

**Foundations of Mathematics**

Code: 104342  
ECTS Credits: 6

Degree	Type	Year	Semester
2503758 Data Engineering	FB	1	1

## Contact

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## Teaching groups languages

You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

## Teachers

Eloi Torrents Juste

## Prerequisites

The mathematical content of the Baccalaureate

## Objectives and Contextualisation

On the one hand, there will be a review of the fundamental concepts studied in the Baccalaureate. On the other hand, new concepts (such as calculus and integration in several variables) will be introduced. Special emphasis will be placed on the use of all these tools in data processing.

## Competences

- Demonstrate sensitivity towards ethical, social and environmental topics.
- Make a critical evaluation of work carried out.
- Search, select and manage information and knowledge responsibly.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Use the concepts and methods of algebra, differential and integral calculus, numerical methods, statistics and optimisation necessary for solving engineering problems.

## Learning Outcomes

1. Demonstrate sensitivity towards ethical, social and environmental topics.
2. Identify and apply the basic theorems of the continuous functions of a variable.
3. Identify when differential and integral calculus is needed.
4. Make a critical evaluation of work carried out.
5. Perform derivatives, partial derivatives and integrals.
6. Search, select and manage information and knowledge responsibly.
7. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.

## Content

1. Functions of one variable
  - 1.1. Domains. Inequalities, limits and continuity.
  - 1.2. Derivation. Absolute and relative extremes.
  - 1.3. Graphical representation of functions
  - 1.4. The Taylor Formula and its applications.
  - 1.5. Zero functions of one variable. Bisection and Newton methods.
2. Sequences of real numbers.
  - 2.1. Cauchy's sequences. The concept of limit. Calculation of limits.
3. Integration
  - 3.1. Definitions and interpretation.
  - 3.2. Integration techniques: Parts and change of variables. Rational integrals.
  - 3.3. The defined integral. Fundamental calculus theorem. Calculation of areas.
4. Functions of several variables.
  - 4.1. Curves and level surfaces.
  - 4.2. Continuity.
  - 4.3. Partial derivatives. Chain rule.
  - 4.4. Gradient and directional derivatives.
  - 4.5. Differentiable functions. Tangent planes.
  - 4.6. Maximum and minimum values. Relative extremes.
  - 4.7. Optimization. Gradient and Lagrange method.
5. Multiple integration.
  - 5.1. Iterated integrals. Fubini's theorem.
  - 5.2. Variable changes. Polar, cylindrical and spherical coordinates.

## Methodology

There will be two hours a week of theoretical classes in which we will introduce the concepts and state the results that form the fundamentals of the course.

Students will receive exercise lists in which they work in the two hours per week of practical classes. Previously, they will have read and worked on the proposed exercises and problems. This will ensure participation in the classroom and facilitate the assimilation of the concepts.

THE VIRTUAL CAMPUS will be used as an essential means of communication. It is recommended to use the institutional email of the teachers, which appears in this guide. Students who want to contact teachers by email must use the institutional address provided by the university (campus.uab.cat). Naturally, students will have tutoring hours (to be agreed upon) in the teachers' offices.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Preparation of partial tests	15	0.6	
Problem Classes	24	0.96	4, 6, 1, 5, 2, 3, 7
Theory Classes	24	0.96	4, 6, 1, 5, 2, 3, 7
Type: Autonomous			
Resolution of problems and delivery of evaluable problems	37	1.48	4, 6, 5, 2, 3, 7
Theory study	25	1	

## Assessment

### a) Evaluation process and activities planned

The course consists of the following assessment activities

#### Recoverable activities:

Two mid-term exams E1 and E2 with a weight of 60% of the final grade (25% for the first and 35% for the second).

#### Non-recoverable activities:

Two or three problem papers with deliveries will give a P grade.

Two or three group activities to be carried out in the problem classes with a weight of 20% of the final grade. These two activities will give a C grade.

In order to pass the course, by means of the continuous assessment, it will be necessary to

$E1 \geq 3.5$ ,  $E2 \geq 3.5$ ,  $P \geq 3$ ,  $C \geq 3$  and  $F = 0.25E1 + 0.35E2 + 0.2P + 0.2C \geq 5$ .

If any of the above parameters are not met then the final grade will be the minimum between F and 4.5.

### b) Programming of evaluation activities:

The calendar of assessment activities will be given on the first day of the course and will be made public through the Virtual Campus and on the School of Engineering website, in the exams section.

c) Recovery process:

There will be a make-up exam where each of the mid be able to take the make-up exam. Students may sit the make-up exam to improve their grade, but should be a may receive a lower grade.

(d) Procedure for the review of qualifications:

For each assessment activity, a place, date and time of review will be indicated in which students can review the activity with the teaching staff. In this context about the grade of the activity, which will be evaluated by the teaching staff responsible for the subject. Students who do not attend this review will not be able to review the activity at a later date.

e) Qualifications:

MH degree is the decision of the lecturers responsible for the subject. UAB regulations state that MHs can only be awarded to students who have obtained a final grade of 9.00 or higher. Up to 5% of the total number of students enrolled may be awarded MHs.

The student will be considered to have passed the course if he/she attends at least one makeup activity and/or one non-make-up activity.

f) Consequences of irregularities committed by students: copying, plagiarism, ....

Without prejudice to other disciplinary measures deemed appropriate, and in accordance with current academic regulations, irregularities committed by a student that may lead to a variation of the grade in an evaluable activity will be graded with a zero (0). Assessment activities graded in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities in order to pass the subject, this subject will be directly failed, with no opportunity to recover it in the same course. These irregularities include, among others:

- copying all or part of a practice, report, or any other assessment activity; - allowing copying;
  - present a group work not done entirely by the group members (applied to all members, not only to those who have not worked);
  - unauthorised use of AI (e.g. Co-Pilot, ChatGPT or equivalent) to solve exercises, practicals and/or any other assessable activity.
  - present as their own materials produced by a third party, even if they are translations or adaptations, and in general work with elements that are not original and exclusive to the student.
  - talk to peers during individual theoretical and practical assessment tests (examinations);
  - copying or attempting to copy from other students during theoretical and practical assessment tests (exams);
  - use or attempt to use written material related to the subject during the theoretical and practical assessment tests (examinations), when these have not been explicitly permitted.
- In summary: copying, allowing copying or plagiarizing (or the attempt to) in any of the assessment activities is equivalent to a SUSPENSION, non-compensable and without validation. of parts of the subject in subsequent years.

f) Assessment of repeat students:

Repeating students must take the course in its entirety. No marks from previous years will be maintained.

The proposed teaching methodology and assessment may undergo some modification depending on the restrictions imposed by the health authorities.

This English version of the guide is a translation of the Catalan version. In the event of any discrepancy between the two, the correct version for all purposes is the Catalan version.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Group activities in problem classes	20% of the final note	6	0.24	4, 6, 1, 5, 2, 3, 7
Partial tests	60% of the final grade	4	0.16	5, 2, 3, 7
Two or three tests in class and/or problem delivery	20% final grade	15	0.6	4, 6, 5, 2, 3, 7

## Bibliography

1. D. Pestana, J. Rodríguez, E. Romera, E. Touris, V. Alvarez, A. Portilla. Curso Práctico de Cálculo y Precálculo, Ed. Ariel, 2000.
2. S.L. Salas, E. Hille. Calculus Vol. 1, Ed. Reverte, 2002.
3. C. Neuhauser, Matemáticas para ciencias. 2a, edición Pearson, Prentice Hall.
4. J.M. Ortega, Introducció a l'Anàlisi Matemàtica. Manual UAB

## Software

SageMath i/o Python