UAB
Universitat Autònoma de Barcelona

Calculus II

Code: 100142
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500097 Physics	FB	1

Contact

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Teachers

Cosimo Nigro

Teaching groups languages

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

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

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. Applications.

2. Improper Integrales

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

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. Introduction to Fourier series.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical classes	21	0.84	
Theory classes	29	1.16	
Type: Autonomous			
Personal study	40	1.6	
Problem solving	51	2.04	

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

Practical classes: active discussion 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.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final Exam	45%	3	0.12	1, 2, 4, 5, 6, 7, 8, 9
Midterm Exam	45%	3	0.12	1, 3, 4, 7, 8, 9
Re-evaluation	90%	3	0.12	1, 2, 3, 4, 5, 6, 7, 8, 9
Take-home exercises	10%	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9

Take-home exercices (10% of the final grade): a problem set will be proposed during the semester that has to be solved individually or in group and delivered within the established term. This qualification can not be improved in the re-evaluation.

First and second term tests (45% + 45% of the final grade): will be taken at the middle and at the end of the semester respectively.

Re-evaluation: no mimimum grade required; it covers all the topics of the course (it will not be possible to be evaluated only on a part of the content). It is mandatory to have taken the midterm and final exam. Participation to improve the final mark is possible.

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 assessement

The students that opted for single assessement evaluation will have to perform a final evaluation that will first consist of a test of the whole syllabus. This test will takeplace on the same date, time and place as the second term test of the continuous assessment modality. Besides, beforethe exam, the student will deliver 1 document with resolved problems of a problem set proposed at an earlier date.

For the mark, 90% of the final mark will come from the exam and the problem set will count 10%.

The students that opted for single assessement evaluation will have the opportunity to take the same re-evaluation test as the students that had opted for the continuous assessement option (both exams will be identical and will take place on the same day, time and in the same place), but itis mandatory to at least have taken the previous final test. Participation to improve the final mark is possible. The grade of the take-home problem set cannot be improved.

Bibliography

Theory:

- A. Méndez, *Càlcul en una variable real*, class notes 2021, available in Campus Virtual de la asignatura
- 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 exercices):

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

Software

No specífic software is required.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	2	Catalan/Spanish	second semester	afternoon
(TE) Theory	1	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	2	Catalan/Spanish	second semester	afternoon