supervised			
Tutorials	10	0.4	
Type: Autonomous			
Self-developed study	81	3.24	

The subject consists of three main activities.

Theory classes in which the scientific and technical concepts and knowledge specific to the subject are introduced and developed.

Problem classes, complementary to theory classes. Exercises will be solved in order to deepen the understanding of the new scientific and technical concepts and knowledge presented in the theory classes. Usually the student thinks and tries to solve the problems that are discussed in class and arrives at the final optimal solution.

Finally, there will be 3 practice sessions in the computer classroom, where specific software will be used for mathematical calculations.

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
Evaluation of practices	15%	1	0.04	SM09, SM10, SM12
Final exam	50%	3	0.12	CM06, CM07, KM08, SM09, SM10
Mid-term exam	35%	3	0.12	CM06, CM07, SM10

There are two written tests, a partial exam, approximately halfway through the semester, with a weight of 35% of the final course grade and a final exam with a weight of 50%.

The practices will be evaluated and will represent the remaining 15% of the final course grade.

Those who have taken the two written exams and have not obtained a final course grade equal to or higher than 5 out of 10, may opt for a reassessment. The reassessment consists of a global examination of the subject. If the weighted average of this exam, with a weight of 85%, and the practice grade, with a weight of 15%, is equal to or higher than 5, the subject will be approved with a 5.0. Otherwise, the course is failed with the average grade obtained.

The Honors Matriculation qualification is the decision of the teaching staff responsible for the subject. UAB regulations indicate that MH can only be granted to those who have obtained a final grade equal to or higher than 9.00 out of 10.00. Up to 5% of MH can be awarded to the total number of students enrolled in the subject.

Those who have not completed at least 50% of the subject's assessment activities will be considered non-evaluable (NA).

The dates of exams and practical assessments as well as other information or relevant dates that occur throughout the course will be communicated on the virtual campus. It is understood that this is the usual platform for the exchange of information between teachers and students.

Those who take the single assessment system will have to take a written exam of the subject that will have a weight of 85% and then a practical test with a computer that will have a weight of 15%. The grade will be the weighted average of both tests.

Aquí tienes la traducción al inglés:

This course/module does not provide a single assessment system.

Bibliography

J. Hefferon, Linear algebra, http://joshua.smcvt.edu/linearalgebra/

M. Masdeu, A. Ruiz, Apunts d'Algebra Lineal,
https://mat.uab.cat/~albert/wp/wp-content/uploads/2020/09/Apunts_d__lgebra_Lineal.pdf

E. Nart X. Xarles, Apunts d'àlgebra lineal, Materials de la UAB, núm. 237, 1a edició.

D.C. Lay, Algebra lineal y sus aplicaciones, Pearson Educación, 2016 (ebook)

Grossman, Stanley I., Algebra lineal. Mc Graw Hill, 2012, 7a edició. (eBook)

Software

Python

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan	second semester	afternoon
(PAUL) Classroom practices	2	Catalan	second semester	afternoon
(PLAB) Practical laboratories	1	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	3	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	4	Catalan	second semester	morning-mixed
(TE) Theory	1	Catalan	second semester	afternoon