# COURSE DATA

| Data Subject | |
|---|---|
| **Code** | 34914 |
| **Name** | Mathematics III |
| **Cycle** | Grade |
| **ECTS Credits** | 6.0 |
| **Academic year** | 2022 - 2023 |

**Study (s)**

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1404 - Degree in Industrial Electronic Engineering | School of Engineering | 1 | Second term |

**Subject-matter**

| Degree | Subject-matter | Character |
|---|---|---|
| 1404 - Degree in Industrial Electronic Engineering | 1 - Mathematics | Basic Training |

**Coordination**

| Name | Department |
|---|---|
| CORDERO CARRION, ISABEL | 363 - Mathematics |
| PASTOR MURCIA, VICENTE JAVIER | 363 - Mathematics |

# SUMMARY

The main thematic subjects are: Numerical  Methods, Statistics and Optimization.

The general objectives of the course are the following:

- To understand the concept of approximation to the solution of a problem.
- To identify those situations that require a numerical method in order to obtain a solution.
- To acquire the ability  to structure a discrete problem in order to be able to solve it using a programming language.
- To learn to question the validity  and or the fiability of the results obtained.
- To stablish conections with other subjects of interest in engineering applications.

# PREVIOUS KNOWLEDGE

## Relationship to other subjects of the same degree

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

## Other requirements

Matemàtiques I

# OUTCOMES

## 1404 - Degree in Industrial Electronic Engineering

- CG3 - Knowledge of basic and technological subjects that allows students to learn new methods and theories and provides them with versatility to adapt to new situations.
- CG4 - Ability to solve problems with initiative, decision-making skills, creativity and critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of industrial engineering (with specific industrial electronics technology).
- CG12 - Ability to solve a wide range of mathematical problems that may arise in engineering. Ability to apply the acquired knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and partial derivatives, numerical methods, numerical algorithms, statistics and optimisation.

# LEARNING OUTCOMES

**Results of knowlegde:**

- Have an understanding of basic mathematical concepts (CG3).
- Solve problems in engineering applying advanced mathematical concepts (CG12).
- Understand the mathematical formalisms presents in engineering (CG3).
- Estructure the resolution of problems in engineering in a mathematical way (CG12).
- Model physical phenomenae using mathematical tools (CG4).
- Interpret mathematical results in physical contexts (CG4).

**Skilss to acquire:**

- Understand the concept of root of a function, and the basic methods to compute approximately those roots. Recognize those situations that need for a numerical method to compute them.
- Know how to complete the data in a table associated with an unknown function using polynomial interpolation.
- Understand the necessity and convenience of using numerial methods to solve linear systems of equations of high dimension.
- Understand and use the relation between the definite integral of a positive function and the corresponding area. Understand the necessity and convenience of using numerial techniques to compute definite integrals.
- Understand the discretization process in the computation of the numerical solution of an ordinary

differential equation. Understand the concept of the order of a numerical method.
- Understand simple processes in decisions based on statistical concepts.
- Understand simple processes of minimization and optimization.
- Discover and understand relations among other subjects of interest for the student.

In addition to the specific objectives previously mentioned, technical and social skills will be developed during the subject, among we can highlight:

- Oral and written correct and understable expositions of mathematical items related to engineering.
- Skills associated with the capability of working in a team.

## DESCRIPTION OF CONTENTS

### 1. Numerical methods for the solution of nonlinear equations.

Roots of nonlinear equations. Methods of bisection and Newton.

### 2. Polynomial Interpolation

Construction of the interpolating polynomial for tables. Error bounds for the interpolation error.

### 3. Numerical methods for the solution of linear systems.

The LU decomposition and its use in the solution of linear systems. Introduction to iterative methods for the solution of large linear systems.

### 4. Numerical Integration

Integration rules. Error bounds for numerical integration.

### 5. Numerical Methods for ordinary differential equations

The Euler method. Convergence of a numerical scheme. Order. First order schemes versus higher order schemes.

### 6. Inference and Decision

Random variables and associated density functions. Confidence Intervals.

### 7. Regression

Linear and nonlinear regression. Goodness of fit.

### 8. Basic convex optimization

Basic convex optimization.

## WORKLOAD

| ACTIVITY | Hours | % To be attended |
|---|---|---|
| Laboratory practices | 30,00 | 100 |
| Theory classes | 15,00 | 100 |
| Classroom practices | 15,00 | 100 |
| Development of group work | 10,00 | 0 |
| Development of individual work | 5,00 | 0 |
| Study and independent work | 10,00 | 0 |
| Preparation of evaluation activities | 25,00 | 0 |
| Preparing lectures | 15,00 | 0 |
| Preparation of practical classes and problem | 25,00 | 0 |
| **TOTAL** | **150,00** | |

## TEACHING METHODOLOGY

- In the theoretical classes the professor will introduce the concepts associated with each chapter, as well as their use in the resolution of specific problems (CG3).
- In the practical classes, the students will do exercises about the theoretical contents, in an individual way and in a group, in order to favor the knowledgement of theoretical concepts (CG4, CG12).
- The work in the practical session in the informatic class is oriented to the resolution of specific problems by the student. They will use an informatic environment to help them the structured programming (CG4, CG12).
- Work in a group will be promoted through the elaboration of works that can be presented to the professor and the rest of the students during the class (CG4).

## EVALUATION

The evaluation procedure of the knowledgement and skills obtained by the students will be done during the whole period and consists of the following evaluation blocs:

1. Evaluation exam or exams of the theoretical-practical contents of the subject, with up to 50% of the final grade of the course (CG3).
2. Continous evaluation of the participation in the practical laboratories of the subject, elaboration of lab diary. For this evaluation, one or more exams will be carried out. Moreover, the professor can ask for presentation of specific works and lab diaries to complete the evaluation. Total evaluation of all the activities in this part is up to 50% of the final grade of the course. Assistance to laboratory sessions is a no recoverable activity and obligatory in order to pass the subject (CG4, CG12).
3. Assistance to theoretical classes, practical classes and participation in the development of the subject will have, according to the professor opinion, up to 10% of the final grade of the course (CG4).

The final grade of the subject will be computed from the qualifications of the previous parts, according to the established percentages by the professor, if the qualifications from points 1 and 2 pass 40% of the maximum qualification in each of the previous parts.

The qualification of the exercises and/or specific works is non recoverable and will be kept for the two convocatories of each academic course.

In any case, the evaluation system will follow that established in the “Reglamento de Evaluación y Cualificación” of the University of Valencia for Grades and Masters (https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639).

## REFERENCES

### Basic

- Métodos Numéricos: Introducción, Aplicaciones y Programación. A. Huerta, J. Sarrate, A. Rodriguez-Ferrer. Edicions UPC
- Análisis Numérico. Burden y Faires. Thomson Learning
- Curs dEstadística. Colomer Mª Àngels. Ed. Universitat de Lleida, 1997
- Problemas resueltos de Métodos Numéricos. A. Cordero, J.L. Hueso, E. Martínez, J.R.Torregrosa, Ed. Thomson.

### Additional

- Aproximació Numèrica. S. Amat, F. Aràndiga, J.V. Arnau, R. Donat, P. Mulet, R.Peris. P.U.V.
- Mètodes Numèrics per a l'àlgebra lineal. F. Aràndiga, R. Donat, P. Mulet. P.U.V
- Càlcul Numèric. F. Aràndiga, P. Mulet. P.U.V.

- Linear and Nonlinear Programming, 2009. David G. Luenberger, Yinvu Ye.
- Estadística Aplicada Básica. Moore David S.Ed. Antoni Bosch, 1998.