COURSE DATA

Data Subject	
Code	34788
Name	Mathematics III
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1402 - Degree in Telecommunications Electronic Engineering	School of Engineering	2	First term

Subject-matter

Degree	Subject-matter	Character
1402 - Degree in Telecommunications Electronic Engineering	1 - Mathematics	Basic Training

Coordination

Name	Department
MARTI VIDAL, IVAN	16 - Astronomy and Astrophysics
MATEO JIMENEZ, FERNANDO	242 - Electronic Engineering

SUMMARY

Course name:	Mathemtics III
Number of credits ECTS:	6
Time slot:	2nd (First Quartal)
Subject:	Mathematics

Character:	Basic Education
Degree:	Degree in Electronic Engineering in Telecommunications
Cicle:	Grade / Bachelor
Departament:	Astronomy and Astrophysics Electronic Engineering

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Contents of the course Mathematics I.

OUTCOMES

1402 - Degree in Telecommunications Electronic Engineering

- G3 - Acquisition of the knowledge of the basic and technological subjects that allows students to learn new methods and theories and endows them with the versatility to adapt to new situations.
- B1 - Ability to solve any mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and partial derivatives, numerical methods, numerical algorithms, statistics and optimization.
- Capacidad de resolver problemas con iniciativa, toma de decisiones, creatividad, razonamiento crítico y de comunicar y transmitir conocimientos, habilidades y destrezas en el campo de la Ingeniería Industrial.

LEARNING OUTCOMES

Learning Results

At the end of the semester and as a result of the learning process of the course, students should be able to:

- Understand and have a good graps of basic concepts in mathematics. (B1)
- Solve problems using mathematical concepts of advanced engineering. (B1)
- Understand the mathematical formalisms that may arise in engineering. (B1)
- Arrange the solution of engineering problems in mathematical form. (B1)
- Model physical phenomena using mathematical tools. (B1)
- Interpret the mathematical results applied to the physical world. (B1)

Skills to be acquired

The student should be able to:

- Understand the concept of a root or zero of a function, and the basic operation of simple methods for calculating approximate roots. Recognize situations that require a numerical method for calculating roots.
- Know how to complete the data in a table associated with an unknown function through polynomial interpolation.
- Understand the need and appreciate the convenience of using numerical methods for solving large systems of linear equations.
- Understand and use the relationship between the definite integral of a positive function and the associated area. Understand the need and desirability of using numerical techniques for calculating definite integrals.
- Understand the process of discretization associated with the calculation of the numerical solution of ordinary differential equations. Understand the concept of order of the numerical method.
- Understand simple processes of making decisions based on statistical concepts.
- Pose basic convex optimization problems and solve them using appropriate mathematical tools.
- Know how to calculate the regression line associated with a set of discrete data.
- Discover and understand connections with other disciplines of interest to the student.

To complement the above results, this subject also to acquire the following skills and social skills:

- Correct and understandable oral and written presentation of mathematical questions related to engeneering.

Skills associated with the ability to work as a team.

DESCRIPTION OF CONTENTS

0. Numerical systems and sources of error.

The concept of encoding / representation of numbers in computers will be introduced describing the basic fixed point and floating point codings. We will show the fact that the discrete representation of the numerical non-integer values has an associated error that must be known and controlled. It will also be explained how the discrete algebra, necessary to operate in a system of representation with a finite number of values, leads to a series of errors that must be taken into account when designing numerical algorithms for solving engineering problems.

1. Numerical methods for the resolution of linear systems: direct methods and iterative methods.

Direct methods for solving systems of linear equations will be presented, with particular emphasis on the usefulness of the LU decomposition for this purpouse, as well as for the calculation of both determinants and inverse matrices. Likewise, we will introduce some basic iterative numerical methods (Jacobi, Gauss-Seidel) stressing its usefulness in dealing with problems associated with sparse matrices.

2. Numerical Methods for the resolution of nonlinear equations

We will introduce the methods of bisection and of Newton-Raphson to find the roots of nonlinear functions. Special emphasis will be put on showing under which conditions the application of each method is more favorable.

