Universidad Zaragoza

Year : 2020/21

28805 - Mathematics II

Syllabus Information

Academic Year: 2020/21
Subject: 28805 - Mathematics II
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 424 - Bachelor's Degree in Mechatronic 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.

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 first 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 Mathematics I.

2.Learning goals

2.1.Competences

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

- (GI03) use the basic and technological subjects that enable the learning of new methods and provide versatility to adapt to new situations.
- (GI04) solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of Mechatronic Engineering.
- (GC02) interpret experimental data, contrast them with the theoretical ones and draw conclusions.
- (GC03) for abstraction and logical reasoning.
- (GC04) learn in a continuous, self-directed and autonomous way.
- (GC05) evaluate alternatives.
- (GC07) lead a team as well as to be a committed member of it.
- (GC08) locate technical information, as well as its understanding and assessment.
- (GC10) write technical documentation and present it with the help of appropriate computer tools.
- (GC11) communicate their reasoning and designs clearly to specialized and non-specialized audiences.
- (EB01) solve mathematical problems in engineering. Ability to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, differential equations, partial differential equations, numerical methods and algorithmic.

2.2.Learning goals

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

1. To know how to apply the fundamental results of the Linear Algebra and the Differential and Integral Calculus of functions of several variables. The student shall also be capable of describing basic concepts such as limit, continuity, derivability and integration, as well as their most important applications and geometric interpretations.
2. To develop and experience problem solving strategies and distinguish the most suitable method for each situation.
3. Ability to reason the difficulty of solving a problem accurately and the necessity to resort to the application of numerical approximation methods for its resolution, determining the degree of accuracy and its error.
4. To know how to use some mathematical software and its applications in the Differential and Integral Calculus of functions of one and several variables.
5. Ability to propose and solve problems concerning the previous areas and applied to the Bachelor's Degree in Mechatronic Engineering, selecting in a critical way the most suitable theoretical methods and results. In the case of complex analytical procedures, the student shall be able to use the mathematical software proposed in section 4 to solve the above mentioned problems.
6. To solve the problems of section 5, working as a team, and expand the information and methods proposed in the classroom. To make oral presentations of the obtained results by using the proper mathematical language and convenient computer programs.
7. To be able to express in a correct oral and written scientific language, the basic concepts of the subject as well as the problem solving process.

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, Physics, Computer Science, Mechanics, Statistics, Operations Research, Economics, Electronics, Resistance of materials... 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, 4, 5 and 7. Weight in the final grade: 80%.
- 4 Test: Related learning goals: 1, 2, 3, 4, 5, 6 and 7. Weight in the final grade: 20%.

Global assessment:

- Final exam. Related learning goals: 1, 2, 3, 4, 5 and 7. 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.

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.

If classroom teaching were not posssible due to health reasons, it would be carried out on-line.

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.- Systems of Linear Equations.
2.- Determinants.
3.- Numerical linear algebra.
4.- Vector Spaces.
5.- Orthogonality and Least Squares
6.- The Geometry of Vector Spaces.
7.- Diagonalization.
8.- Singular value decomposition.
9.- Multiple integrals: double integrals.
10.- Multiple integrals: change of variables; triple integrals.
11.- Plane and space curves: curvature and torsion.
12.- Line Integrals: the fundamental theorem for line integrals; Green's theorem.
13.- Surfaces: normal vector.
14.- Surface Integrals: Stokes' theorem, Gauss' theorem.

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://biblos.unizar.es/br/br_citas.php?codigo=28805&year=2020