Universidad Zaragoza

Academic Year/course: 2024/25

30111 - Mathematics III

Syllabus Information

Academic year: 2024/25
Subject: 30111 - Mathematics III
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
179 - Centro Universitario de la Defensa - Zaragoza
Degree: 425 - Bachelor's Degree in Industrial Organisational Engineering
563 - Bachelor's Degree in Industrial Organisational Engineering
ECTS: 6.0
Year: 2
Semester: First semester
Subject type: Basic Education
Module:

1. General information

Differential equations are one of the fundamental building blocks of modern mathematics. They are the basis for the analysis, modeling and resolution of complex problems in engineering, science, economics or business.

This subject addresses the **ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial differential equations; numerical methods; numerical algorithms; statistics and optimization**. This capacity is covered by the subjects Mathematics I, Mathematics II, Mathematics III and Statistics.

2. Learning results

1. Solve mathematical problems that may arise in Engineering.

2. Have aptitude to apply the acquired knowledge of Differential Equations, Partial Derivative Equations; Numerical Methods and Numerical Algorithmics.

3. Know how to use numerical methods in the solution of some mathematical problems.

4. Know the reflexive use of symbolic and numerical calculation tools.

5. Possess scientific-mathematical thinking skills that allow them to ask and answer certain mathematical questions.

6. Be skilled in handling mathematical language; in particular, symbolic and formal language.

3. Syllabus

COMPANY PROFILE

1. Ordinary differential equations: basic concepts, existence and uniqueness, analytical solvability of some special equations.

2. Qualitative studies: fixed points and linear stability.

3. Numerical methods: Euler and Runge-Kutta.

4. EDO of order greater than one.

5. Laplace transform.

6. Applications of the Laplace transform: Oscillators and resonance.

7. Discrete-time systems: The Z-transform and its applications.

8. Series and Fourier transform. Applications.

9. Fourier transform in discrete time: FFT and applications.

10. Introduction to PDEs: Separation of variables, vibrations.

DEFENSE PROFILE

Topic 1: Introduction to differential equations.

Topic 2: Existence and uniqueness of solutions of ordinary differential equations and initial value problems.

Topic 3: Solving ordinary differential equations and first-order initial value problems. Qualitative study of the solutions of ordinary differential equations.

Topic 4: Solving ordinary differential equations and higher order initial value problems. Solving linear first order systems. Qualitative study of autonomous system solutions.

Topic 5: Mathematical tools: Laplace transform and Fourier series.

Topic 6: Partial derivative equations.

4. Academic activities

COMPANY PROFILE

- Theoretical and practical lectures always in a computer classroom using algebraic and numerical manipulation software.
- Participation checks with guided and collaborative problem solving.
- Written assessment tests:
- Face-to-face and remote tutoring.
- Personal work.

DEFENSE PROFILE

- Theoretical and practical lectures.
- Written tests oriented to the detailed resolution of theoretical and practical problems.
- Individual activities and group activities where the Flipped Classroom methodology is used.
- Practical exercises, carried out with the student's laptops or in the computer labs, using appropriate mathematical software.
- Study and personal work. Tutoring.

5. Assessment system

COMPANY PROFILE

- **Continuous assessment system**

In order to opt for continuous assessment it is necessary to attend at least 80% of the classroom activities.

The subject will be considered passed if 50% or more of the following score is obtained:

- Written tests: There will be two written tests on the content of the subject. Its weight in the final grade will be 80%.
- **Participatory controls:** There will be 4 guided and collaborative controls valued at 20% of the final grade, with problems or quizzes programmed through the ADD.

To add the grade of the controls to the final grade, the student must have obtained **at least 10 points out of 40** in each of the written tests.

- **Global assessment**

Students who have not passed the course with the continuous assessment system, must take a compulsory written test equivalent to the written tests described in point 1, whose weight in the final grade will be 100%.

The assessment criteria for **all** these tests will be:

- Understanding of the mathematical concepts used to solve the problems.
- The use of strategies and procedures in their resolution.
- Clear, organized and detailed explanations.
- Correct use of terminology and notation

DEFENSE PROFILE

FIRST CALL

Continuous assessment:

The student will be able to pass the total of the subject by the continuous assessment procedure. The student must demonstrate that they have achieved the expected learning results through the assessment activities that will be distributed throughout the term.

- Assessment instrument 1: It will consist of two written tests, each of which will cover approximately half of the subject's syllabus and whose contents will be of a theoretical-practical nature. The tests will have a weight in the final grade of 40% each.
- Assessment instrument 2: It will consist of solving a series of problems. Each of these problems will be solved, either individually or collaboratively in small groups, during class. Its total weight in the final grade will be 20%.

The final continuous assessment grade (100%) will be calculated according to the specific weight of each continuous assessment test . In order to pass the subject, the student must obtain a final grade of 5 or higher.

Global test:

Students who do not pass the subject by continuous assessment or who would like to improve their grade, will have the right to take the global test set in the academic calendar, prevailing, in any case, the best of the grades obtained. This global test will be equivalent to the continuous assessment tests described above and will have a 100% weight in the final grade. It will consist of an individual written test whose contents will be of a theoretical-practical nature . In order to pass the subject, the student must

obtain a final grade of 5 or higher.

SECOND CALL

Global test:

Students who do not pass the subject in the first call may sit for a global test set in the academic calendar for the second call. This global test will consist of a written test individual whose contents will have a theoretical-practical character, and will have a weight of 100%. To pass the subject, the student must obtain a final grade greater than or equal to 5.

ASSESSMENT CRITERIA: The following criteria will be followed in the evaluation according to the nature of the test:

- Understanding of the mathematical concepts used to solve the problems.
- The use of efficient strategies and procedures in their resolution.
- The absence of mathematical errors in the development and solutions.
- Correct use of terminology and notation.
- Orderly, clear and organized exposition.
- The correct resolution of the problems and the mathematical methods and strategies used.
- The correct interpretation of the results obtained.
- The ability to select the most appropriate method.
- Clear and detailed explanations and/or reasoning to the questions asked.
- The mastery and correct use of the mathematical software commands necessary to solve the practical tests.

Assessment instruments VS: Learning Results (LR)

Assessment instruments:	Weighting	RA1	RA2	RA3	RA4	RA5	RA6
Written test 1	40%	X	X	X		X	X
Written test 2	40%	X	X	X		X	X
Group activities	20%	X	X	X	X	X	X

6. Sustainable Development Goals

4 - Quality Education
5 - Gender Equality
9 - Industry, Innovation and Infrastructure