



COURSE DATA

DATA SUBJECT

Code: 34161
Name: Numerical methods for lineal algebra
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Facultat de Ciències Matemàtiques	2	First quarter
1935 - Double Degree Program in Mathematics-Telematics Engineering	Facultat de Ciències Matemàtiques	2	First quarter
1936 - Double Degree Program in Mathematics-Telematics Engineering	Facultat de Ciències Matemàtiques	2	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1107 - Degree in Mathematics	Numerical methods	COMPULSORY
1935 - Double Degree Program in Mathematics-Telematics Engineering	Segundo curso	COMPULSORY
1936 - Double Degree Program in Mathematics-Telematics Engineering	Segundo curso	COMPULSORY

COORDINATION

LOPEZ UREÑA SERGIO

CORDERO CARRION ISABEL

SUMMARY

The purpose of the subject of numerical methods for linear algebra is the knowledge of the basic methods of solving systems of linear equations and eigenvalues and eigenvectors of matrices and the analysis of their computational cost.

A lot of physical and technical problems lead after an appropriate mathematical modeling, to find the solution of a linear system, often large-scale, or also the calculation of eigenvalues and eigenvectors of certain matrices related to the issues at hand. The abundance of these problems in various scientific fields (physics, chemistry, economics, engineering, etc.) is very high, and therefore its resolution is of great importance.



The numerical linear algebra is a mathematical area with a large impact on other scientific and technological areas. The development of numerical linear algebra is continuously driven by specific problems then they benefit from the techniques developed. An example would be the relationship between linear and systems in different methods used to solve differential equations.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

The necessary basic knowledge for the start of this course will have completed courses in computer science, computer tools, mathematical analysis I, linear algebra and geometry.

COMPETENCES / LEARNING OUTCOMES

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Ability to work in teams.

Capacity for analysis and synthesis.

Capacity for organization and planning.

Capacity of abstraction and modeling.

Expressing mathematically in a rigorous and clear manner.

Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.

Learn autonomously.

Participate in the implementation of software and learn mathematical software.

Possess and understand the mathematical knowledge.

Reason logically and identify errors in the procedures.

Solve problems that require the use of mathematical tools.

DESCRIPTION OF CONTENTS



1. Direct methods

- . Introduction.
- . Triangular systems. Substitution algorithms.
- . Gaussian elimination. Pivot.
- . Computational complexity.

2. LU decomposition

- . Elementary transformations.
- . Existence and uniqueness of the LU decomposition.
- . Partial pivoting.
- . Calculation of determinants.
- . Multiple independent terms. Reverse calculation.
- . Definidad positive matrices. Choleski decomposition.

3. Linear systems and their numerical solution

- . Norms of vectors and matrices.
- . Numerical solution of linear systems.
- . Stability of the solutions. Condition number.

4. Iterative methods

- . Introduction. Need for iterative methods.
- . Jacobi method.
- . Gauss-Seidel method.
- . Analysis of convergence.

5. Methods for eigenvalues and eigenvectors

- . Eigenvalues and eigenvectors.
- . Gershgorin theorems.
- . Analysis of disturbances.
- . Power method.
- . Inverse power method.

WORKLOAD

PRESENCIAL ACTIVITIES



Activity	Hours
Theory	30,00
Other activities	7,50
Computer classroom practice	22,50
Total hours	60,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	7,50
Preparation of lessons	57,50
Preparation for assessment activities	25,00
Resolution of case studies	0,00
Total hours	90,00

TEACHING METHODOLOGY

The theory sessions, practical sessions (in the classroom with computer) and tutorials and seminars: The development of the subject around three axes structure.

As regards the former, the teacher will develop the main agenda items, using computer classroom where necessary to illustrate a particular point. The student must attend at the time of preparation of the classes scheduled for their optimal use. The practical classes so that students will check the level of acquired knowledge, facing relatively complex problems and analyzing the results. As before, students must prepare such sessions to perform experiments in the schedule.

EVALUATION

REFERENCES

- A. Aubanell, A. Benseny y A. Delshams. Eines Bàsiques de Càlcul Numèric. Manuals de la Universitat Autònoma de barcelona, 1991
- Golub, G. H. y C. F. van Loan: Matrix Computation, 3rd ed., Johns Hopkins University Press, Baltimore, MD, 1996
- F. Aràndiga, R. Donat y P. Mulet. Mètodes Numèrics per a l'Àlgebra Lineal. Publicacions de la Universitat de València. 2000
- R. L. Burden y J. D. Faires. Anàlisis Numèric. Thomson-Learning. Mèxico, 2002
- Biswa Nath Datta: Numerical Linear Algebra and Applications, Society for Industrial and Applied



Mathematics, 2010

- E. Checa Martínez y A. Marqués Mateu: Álgebra lineal numérica: teoría y prácticas con Mathematica. Comunicación Matemática y C (I), Editorial Universidad Politécnica de Valencia, 2001