3. Polynomial interpolation and numerical integration

Polynomial interpolation is introduced from the methods of Lagrange and Newton, emphasizing its utility for estimating the errors in the process and the usefulness of these methods to numerically estimate the value of definite integrals.

Definite integrals will be evaluated numerically using the basic and compound rules of the rectangle, of the trapezoid, of the midpoint, and of Simpson. We will emphasize the differences in the order of each of these methods and their numerical cost.

4. Probability, Inference and hypothesis testing

The basic concepts of probability (mean, variance , etc.) will be introduced. the different types of random variables (discrete and continuous) roasted as the most common probability functions (uniform, Bernoulli , binomial , geometric , normal and exponential) are displayed.
Statistical inference takes the observed values of a variable and tries to deduce the probabilistic model that has generated these data. This unit will equip students with the mathematical criteria that allow you to extract and test hypotheses from experimental data. The concept of confidence interval as a key element in statistical inference will also be considered. It will show how to take decisions on the basis of statistical hypothesis testing nature.

5. Regression.

Least squares method to fit statistical or previously decided analytical models. In particular, we will consider regression lines or analytic functions that can be reduced to the evaluation of regression lines.

6. Basic optimization

We will raise the basic methods for solving linear programming problems. The iterative gradient method for optimizing functions of several variables starting with the case of a single one.

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	4,00	0
Study and independent work	9,00	0
Readings supplementary material	2,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	25,00	0
Resolution of case studies	5,00	0
Resolution of online questionnaires	10,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

- In the theory lectures, the teacher will introduce the concepts necessary to address all the practical exercices, as well as their use in specific examples.
- Each lecture will be divided in two parts: theory (1.5 ECTS) and practical exercises (1.5 ECTS).
- In the time dedicated to problem solving, several (individual and group) exercises will be proposed to the students, to favour the learning of the essential concepts.
- In the practical lectures (computer room) the students will solve particular exercises using an structured programming environment.
- Team work will be encouraged throughout group presentations of exercises proposed in the theory lectures.

EVALUATION

The course assessment will be performed in the following way:

1.- Continuous Assessment: 25%-50% of the final grade.

1.1. Partial voluntary exam (25% of the final grade). The minimum score for the exam to be taken into account in the final grade is *4 points over 10*.

1.2. Exercises (proposed either in the «Aula Virtual» or during the lectures): up to 10% of the final grade.

1.3. Questionnaires (in the «Aula Virtual»), related to the computer-room practical exercises (15% of the final grade).

2.- Exams: 50%-75% of the final grade.

2.1. Final exam: either 25% or 50% of the final score (depending on whether the partial exam is included in the computation of the final score). The minimum score for the exam to be taken into account in the final grade is *4 points over 10*.

2.2. Exam of computer exercises: 25%. The minimum score for the exam to be taken into account in the final grade is *4 points over 10*.

Additional considerations:

- To pass the course, it is mandatory to attend to (at least) 50% of the practical (i.e., computer room) sessions.

- All scores related to the exercises will be kept until the end of the course.

- The scores related to the practical exercises (i.e., computer room) can be kept between years (subject to the teacher’s criterion). In any case, only scores higher than (or equal to) 5 points (over 10) can be kept between courses.

- In any case, the evaluation system will follow the rules established in the normative of the University of Valencia:

https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639

REFERENCES

Basic

- Cálculo científico con MATLAB y Octave. A. Quarterioni. Springer ,2010
- Análisis Numérico. Burden y Faires. Thomson Learning.
- Curs dEstadística. Colomer Mª Àngels. Ed. Universitat de Lleida, 1997
- Aproximació Numèrica. S. Amat, F. Aràndiga, J.V. Arnau, R. Donat, P. Mulet, R.Peris. P.U.V.

Additional

- Problemas resueltos de Métodos Numéricos. A. Cordero, J.L. Hueso, E. Martínez, J.R.Torregrosa, Ed. Thomson.
- 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.
- Convex Optimization. S. Boyd y L. Vandenberghe. Cambridge Univ. Press 2009