1. OVERVIEW

Subject area	Mathematical Analysis
Degree	Bachelor's Degree in Computer Engineering
School/Faculty	School of Architecture, Engineering and Design
Year	First
ECTS	6 ECTS
Type	Core
Language(s)	Spanish
Delivery mode	On-campus/Online
Semester	First semester
Year	2022/2023
Coordinating professor	Luis Miguel Gracia Expósito

2. INTRODUCTION

Mathematical Analysis/Calculus is the branch of mathematics that deals with variation and motion. Since the times of Newton and Leibniz, wherever motion or growth is involved, Calculus continues to be the best mathematical tool for developing the skills to approach and solve such problems. Calculus is used to verify scientific theories about issues such as pressure in liquids, fluids in motion, mechanical vibrations, engineering problems, etc.

Mathematical Analysis will allow students to acquire the skills needed to fully engage in subjects such as "Fundamentals of physics for Engineering", "Statistics and optimisation" and practically all other subject areas in the degree programme, where they must apply their acquired knowledge of calculus.

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.

This subject area belongs to the "Mathematics" subject and is taught in the "Basic Training" module, formed by the following subjects:

- Mathematical Analysis 6 ECTS (1st year)

• Algebra 6 ECTS (1st year)

• Statistics and Optimisation 6 ECTS (2nd year)

3. SKILLS AND LEARNING OUTCOMES

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

CB1: Students have demonstrated 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.

CB2: Students can apply their knowledge to their work or vocation in a professional manner and possess the skills which are usually evident through the forming and defending of opinions and resolving problems within their study area.

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.

• General skills (CG, by the acronym in Spanish):

CG8. Knowledge of the basic topics and technologies, which enable the students to learn and develop new methods and technologies, as well as give them the versatility to adapt to new situations.

CG10. Knowledge to carry out measurements, calculations, valuations, appraisals, expert's reports, studies, reports, task planning and other similar computer-related work.

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

CT3: Ability to adapt to new circumstances: Being able to evaluate and understand different points of view, taking different approaches to suit the situation.

CT6: Oral or written 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.

CT15: Responsibility: Ability to fulfil commitments to themselves and others when undertaking a task and try to meet a range of objectives within the learning process. Ability to face and accept the consequences of actions taken freely.

CT17: Teamwork: Ability to integrate and collaborate actively with other people, departments and/or organisations in order to reach common goals.

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

CE1. Ability to solve mathematical problems that may arise in the field of engineering. Ability to apply knowledge on linear algebra, geometry, differential geometry, differential and integral calculus,

differential and partial differential equations, numerical methods, numerical algorithms, statistics and optimisation.

CE3. Ability to understand and master the basic concepts of discrete mathematics, logic, algorithmics and computational complexity, and their application to solve engineering problems.

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

RA1: Apply the principles of complex variable calculus and its application in different branches of Engineering.

RA2: Analyse the behaviour of the real-valued functions of one or various variables, determining the location of their critical points by means of derivation.

RA3: Apply the different integration techniques needed for the calculation of primitives, areas and volumes.

RA4: Apply the characterisation and calculation of numerical sequences and series, in particular, the Taylor series.

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

Skills	Learning outcomes
CB1, CB2, CB3, CT3, CT6, CT15 CG8, CE1, CE3	RA1
CB1, CB2, CB3, CT3, CT6, CT15, CT17 CG8, CE1, CE3	RA2
CB1, CB2, CB3, CT3, CT6, CT15, CT17 CG8, CE1, CE3	RA3
CB1, CB2, CB3, CT3, CT6, CT15, CT17 CG8, CE1, CE3	RA4

4. CONTENTS

- Real and complex numbers
- Real-valued functions of a real variable
- Sequences and series of real numbers
- Real-valued functions of various variables

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- **MD2. Lectures, subjects of study and seminars.** The "lectures" taught in the on-campus delivery mode are called subjects of study and seminars in the online delivery mode, and are conducted through readings on the topic, technical notes and webinars (which are recorded for students to access).

