COURSE DATA

Data Subject	
Code	34161
Name	Numerical methods for lineal algebra
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Faculty of Mathematics	2	First term

Subject-matter

Degree	Subject-matter	Character
1107 - Degree in Mathematics	8 - Numerical methods	Obligatory

Coordination

Name	Department
CORDERO CARRION, ISABEL	363 - Mathematics
LOPEZ UREÑA, SERGIO	363 - Mathematics

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.

OUTCOMES

1107 - Degree in Mathematics

- Capacity for analysis and synthesis.
- Capacity for organization and planning.
- Solve problems that require the use of mathematical tools.
- Ability to work in teams.
- Learn autonomously.
- Possess and understand the mathematical knowledge.
- Expressing mathematically in a rigorous and clear manner.
- Reason logically and identify errors in the procedures.
- Capacity of abstraction and modeling.
- Participate in the implementation of software and learn mathematical software.
- Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.

LEARNING OUTCOMES

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

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Computer classroom practice	22,50	100
Other activities	7,50	100
Preparation of evaluation activities	25,00	0
Preparing lectures	30,00	0
Preparation of practical classes and problem	27,50	0
TOTAL	**142,50**	

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

English version is not available

REFERENCES

Basic

- A. Aubanell, A. Benseny y A. Delshams. Eines Bàsiques de Càlcul Numèric. Manuals de la Universitat Autònoma de barcelona, 1991
- F. Aràndiga, R. Donat y P. Mulet. Mètodes Numérics per a l'Àlgebra Lineal. Publicacions de la Universitat de València. 2000
- R. L. Burden y J. D. Faires. Análisis Numérico. Thomson-Learning. México, 2002

Additional

- Golub, G. H. y C. F. van Loan: Matrix Computation, 3rd ed., Johns Hopkins University Press, Baltimore, MD, 1996
- 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 Mathemática y C (I), Editorial Universidad Politécnica de Valencia, 2001