

Foundations of Mathematics

Code: 104342
ECTS Credits: 6

Degree	Type	Year	Semester
2503758 Data Engineering	FB	1	1

Contact

Name: Joaquin Martín Pedret
Email: joaquin.martin@uab.cat

Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

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

Recoverable activities:

Two partial exams E1 and E2 with a weight of 60% of the final grade (20% the first partial and 40% the second).

There will be a recovery exam of where these partials could be recovered. Students may take the exam to improve their grade, but they should be aware that they can get a lower grade.

Unrecoverable activities

Two or three delivery of problems and/or tests in class with a weight of 20% of the final grade. These three activities will give a P-note.

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

Students pass the course if:

$$E1 \geq 3.5, E2 \geq 3.5, P \geq 3, A \geq 3, \text{ and } F = 0.2E1 + 0.4E2 + 0.2P + 0.2C \geq 5.$$

If any of these parameters is not achieved, then the final grade will be the minimum between F and 4.5.

Students who have more than 9 on the final grade will have a MH up to the 5% enrollment limit. If you have more than 5% of the previous students, those with the highest grades will be MH.

The student have applied to the subject if he or she is presented to at least one recoverable activity and one of non-recoverable activities.

Repeater students must take the course completely. Previous grades will not be maintained.

Without prejudice to other disciplinary measures and in accordance with current academic regulations, any irregularity committed by a student that may lead to a variation in the qualification will be rated with zero (0). Evaluation activities rated in this manner by this procedure will not be recoverable. If it is necessary to pass any of these evaluation activities to pass the subject, this subject will be suspended directly, without the possibility of recovering it in the same course. These irregularities include, but are not limited to: the total or partial copying of a practice, report or any other evaluation activity; Allow copying; Group work not done entirely by group members; Present as their own materials those made by a third person, and in general works with the non-original and exclusive elements of the student; Have communication devices (such as mobile phones, smartwatches, etc.) accessible during individual theoretical-practical tests (exams).

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

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