

Course guide

340021 - FOMA-N - Fundamentals of Mathematics

Last modified: 26/06/2026

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING AND RAILWAY SYSTEMS (Syllabus 2024). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: CARLES BATLLE ARNAU

Others: CARLES BATLLE ARNAU
DANIEL PONZ IRANZO
JOANA D'ARC PRAT FARRAN
JOAN RAVENTOS LORENZO
ANDREA RODRÍGUEZ DE LIÉBANA

PRIOR SKILLS

Calculate and simplify derivatives of functions using the basic product, quotient, and chain rules.

Solve systems of linear equations using Gaussian elimination and Cramer's rule.

Perform operations with matrices: addition, multiplication, inverse, and determinant.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

Transversal:

2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

TEACHING METHODOLOGY

The theory classes consist of theoretical explanations, description of examples and solution of selected problems, using various traditional and digital media.

In several parts of the subject, open source software or with UPC license will be used to solve applied problems.

LEARNING OBJECTIVES OF THE SUBJECT

Use the fundamental tools of differential calculus to study functions of one variable, obtain approximations of functions using Taylor polynomials, and analyze the corresponding error.

Understand the fundamental theorem of integral calculus and its use in solving various problems.

Know the fundamental concepts and some examples of the use of vector spaces and linear mappings.

Recognize the importance of eigenvalues and eigenvectors, as well as their applications, especially regarding symmetric matrices.

Use specific software to solve some applied problems.

STUDY LOAD

Type	Hours	Percentage
Hours large group	60,0	40.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

1. Differential and integral calculus

Description:

Continuity. Bolzano's theorem.

Differentiation. Geometric interpretation of the derivative. L'Hôpital's rule.

Application to the local study of functions: increasing and decreasing behavior. Extrema.

Taylor polynomial. Truncation error. Application to the local study of functions.

Representation of real numbers. Errors.

Fundamental theorem of integral calculus. Definite integral as area. Barrow's rule. Definite integration by parts and change of variables.

Specific objectives:

Related activities:

Full-or-part-time: 52h

Theory classes: 26h

Self study : 26h

2. Linear algebra

Description:

Linear systems. Matrix manipulations. Classification. Rouché-Frobenius theorem. General form of the solution of a linear system. Vector spaces. Axioms of vector spaces. Vector subspaces. Linear combinations. Linear independence. Bases. Dimension theorem. Linear mappings. Associated matrix in a basis. Kernel and image of a linear mapping. Fundamental theorem of linear algebra. Types of linear mappings. Preimage of a vector. Eigenvectors and eigenvalues of an endomorphism. Diagonalization. Changes of basis.

Quadratic forms. Associated matrix. Diagonalization in an orthonormal basis. Classification of quadratic forms.

Specific objectives:

Related activities:

Full-or-part-time: 52h

Theory classes: 26h

Self study : 26h

ACTIVITIES

xxx

Description:

Individual written exam, the week of first exams, of contents given until then.

Full-or-part-time: 2h

Theory classes: 2h

xxx

Description:

Individual written exam of all contents.

Full-or-part-time: 3h

Theory classes: 3h

GRADING SYSTEM

See the catalan version.

BIBLIOGRAPHY

Basic:

- Amorós Torrent, Jaume. Apunts d'àlgebra lineal [on line]. Barcelona: Universitat Politècnica de Catalunya, 2023 [Consultation: 26/06/2026]. Available on: <https://hdl.handle.net/2117/427387>.

- Herman, Edwin; Strang. Gilbert. Calculus. Vol. 1 [on line]. Houston, Texas: OpenStax, 2026 [Consultation: 29/06/2026]. Available on:

chrome-extension://efaidnbmninnbpcjpcglclefindmkaj/<https://d3bxy9euw4e147.cloudfront.net/oscms-prodcms/media/documents/CaculusVolume1-OP.pdf>. ISBN 9781947172135.



RESOURCES

Other resources:

- Matlab online: <https://es.mathworks.com/products/matlab-online.html> />- OCtave: <https://www.gnu.org/software/octave/> />-
Geogebra: <https://www.geogebra.org/> />- Wolfram: <http://mathworld.wolfram.com>