1. OVERVIEW

Subject area	Mathematical Analysis II
Degree	Bachelor's Degree in Physics
School/Faculty	Architecture, Engineering and Design
Year	First
ECTS	6 ECTS
Type	Core
Language(s)	Spanish
Delivery mode	On campus
Semester	Second semester

2. INTRODUCTION

Mathematical Analysis II is one of the 6 ECTS subject areas in the first year of the Bachelor's Degree in Physics that belongs to the subject "Mathematical Methods in Physics".

Calculus is the branch of mathematics that deals with variation and motion. Wherever motion or growth is involved, calculus has been, since the times of Newton and Leibniz, the best mathematical tool for developing the skills to approach and solve such problems. Calculus is used to verify scientific theories about issues like pressure in liquids, fluids in motion, mechanical vibrations and engineering problems. Mathematical Analysis II will allow students to build the skills needed to fully engage with practically all other subject areas on the degree programme, where they will need to apply their acquired knowledge.

Students will need to understand the concepts, procedures and strategies of infinitesimal, differential and integral calculus, in one or more variables, to then apply them in practical exercises and problems.

3. SKILLS AND LEARNING OUTCOMES

Key skills (CB, by the acronym in Spanish):

- CB3 - Students have the ability to gather and interpret relevant data (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.

Transversal skills (CT, by the acronym in Spanish):

- CT4 - Written communication/Oral communication: Ability to communicate and gather information, ideas, opinions and viewpoints in order to understand and be able to act upon them, whether they are through spoken word and gestures, or through written word and/or visual aids.
- CT5 - Problem solving: Be able to critically evaluate information, separate complex situations into their constituent parts, recognise patterns, and consider alternatives, different approaches and perspectives in order to find optimal solutions and negotiate efficiently.

Specific skills (CE, by the acronym in Spanish):

- CE05 - To understand and know how to use the mathematical and numerical methods used in physics and in handling experimental data.

Learning outcomes (RA, by the acronym in Spanish):

- To skilfully handle mathematical functions of two or more variables and to characterise their behaviour through partial differentiation.
- To successfully apply the method of successive integration in multivariable integral calculus.
- To solve integrals of several variables, line integrals and surface integrals in mathematical contexts and physical science contexts. To know how to apply the theorems of Green, Stokes and Gauss.

The following table shows how the skills developed in the subject area match up with the intended learning outcomes:

Skills	Learning outcomes
CB3, CT4, CT5, CE05	To skilfully handle mathematical functions of two or more variables and to characterise their behaviour through partial differentiation.
CB3, CT4, CT5, CE05	To successfully apply the method of successive integration in multivariable integral calculus.
CB3, CT4, CT5, CE05	To solve integrals of several variables, line integrals and surface integrals in mathematical contexts and physical science contexts. To know how to apply the theorems of Green, Stokes and Gauss.

4. CONTENTS

This subject area will cover the following content:

1. Functions of several variables
2. Differential calculus in several variables
3. Integral calculus in several variables
4. Line integrals
5. Surface integrals

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Collaborative learning: Students learn to collaborate with other people (classmates and professors) in order to find creative, comprehensive and constructive solutions to questions and

problems that arise from the given case studies, using all relevant knowledge and material resources available.

- Problem-based learning: Students are given problems and asked to solve them, working individually or in groups.
- Lectures: Presentations by the professor with the necessary technological tools to maximise comprehension of the learning content.
- Workshop-based learning: Students acquire knowledge through learning to use the tools and equipment needed in their profession. In other words, "learning by doing".

Guided academic activities: Individual and group work that is more independent, including information searches, written summaries, debates and the public defence of projects.

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Lectures	50
Oral presentations of projects and debates	6
Report writing	20
Assessment	6
Practical activities (problems, written work, projects, workshops and/or lab work)	20
Tutorials	16
Independent working	32h
TOTAL	**150**

7. ASSESSMENT

The assessment systems, plus their weighting in the final grade for the subject area, are as follows:

On campus:

Assessment system	Weighting
Midterm knowledge test	20%
Group project	20%

Individual/group activities	30%
Integrative knowledge test	30%

On the Virtual Campus, when you open the subject area, you'll find details of your assessable tasks, including the submission dates and assessment procedures for each task.

8. BIBLIOGRAPHY

The recommended reading for the subject area is listed below. All publications are available in the Dulce Chacón University Library for reference or loan.

Other resources

- We recommend watching the videos on the AulaUE YouTube channel: https://www.youtube.com/user/AulaUE