Universidad Zaragoza

Academic Year/course: 2023/24

28605 - Mathematics applied to building II

Syllabus Information

Academic year: 2023/24
Subject: 28605 - Mathematics applied to building II
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 422 - Bachelor's Degree in Building Engineering
ECTS: 6.0
Year: 1
Semester: Second semester
Subject type: Basic Education
Module:

1. General information

Basic mathematical methods are part of the many tools that all professionals in Architecture and Engineering must have to solve the problems that arise in their work. Among the objectives of this subject is the mastery of techniques not only theoretical, but also practical, allowing the direct application of the methods considered in the subject to real problems, with realistic calculation methods that are incorporated in effective and proven software packages . It is therefore a fundamental subject for the integral formation of an Architect and Engineer. The final goal of this subject is that the students integrate the basic knowledge of this subject in all type of aspects related to Technical Architecture and Civil Engineering, so that they serve as a basis for other subjects and in turn acquire techniques that allow their professional development.

At the same time, and no less important, is that this subject will provide students with the necessary tools and concepts for the subsequent successful and profitable study of the subjects of structures and materials, as well as for their application in other areas of Technical Architecture, Civil Engineering and the practice of the profession.

The approaches and goals of this subject are aligned with the Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (https://www.un.org/sustainabledevelopment/es/), in such a way that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to their achievement: objective 9.5 and 9.b of Goal 9.

Mathematics entails a series of difficulties and objectives that only work and progress based on previously elaborated knowledge can overcome. This is why students should start the subject with a series of knowledge and tools well established during the first semester of the first year of this degree. To successfully take this subject it is recommended to have passed the first semester subject "Applied Mathematics I" and to have elementary knowledge of symbolic calculus programs.

2. Learning results

The student, in order to pass this subject, must demonstrate the following learning results:

- Solve mathematical problems that may arise in Architecture and Engineering.
- Have the ability to apply the acquired knowledge of calculus, geometry and differential equations.
- Know how to use numerical methods in the solution of some mathematical problems.
- Know the reflexive use of symbolic and numerical calculation tools.
- Possess scientific-mathematical thinking skills that allow them to ask and answer certain mathematical questions.
- Have the ability to handle mathematical language; particularly, symbolic and formal language.

3. Syllabus

According to the verification report of the degree, this term is structured around the following contents:

1. Curves in the plane and in space: Frenet's Trihedron; bending and torsion.
2. Functions of several variables, limits and continuity.
3. Partial and differential derivatives; the chain rule.
4. Extremes. Conditioned extremes: The Lagrange multiplier method.
5. Double integral; changes of variable.
6. Triple integrals.
7. Integral line. Work and energy. Green's Theorem.
8. Surfaces. Surface integrals; Stokes and Gauss theorems.
9. EDO: Basic concepts, existence and uniqueness, analytical resolvability.
10. Qualitative studies: Fixed points and linear stability.
11. Numerical methods: Euler and Runge-Kutta.

12. ODE of order greater than one: Oscillators; resonance. Stability of beams.

13- Numerical methods for ODEs of order two and higher: IVP and FVP (MDF and MEF).

14- Introduction to PDEs.

15- PDE - Separation of variables: Vibrations.

4. Academic activities

The term, of 6 ECTS credits (150 hours), will be organized as follows:

- **Theory classes (3 ECTS: 30 h)**: Goals and contents of the subject. Development and interpretation of theories and methodologies and their implications. Use of basic didactic resources such as the blackboard and complements with projector and other technological means. Active student participation will be encouraged by posing questions and short exercises.
- **Problem solving classes (1,75 ECTS: 17,5 h)**: Theoretical and practical questions with different levels of difficulty, in increasing order to facilitate the assimilation and familiarization with theories, concepts, approximations and calculation methods. The active participation of the students will be encouraged by proposing them to solve the selected problems on the blackboardthemselves.
- **Sessions dedicated to the use of computer tools (1 ECTS: 10 h):** Presentation and explanation of the use of computer tools useful for the subject. In any case, students will be encouraged to use these tools continuously and recurrently throughout the term.
- **Seminar classes (0.25 ECTS:** 2.**5 h)**: Activities of master classes given by teachers of other subjects of the career with the objective of presenting to the students the different applications of Mathematics in Architecture and Engineering.
- **Tutoring**: Individualized, giving personalized attention by the teacher. An attempt will be made to offer an appropriate timetable to students and its use will be encouraged on a continuous basis throughout the term (and not only on the eve of tests). Resolution of some complex problems proposed and clarification of doubts.
- **Autonomous work and study (90 hours)**:

Study and understanding of master class theory.

Understanding and assimilation of the practical problems developed in class.

Preparation of the proposed problems and assignments.

Use of computer tools.

Preparation of written tests.

- **Examinations:** Written tests will be given within the time frame of the theoretical sessions and problems.

5. Assessment system

There will be two types of evaluation: the **Continuous** Assessment and the **Final Global Assessment**.

The **Continuous** Assessment will be composed of 6 tests: 4 controls with a weight of 5% each and 2 midterm exams global with a weight of 40%, which will be carried out throughout the academic year; while the **Final Global** assessment is the Examination of call set by the center.

Students will be able to pass the subject by **Continuous Assessment** if they obtain a grade of 5.0 or higher on the 6 tests taken as a whole. Those students who have not been able to pass the subject by the method of Continuous assessment must take the **Ordinary and Extraordinary** call of Final Global assessment in force and must obtain at least a grade of 5.0 to pass the subject, being the exam about all the content studied in the subject in the current academic year.