

Calculus II

Code: 100142
ECTS Credits: 6

Degree	Type	Year	Semester
2500097 Physics	FB	1	2

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

Cosimo Nigro

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Prerequisites

There are no prerequisites. Nevertheless, in the development of the subject it is assumed that the contents of *Càlcul I* have been assimilated.

Objectives and Contextualisation

This course is the natural continuation of *Càlcul I*. It develops the basic tools of calculus with a real variable and focuses on integration, numerical series and functional series. A first introduction to complex functions is also included.

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. Break down a periodic function into Fourier series.
3. Calculate integrals analytically.
4. Determine the convergence of improper integrals.
5. Determine the convergence of numerical series.
6. Determine the radius of convergence for a power series.
7. Express definitions and theorems rigorously.
8. Transmit orally and in writing, in a clear manner, the logical-mathematical reasoning that leads to problem resolution.
9. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments

Content

0. The field of the complex numbers

1. Riemann's Integral

The problem of the area under a curve. Riemann Integrability. The integral as a limit of Riemann sums. Fundamental theorem of calculus. Partial Integration. Change of variable.

2. Improper Integrales

Improper integral of a locally integrable function. Improper integrals of non-negative functions. Euler's Gamma function. Cauchy's principal value. Introduction to the Laplace Transform.

3. Number Series

Series of real numbers. General criterion of convergence. Absolute and conditional convergence. Absolute convergence criteria. Other convergence criteria.

4. Sequences and Series of functions

Sequences of functions. Pointwise and uniform convergence. Series of functions. Power series. Taylor series. Fourier series and an introduction to the Fourier Transform.

Methodology

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

Practical classes: exposition of the resolution of some problems from the list previously delivered to the students and some 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
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Type: Directed		
Practical classes	21	0.84
Theory classes	29	1.16
Type: Autonomous		
Personal study	40	1.6
Problem solving	51	2.04

Assessment

Take-home exercises (20% of the final grade): a problem will be proposed at the end of each chapter that has to be solved individually and delivered within the established term. Their qualification can not be improved in the re-evaluation.

First and second term tests (40% + 40% of the final grade): will be taken at the middle and at the end of the semester respectively.

Re-evaluation: allows to improve the grade obtained in the term tests (80% of the final grade). It is possible to improve both or only one of the terms but in order to be eligible for re-evaluation it is mandatory to at least have taken the two terms.

Non assessable: the student who has not carried out evaluation activities accounting for 50% of the final grade will be rated as non-assessable.

Single assesement

The students that opted for single assesement evaluation will have to perform a final evaluation that will first consist of a test of the whole syllabus. This test will take place on the same date, time and place as the second term test of the continuous assessment modality. Besides, before the exam, the student will deliver 2 documents with resolved problems of 2 problem sets proposed at an earlier date.

For the mark, 80% of the final mark will come from the exam and each of the set of problems will count 10%.

The students that opted for single assesement evaluation will have the chance of passing the module or improve their mark at the same re-evaluation test as the students that had opted for the continuous assesement option (both exams will be identical and will take place on the same day, time and in the same place), but it is mandatory to at least have taken the previous final test. At this test, it is only possible to improve the mark of the exam. The part of the problem sets can not be improved in the re-evaluation.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
First term test	40%	3	0.12	1, 3, 4, 7, 9, 8
Re-evaluation	80%	3	0.12	1, 3, 2, 6, 4, 5, 7, 9, 8
Second term test	40%	3	0.12	1, 2, 6, 5, 7, 9, 8

Bibliography

Theory:

- A. Méndez, *Càlcul en una variable real*, class notes 2021, available in Campus Virtual de la assignatura
- J. Rogawski, *Cálculo: Una variable* (2a ed.); Reverté 2016 <https://elibro.net/es/lc/uab/titulos/46777>
- J.M. Ortega, *Introducció a l'anàlisi matemàtica*, Manuals de la UAB 2002
- M. Spivak, *Calculus*, Reverté 2013
- 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> (ebook available UAB)

Problems (books containing solved exercises):

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

Software

No specific software is required.