UAB
Universitat Autònoma de Barcelona

Calculus I

Code: 100141
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500097 Physics	FB	1

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

There are no requirements.

Nevertheless, the preparatory course "Curs propedèutic de Matemàtiques per als graus de Física i de Matemàtiques" is recommended to students who have had difficulties with High School mathematics.

Objectives and Contextualisation

The basic concepts of real variable calculus are introduced.

The concepts of limit, continuity and derivation are introduced. The student will learn the corresponding practcal techniques.

Competences

- Develop strategies for analysis, synthesis and communication that allow the concepts of physics to be transmitted in educational and dissemination-based contexts
- Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
- Use mathematics to describe the physical world, selecting appropriate tools, building appropriate models, interpreting and comparing results critically with experimentation and observation

Learning Outcomes

1. Argue with logical rigor.
2. Calculate limits of sequences and functions.
3. Calculate the Taylor expansion of a function, and estimate the remainder.
4. Calculate the derivative of a function.
5. Determine maximums and minimums of a function.
6. Express definitions and theorems rigorously.
7. Transmit orally and in writing, in a clear manner, the logical-mathematical reasoning that leads to problem resolution.
8. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments

Content

1. Preliminars: Sets, correspondences, maps. Natural, Integer and Rational Numbers. Induction.
2. Real Numbers: Definition of R. Properties of real numbers. Elementary topology. Cauchy sequences and convergent sequences. Computation of límits.
3. Functions of a real variable: Límits of functions and continuity. Theorems on continuous functions. Infinities and infinitessimals.
4. Derivation: Derivative and differential. Mean value Theorems. Monotony. L'Hôpital's rules. Taylor's Polynomial and Taylor's formula. Concavity, convexity and inflection.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical classes	21	0.84	1, 2, 3, 4, 5, 6, 7, 8
Theory classes	29	1.16	1, 2, 3, 4, 5, 6, 7, 8
Type: Autonomous			
Personal study	40	1.6	2, 3, 4, 5, 6
Problems solving	51	2.04	1, 2, 3, 4, 5, 6, 7

Theory classes: exposition of the theoretical body of the subject.

Practical Classes: explanation of the resolution of some problems of the list previously accessible to the students and guidance for the resolution of the rest.

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.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Re-evaluation	80% (only the tests can be re-evaluated)	3	0.12	1, 2, 3, 4, 5, 6, 7, 8
Take-home exercices	20%	0	0	1, 2, 3, 4, 5, 6, 7, 8
Two tests	80% (40% each one)	6	0.24	1, 2, 3, 4, 5, 6, 7, 8

The evaluation is based on two tests with a global weight of 80% and on the assessment of the student work (take-home exercices) with a global weight of 20%.

The re-evaluation allows only to improve the qualification of the tests, the qualification of the continuous work is not recoverable.

In order to qualify for the re-evaluation it will be necessary to have completed at least the two partial exams.

Single Assessment:

The students following the single evaluation modality must:

- Present the same take-home exercicess as the rest of the students, with the same deadline if possible or, if not possible, the same day as the final test (20%).
- Take a final test that will be similar to the two partial tests (80%). This exam will take place at the same day, hour and location as the corresponding exam of the continuous evaluation.
- If necessary they could take the re-evaluation, that will be the same as fot the rest of the students.

Bibliography

Theory:

- A. Méndez, *Càlcul en una variable real*, notas de clase 2021. Available from the course's Campus Virtual (minimal basic bibliography)
- J. Rogawski, *Cálculo: Una variable* (2a ed.), Reverté 2016. (basic bibliography)
- J.M. Ortega, *Introducció a l'anàlisi matemàtica*, Manuals de la UAB 2002 (basic and deepening bibliography)
- M. Spivak, *Calculus*, *(3a ed.)*, Reverté 2019 link to ebook (basic and deepening bibliography)
- M. Brokate, P. Manchanda, A.H. Siddiqi, Calculus for Scientists and Engineers, Springer 2019 https://link-springer-com.are.uab.cat/book/10.1007/978-981-13-8464-6 (e-book available from UAB)

Problems (books with solved exercices):

- F. Aryes y E. Mendelson, *Cálculo diferencial e integral,* McGraw-Hill (Schaum).
- M. Spiegel, *Cálculo Superior*, McGraw-Hill (Schaum).
- B.P Demidovich, *5000 problemas de análisis matemático*, Paraninfo.

Software

No specific software will be used.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	2	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	morning-mixed
(TE) Theory	2	Catalan	first semester	morning-mixed