Universidad Zaragoza

Year : 2019/20

28605 - Mathematics applied to building II

Syllabus Information

Academic Year: 2019/20
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

1.1.Aims of the course

Basic mathematical methods belong to a wide class of tools which engineering professionals should use to solve the problems that may occur at work. Among the learning goals we find the mastery of some practical and theoretical techniques leading to the direct application of the topics taken in this course to real problem solving, using realistic computational methods built in efficient and reliable software packages. Therefore, it is of utmost importance in the proper training of an engineer to acquire the learning goals covered in this course. The ultimate goal is that students integrate basic knowledge of the course in all kinds of topics related with Building Engineering. This will allow the students to pursue more advanced courses and to acquire additional skills leading to his or her professional development.

1.2.Context and importance of this course in the degree

This course is compulsory and belongs to the basic education module. It is taken during the second semester of the second year of the Bachelor's Degree in Building Engineering. This course provides skills in tools relevant to different subsequent courses with direct application in Physics, Mechanics, Structures, Statistics, Economy, etc. In many cases, the unifying approach of Mathematics simplifies problems encountered in another subjects, and similarities between seemingly different problems become apparent, providing insight into solutions.

1.3.Recommendations to take this course

The recommended profile to take the Mathematics applied to building II course is to possess working knowledge of differential and integral calculus in one variable, as covered in the Mathematics applied to building I course. In addition, it is highly advisable that the student be familiar with symbolic computation software tools.

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

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

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 theory sessions, practice sessions, tutorials and autonomous work and study.

A strong interaction between teacher-student is promoted. 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.

The current course, *Matemática Aplicada a la Edificación II*, is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary forms, which are: the theoretical concepts of each teaching unit, the solving of problems or resolution of questions, at the same time supported by other activities.

4.2.Learning tasks

This 6 ECTS (150 hours) course is organized as follows:

- **Theory sessions**: 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.
- **Autonomous work and study**
    - Study and understanding of the theory taught in the lectures.
    - Understanding and assimilation of the problems and practical cases solved in the practice sessions.
    - Preparation of seminars, solutions to proposed problems, etc.
    - Preparation of the written tests for continuous assessment and final exams.

4.3.Syllabus

This course will address the following topics:

1. Planar and spatial curves: Frenet frame; curvature and torsion.
2. Functions of several variables. Limits and continuity.
3. Partial derivatives and differential; the chain rule.
4. Extrema. Constrained extrema: the method of Lagrange multipliers.
5. Double integral; change of variables.
6. Triple integrals.
7. Line integral. Work and energy. Green's Theorem.
8. Surfaces. Surface integrals; Stokes and Gauss Theorems.
9. Ordinary Differential Equations: basic concepts, existence and uniqueness.
10. Analytic solvability.
11. Qualitative aspects: fixed points and linear stability.
12. Numerical methods: Euler, Runge-Kutta.
13. Higher orden ODE: Oscillators; resonance. Beam stability.
14. Higher order numerical methods (FDM y FEM).
15. Introduction to Partial Differential Equations: separation of variables; vibrations.

4.4.Course planning and calendar

Week	Theme	Topic	Tests	Weight	Content
1	1	Curves			
2	2	Continuity			
3	3	Differentiability			
4		Extrema	1st test	5	Dif./Cont.
5	4	Multiple Integrals	2nd test	5	Integrals
6	5	Line Integrals			
7	6	Surface Integrals	1st Exam	40	Several V.
8	7	ODE: Introduction, 1st order			
9		Linear equations	3rd test	5	1st order ODE
10	8	Linear stability			

11	9	Numerical Methods			
12	10	Oscillators, resonance	4th test	5	ODE
13	11	Beam Stability			
14	12	PDE: Introduction			
15		Separation of variables	2nd Exam	40	ODE, PDE

Further information concerning the timetable, classroom, office hours, assessment dates (https://eupla.unizar.es/asuntos-academicos/examenes.) and other details regarding this course will be provided on the first day of class or please refer to the Faculty of EUPLA website and Moodle.

4.5.Bibliography and recommended resources

Main resources

- Subject presentations (available in the subject's Moodle webpage)
- Problem sheets (available in the subject's Moodle webpage)
- Symbolic calculus tool `Maxima` http://andrejv.github.io/wxmaxima/.

http://biblos.unizar.es/br/br_citas.php?codigo=28605&year=2019