- **MD4. a) Group research** and/or **b) group problem-solving.** This learning method will be used for the development of both declarative and procedural knowledge. In method type a), a different topic will be assigned to each group to be investigated. Later, new groups will be formed with students who have all studied a different topic, and these new groups will be proposed comprehension and problem-solving activities. In method type b), a series of questions and short problem activities will be proposed to be solved in groups.

6. LEARNING ACTIVITIES

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

On campus:

Learning activity (AF, by the acronym in Spanish)	Number of hours
Lectures, reading on main topics and complementary materials, implementation of activities carried out independently and collectively	**50**
Group work	25
Independent working	50
Tutorials, academic monitoring and assessment	25
TOTAL	**150 h**

Hybrid learning:

Learning activity (AF, by the acronym in Spanish)	Number of hours
Independent working	50
Independent reading on complementary topics and materials and implementation of activities carried out independently. Asynchronous group discussion on the Campus Virtual forum, and online seminars	50
Group work	25
Tutorials, academic monitoring and assessment	25
TOTAL	**150 h**

7. ASSESSMENT

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

On campus:

Assessment system	Weightin
On-campus knowledge tests	30 – 40 %
Reports and papers	15 - 30 %
Alternative assessment methods	15 - 30 %
Field experience (discussion forum)	0 - 10 %
Skills	15%

Hybrid learning:

Assessment system	Weightin
On-campus knowledge tests	60%
Reports and papers	10 - 20 %
Alternative assessment methods	10 - 20 %
Field experience (discussion forum)	0 - 5 %
Skills	10 - 20 %

The “On-campus knowledge tests” comprise of:

• The final integrative test, which must be passed in order to complete the year, and will assess all the content taught over the year, weighing 40% of the subject area’s final grade.

• The midterm follow-up test, which weighs 20% of the subject area’s final grade, will assess the content taught in the lectures prior to the official date of the test. It aims to encourage daily study and assess the students’ learning progress.

On the Campus Virtual, when you open the subject area, you will find all the details of your assessable tasks and the deadlines and assessment procedures for each task.

7.1. Ordinary exam period

To pass the subject area in the ordinary exam period, you will need a final grade of at least 5.0 out of 10.0 (weighted average) for the subject area.

In any case, you will need a grade of at least 5.0 in the final test for it to be included in the weighting with the other activities.

7.2. Extraordinary exam period (resits)

To pass the subject area in the ordinary exam period, you will need a final grade of at least 5.0 out of 10.0 (weighted average) for the subject area.

In any case, you will need a grade of at least 5.0 in the final test for it to be included in the weighting with the other activities.

Activities not passed in the ordinary exam period, or those not submitted, must be submitted after receiving the relevant corrections and feedback from the lecturer.

8. TIMELINE

The predicted timetable for the learning units of year are as follows:

Unit	Weeks
1	1, 2, 3, 4, 5
2	5, 6, 7, 8
Midterm Test	9
3	10, 11
4	12, 13, 14 and 16
Revision	17
Final Integrative Test	18

This timetable may be subject to modifications for teaching and/or logistical reasons, which will be notified to the student in due time and course.

9. BIBLIOGRAPHY

• LARSON R., et al., Calculus of a single variable. Brooks Cole, 2009.

• STEWART J., Cálculo de una variable: trascendentes tempranas. Cengage Learning, 2008 (6ª edición).

• STEWART J., Cálculo multivariable. International Thomson, 1999 (3ª edición).

AYRES F. and MENDELSON E., Schaum's Outline of Calculus. McGraw-Hill, 2012 (7th Edition).

10. DIVERSITY AWARENESS UNIT

Students with special educational needs:

To ensure equal opportunities, curricular adaptations or adjustments for students with special educational needs will be outlined by the Diversity Awareness Unit (UAD, Spanish acronym).

As an essential requirement, students with special educational needs must obtain a report about the curricular adaptations/adjustments from the Diversity Awareness Unit by contacting unidad.diversidad@universidadeuropea.es at the beginning of each semester.

11. STUDENT SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, degrees and the learning process.

These surveys will be available in the survey area of your campus virtual or by email.

Your opinion is essential to improve the quality of the degree. Many thanks for taking part.