

Academic Year/course: 2022/23

29505 - Fundamentals of Mathematics II

Syllabus Information

Academic Year: 2022/23

Subject: 29505 - Fundamentals of Mathematics II

Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia

Degree: 625 - Bachelor's Degree in Industrial Processes' Data Engineering

ECTS: 6.0

Year: 1

Semester: Second semester

Subject Type: Basic Education

Module:

1. General information

1.1. Aims of the course

Mathematical methods are a basic tool in Engineering. The aims of the course are precisely the knowledge of these tools, in a way that is both theoretical and applied to real problems (using mathematical software). This knowledge and techniques will serve as the basis for other subjects.

The following SDGs will be worked on during the next academic year:

-Goal 7: Affordable and Clean Energy.

1.2. Context and importance of this course in the degree

The subject is compulsory and forms part of the basic education of the students.

It is taught in the second semester of the first course and its content is part of the basis for other subjects. The practical approach of the subject helps to achieve this objective.

The unifying character of Mathematics simplifies problems dealt with in other subjects and makes evident the similarities in apparently different problems.

1.3. Recommendations to take this course

This subject is the continuation of Fundamentals of Mathematics I.

2. Learning goals

2.1. Competences

When the subject is successfully passed, the student will be more competent to...

- CG03 - Apply techniques for the acquisition, management and treatment of data in Engineering.
- CG06 - Build solutions derived from data analysis that optimize production processes in the industry.
- CB2 - That students know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are often demonstrated through the development and defense of arguments and problem solving within their area of study.
- CB4 - That students can transmit information, ideas, problems and solutions to both specialized and non-specialized audiences.
- CB5 - That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.
- CT03 - Search, select and manage information and knowledge responsibly.
- CT04 - Develop critical thinking and reasoning.
- CT05 - Communication of results effectively.

- CT07 - Analyze and solve problems autonomously, adapt to unforeseen situations and make decisions.
- CE04 - Solve mathematical problems that may arise in engineering.

2.2. Learning goals

The student, to pass this subject, must show the following results ...

1. Learn the necessary bases to solve mathematical problems that can be posed in Linear Algebra; Graphic Schema Theory; Differential and Integral Calculus, Numerical Methods and optimization.
2. Know the reflective use of symbolic and numerical calculation tools.
3. Possess their own scientific-mathematical thinking skills, which allow them to ask and answer certain mathematical questions.
4. Have the ability to handle mathematical language; in particular, symbolic and formal language.

2.3. Importance of learning goals

The results of the learning process are important since they provide the students the necessary mathematical basis for other subjects of a scientific-technological nature of the Degree, such as, Computer Science, Statistics, Operations Research, Economics, Electronics, Data science. The ability to apply mathematical techniques to solve problems of different fields related to engineering is a fundamental ability of an engineer/officer, as well as the use of the existing resources and the interpretation of the obtained results.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must show has achieved the expected learning goals through the following assessment tasks:

Continuous assessment:

- 2 midterm exam. Related learning goals: 1, 2, 3 and 4. Weight in the final grade: 80%.
- 4 Test: Related learning goals: 1, 2, 3 and 4. Weight in the final grade: 20%.

Global assessment:

- Final exam. Related learning goals: 1, 2, 3 and 4. Weight in the final grade: 100%.

Assessment criteria: The assessment criteria are the same for all assessment tasks:

- understanding the mathematical concepts used to solve problems;
- the use of efficient strategies and procedures in their resolution;
- clear and detailed explanations;
- the absence of mathematical errors in development and solutions;
- correct use of terminology and notation; orderly, clear and organized exhibition.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. . A wide range of teaching and learning tasks are implemented, such as:

Strong interaction between the teacher/student. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

Fundamentals of Matemáticas II is conceived as a stand-alone combination of contents, yet organized into two fundamental and complementary forms, which are: the theoretical concepts of each teaching unit and the solving of problems or resolution of questions, at the same time supported by other activities.

The approach, methodology and assessment of this guide are intended to be the same for any teaching scenarios. They will be adapted to the social-health situation at any particular time, as well as to the instructions given by the authorities concerned.

4.2. Learning tasks

The course includes the following learning tasks:

- Face-to-face generic activities:
 - Lectures: The theoretical concepts of the subject are explained and illustrative examples are developed as a support to the theory when necessary.
 - Practice Sessions: Problems and practical cases are carried out, complementary to the theoretical concepts studied.
 - Individual Tutorials: Those carried out giving individual, personalized attention with a teacher from the department. Said tutorials may be in person or online.
- Generic non-class activities:
 - Study and understanding of the theory taught in the lectures.
 - Understanding and assimilation of the problems and practical cases solved in the practical classes.
 - Preparation of seminars, solutions to proposed problems, etc.
 - Preparation of summaries and reports.
 - Preparation of the written tests for continuous assessment and final exams.

The subject has 6 ECTS credits, which represents 150 hours of student work in the subject during the semester, in other words, 10 hours (Lectures: 4 h.; Other Activities: 6 h.) per week for 15 weeks of class.

The overall distribution is:

- 52 hours of lectures, with 50% theoretical demonstration and 50% solving type problems.
- 8 hours of written assessment tests.
- 90 hours of personal study, divided up over the 15 weeks of the semester.

There is a tutorial calendar timetable set by the teacher that can be requested by the students who want a tutorial.

4.3. Syllabus

The course will address the following topics:

1. Functions of several variables: limits and continuity.
2. Directional and partial derivatives.
3. The Chain Rule.
4. Tangent Planes and differentiability.
5. Extrema. Extrema with constraints: Lagrange's multipliers.
6. Multiple integrals: double integrals.
7. Multiple integrals: change of variables; triple integrals.
8. Systems of Linear Equations.
9. Determinants.
10. Numerical linear algebra.
11. Vector Spaces.
12. Orthogonality and Least Squares
13. The Geometry of Vector Spaces.
14. Diagonalization.
15. Singular value decomposition.

4.4. Course planning and calendar

A detailed schedule will be published on the Moodle page on the subject.

The dates of the final exams will be those that are officially published on the School website.

4.5. Bibliography and recommended resources

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=29505>