UAB
Universitat Autònoma de Barcelona

Linear Algebra

Code: 104381
ECTS Credits: 6

2025/2026

Degree	Type	Year
Computational Mathematics and Data Analytics	FB	1

Contact

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Teachers

(External) Pol Orobitg

Teaching groups languages

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

Prerequisites

Although the course is essentially self-contained, the student will be required to know how to solve systems of linear equations, the basic arithmetic of numbers and polynomials, and how to perform algebraic manipulations.

Objectives and Contextualisation

In order to acquire a proper mathematical training, it is essential to understand linear algebra in depth. One needs to learn how to manipulate the objects introduced in such a class and to interpret their meanings. The tools provided in this course are essential not only in all branches of Mathematics, but also in most Sciences and Engineering studies.

Among the many goals we underline the following: to understand and correctly use mathematical language, to appreciate the need for proofs, and to develop a critical approach to mathematical statements.

As more specific goals: the student will learn to manipulate matrices as a basic tool to analyze systems of linear equations, to formalize the necessary language in order to understand the concepts of vector space and linear map, as well as to manipulate bilinear forms. All of this will be reinforced with the introduction of the appropriate software.

Learning Outcomes

1. CM02 (Competence) Use matrices to solve systems of equations, make changes of base and study linear applications.
2. CM03 (Competence) Contrast the use of calculus with the use of abstraction in algebra and analysis to solve a real problem.
3. CM04 (Competence) Explain ideas and concepts of fundamental mathematics, communicating one's own reasoning to others.
4. KM01 (Knowledge) Identify the essential ideas of the proofs of some basic algebra and calculus theorems.
5. SM01 (Skill) Write small mathematical texts (exercises, solving theoretical questions, etc.) in an orderly and precise manner.
6. SM03 (Skill) Classify matrices and linear applications according to diverse criteria (rank, diagonal forms and Jordan form).

Content

The course is structured in 4 parts: a first, more computational one, where the emphasis is put in the algebraic manipulation of matrices, introducing their basic operations. In the second part the concepts of abstract vector space and linear map are formalized, as well as their relation with the contents of the first block. The third and fourth parts are devoted to more advanced concepts that build on the structure of vector space and linear map.

Parts

1. Matrices and linear equations
2. Vector spaces and linear maps
3. Diagonalization
4. Orthogonality and quadratic forms

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	27.5	1.1	
Practice sessions	11	0.44	
Problem sessions	12	0.48	
Type: Autonomous			
Preparation of problems to deliver	15	0.6	
Problem solving	30	1.2	
Theory study	26	1.04	
Use of software	20	0.8	

The course has 4 weekly hours grouped in blocks of 2 hours during the semester. Each of these blocks will combie theoretical contents and resolution of problems, which may be on paper or with the use of software.

In order to introduce the software, more time will be devoted to this part in the first sessions.

During the course five quizzes will be offered, and students will have to take them individually. The dates in which these tests will be announced at the beginning of the course.

This course will realize, initially, in-class lectures and also taking advantage of the resources made available by UAB. It will also make extended use of the corresponding Moodle classroom hosted at UAB's servers, to complement the explanations made in class, offer the necessary material, open forums and make deliveries.

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
Final exam	50%	4	0.16	CM03, CM04, KM01, SM01, SM03
Practice exam	15%	2	0.08	CM02, CM03, SM03
Problems to turn in	15%	0	0	CM02, CM03, SM01
Regular quizzes	20%	2.5	0.1	CM02, CM03, KM01, SM03

During the course, the dates of each test or evaluation will be announced. There will be second oportunity for the final exam and the practice exam. The student needs a grade bigger to 3,5 for the final exam in order to compute grade by using the marks of the regular quizes, problems to turn in, and practice exam.

The mark corresponding to *Regular quizzes* will be obtained from the average of the three best qualifications out of the five tests that will be made, and will not be recoverable.

There will be two problems that the student must do on their own and turn in.

Students who have requested the single assessment and it has been accepted by the Faculty, the assessment will consist of a final exam that will count for 80% of the grade and a practical exam that will count for 20% and that both they have a minimum grade of 3,5 points to be able to pass the subject. These exams will be taken one after the other on the date of the subject's final exam.

Bibliography

Teaching notes:

- Marc Masdeu, Albert Ruiz, *Apunts d'Àlgebra Lineal*. Available at the Moodle classroom.

Basic:

- Otto Bretscher, *Linear Algebra with Applications*. Pearson, 2013.
- Enric Nart, Xavier Xarles, *Apunts d'àlgebra lineal*. Materials UAB, 2016.

Complementary:

- Sheldon Axler, *Linear algebra done right*. Springer UTM, 2015.
- Manuel Castellet i Irene Llerena, *Àlgebra lineal i geometria*. Manuals UAB, 1991.
- Ferran Cedó i Agustí Reventós, *Geometria plana i àlgebra lineal*. Manuals UAB, 2004.
- - Gilbert Strang, Linear Algebra and Learning from Data. Wellesley-Cambridge Press, 2019, pp.446. ISBN:978-06921963-8-0
  - Mike X. Cohen, Practical Linear Algebra for Data Science: From Core Concepts to Applications using Python. O'reilly Media, 300pp (2022). ISBN:978-1098120610
  - Charu C. Aggarwal, Linear algebra and optimization for Machine Learning: a textbook. Springer International Publishing (2020). ISBN: 9783030403430

Software

SageMath (https://www.sagemath.org/)

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
(PLAB) Practical laboratories	1	Catalan	first semester	morning-mixed
(SEM) Seminars	1	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	morning-mixed