

Calculus I

Code: 100141
ECTS Credits: 6

Degree	Type	Year	Semester
2500097 Physics	FB	1	1

Contact

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Use of Languages

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

Teachers

Juan Manuel Apio Laguia

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 practical 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 \mathbb{R} . Properties of real numbers. Elementary topology. Cauchy sequences and convergent sequences. Computation of limits.
3. Functions of a real variable: Limits of functions and continuity. Theorems on continuous functions. Infinities and infinitesimals.
4. Derivation: Derivative and differential. Mean value Theorems. Monotony. L'Hôpital's rules. Taylor's Polynomial and Taylor's formula. Concavity, convexity and inflection.

Methodology

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.

Activities

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

Assessment

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

Assessment Activities

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

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. <https://elibro.net/es/lc/uab/titulos/46777> (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 exercises):

- 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.