1. OVERVIEW

Subject area	Mathematical Analysis
Degree	Bachelor's Degree in Industrial Organisation Engineering
School/Faculty	Faculty of Science, Engineering and Design
Year	First
ECTS	6 ECTS
Type	Core
Language(s)	Spanish
Delivery Mode	On campus and Online
Semester	1

2. INTRODUCTION

Mathematical Analysis is a branch of maths which studies real and complex numbers and their functions. We start to develop these skills beginning with the rigorous formulation of calculus and study aspects such as continuity, integration and differentiability of different forms. It has wide application across many different fields as it provides a base for lots of more specific subject areas.

This subject teaches aspects associated with differential and integral calculus, optimisation, differential geometry, sequences and series, and much more.

This subject therefore provides a suitably profound and solid mathematical base offering both analytical and graphical analysis skills which can be applied in further areas of study.

3. SKILLS AND LEARNING OUTCOMES

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

- CB1: Students have shown their knowledge and understanding of a study area originating from general secondary school education, and are usually at the level where, with the support of more advanced textbooks, they may also demonstrate awareness of the latest developments in their field of study.

- CB4: Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

Cross-curricular skills (CT, by the acronym in Spanish):

- CT02: Independent learning: skills for choosing strategies to search, analyse, evaluate and manage information from different sources, as well as to independently learn and put into practice what has been learnt.

- CT03. Teamwork: ability to integrate and collaborate actively with other people, areas and/or organisations to reach common goals.

- CT04. Written/spoken communication: ability to communicate and gather information, ideas, opinions and viewpoints to understand and be able to act, spoken through words or gestures or written through words and/or graphic elements.

- CT05. Analysis and problem-solving: be able to critically assess information, break down complex situations, identify patterns and consider different alternatives, approaches and perspectives in order to find the best solutions and effective negotiations.

- CT06. Adapting to change: be able to accept, consider and integrate different perspectives, adapting your own approach as required by the situation at hand, and to work effectively in ambiguous situations.

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

- CE1. Ability to solve mathematical problems which may arise in engineering and data science by applying linear algebra, geometry, differential and integral calculus, discrete mathematics and optimisation.

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

- RA1: Successfully solve maths problems which may arise in engineering and data science projects, whether they involve algebra, calculus, statistics or optimisation.

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

Skills	Learning outcomes (RA, by the acronym in Spanish)
CB1, CB4, CT02, CT03, CT04, CT05, CT06, CE1	RA1: Successfully solve maths problems which may arise in engineering and data science projects, whether they involve algebra, calculus, statistics or optimisation.

4. CONTENTS

1. Differential calculus of one or more variables.
2. Integral calculus of one or more variables.
3. Optimisation.
4. Differential geometry.
5. Sequences and series.
6. Limits.
7. Introduction to differential equations.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Collaborative learning: students learn to work with other people (colleagues and professors) to find creative, comprehensive and constructive solutions to questions and problems that arise from the given case studies, using relevant knowledge and available resources in relation to each subject.
- Problem-based learning: students face problems they must solve either working as a team or independently.
- Master Lecture: presentations by the professor using the appropriate technological tools to facilitate understanding of the subject matter.
- Gamification: students learn through game-based activities.

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
Master lectures	30
Problem-solving and case studies	22
Practical seminars and debates/discussions	21
Learning contract (definition of interests, needs and objectives)	1
Autonomous learning	68
Tutorials	8
TOTAL	**150**

Online:

Learning activity	Number of hours
Master lectures and online lectures	30
Problem-solving	23
Case studies	10
Online forum (debates and discussions)	8
Learning contract (definition of interests, needs and objectives)	2

Study of course content and additional documentation (independent working)	67
Online tutorials	8
On campus knowledge tests	2
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
On Campus tests to evaluate objectives of theory/practical learning (exam-type objective tests, written compositions, oral presentations, case studies/problem solving, debates, simulation tests)	50%
Off-site tests to assess theory/practical learning (case studies/problem-solving)	30%
Attitude assessment tests (attitude assessment rubrics, class participation)	10%
Self- and co-assessment (learning contract, learning objectives)	10%

Online:

Assessment system	Weighting
On Campus knowledge test	60%
Off-site activities	25%
Attitude	5%
Self-assessment	10%

On the Virtual Campus, when you open the subject area, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

8. BIBLIOGRAPHY

The reference publication to accompany this subject area is:

- J.I. Barragues Fuentes. Análisis Matemático, (2010). Ed. Pearson

The recommended bibliography is indicated below:

- T.M. Apóstol. Análisis Matemático, (2009). Ed. Reverte
- R Courant. Introducción al Cálculo y al Análisis Matemático, (1987), Vol 1. Ed. Limusa.
- B.P. Demidovich. Problemas y ejercicios de Análisis Matemático (1993). Ed. Paraninfo.