UAB
Universitat Autònoma de Barcelona

Calculus 1

Code: 104844
ECTS Credits: 6

2024/2025

Degree	Type	Year
2503852 Applied Statistics	FB	1

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Teachers

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Teaching groups languages

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

Prerequisites

This course is basic in nature and aims to familiarize students with the key concepts of the calculus of real functions of one variable and their use in problem-solving.

A solid knowledge of mathematics corresponding to secondary education is necessary, with special emphasis on the topics covered in high school.

Those who have not taken any mathematics courses recently will need to make an effort to catch up with the necessary material for this course, such as the basics of algebraic manipulation (calculations with fractions, polynomials, powers, trigonometric functions, etc.), as well as the basic study of functions (derivatives and graphical representation).

Objectives and Contextualisation

Familiarize students with the key concepts of the calculus of real functions of one variable: functions, limits, continuity, differentiation, integration, and power series, etc.

Throughout the course, students should acquire skills in practical calculations of operations with powers, logarithms, trigonometric functions, derivatives, limits, the calculation of antiderivatives, and power series. Beyond the mechanics of calculation, it is also very important for students to identify when and which of the tools and concepts of calculus they have studied apply to the resolution of specific problems they encounter, and, in particular, to the theory of probability and statistics inherent to the degree.

Learning Outcomes

1. KM01 (Knowledge) Recognise the language and basic tools of calculus in one and various variables.
2. SM01 (Skill) Apply the concepts studied to calculate the extreme points of functions and moments of random variable distributions.
3. SM03 (Skill) Solve, using numerical methods, optimisation problems, linear algebra and analysis in general that appear in science and, especially, in statistics.
4. SM04 (Skill) Resolve problems associated with the extreme points of functions of one and several variables, and the calculation of moments.

Content

1. Real numbers

1.1 Numbers. Inequalities. Absolut value. Intervals.

2. Differential Calculus

2.1 Functions of a real variable. Limits and continuity.
2.2 Exponential, logarithmic and trigonometric functions.
2.3 Derivative of a function. Derivation rules. Derivation of elementary functions.
2.4 Mean Value Theorem. Increasing and decreasing functions. Absolute and relative extrema. Optimization.
2.5 Higher order derivatives. Taylor's formula.

3. Integral Calculus

3.1 Definite integral. Fundamental theorems of integral calculus.
3.2 Fundamental theorems of integral calculus.
3.3 Calculus of primitives.
3.4 Aplications
3.5 Improper integrals

4. Series and power series

4.1 Numerical series and convergence.
4.2 Series of positive terms and convergence criteria.
4.3 Absolutely convergent series.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problems classes	24	0.96	
Theoretical classes	24	0.96	
Type: Supervised			
Tutoring	18	0.72	

Type: Autonomous		
Personal study	66	2.64

The learning process for the subject should essentially be based on the personal work of the students. Therefore, we emphasize the importance of the students' participation (and attendance) in the maximum number of classes where theoretical concepts are developed, problems are discussed and solved, practical exercises are carried out, and tutorials are held. However, (as in many other areas of human activity: music, sports...), merely observing how the teacher solves certain problems has very limited value. Knowledge is only achieved when one works autonomously and critically.

Directed activities are distributed according to the following types:

Development of concepts, techniques, and examples (theory): These are classes in which the teacher introduces the basic concepts and techniques related to the subject matter, showing examples of their application. It is recommended to complete the study using the books from the bibliography. On the "Campus Virtual/Moodle", the students will find helpful material for the course.

Problem-solving (problems): Problems from the lists previously posted on the CV will be treated. For the problem-solving sessions, it will be useful for students to have thought about and reflected on the problems before the class time. Thinking about and solving problems is considered essential for satisfactorily assimilating the concepts and results of the subject.

Practical use of acquired knowledge: One of the basic objectives is for students to become familiar with the process of translating real problems into mathematical language, know how to interpret them, and be able to use the concepts and techniques from the course to carry out a satisfactory resolution.

It is worth insisting that the best work methodology is based on constant work. If this is not done, classes become tedious and unproductive, as mathematics is based on building new knowledge on top of previously mastered concepts, in a pyramidal manner. This individual and autonomous study must always be linked to the practice of written mathematical communication. It is necessary to know how to write correctly on paper the ideas we have in mind about solving a particular problem.

The "Campus Virtual" will be used as a means of communication. Course notes, exercise lists, and all teaching materials used will be posted on the CV.

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
Mid term exam	40	4	0.16	KM01, SM01, SM03, SM04
Problem delivery	10	6	0.24	KM01, SM01, SM03, SM04
Recovery exam	90	4	0.16	KM01, SM01, SM03, SM04

Second mid term exam	50	4	0.16	KM01, SM01, SM03, SM04

Grading Instruments (all grades range between 0 and 10):

- A midterm written assessment will be conducted, resulting in a grade A1.
- A second midterm written assessment will be conducted, resulting in a grade A2.
- There will be a maximum of two written problem assignments, with a grade P.

Interviews will be conducted in person regarding the submission(s) of problem assignments to the students. The individuals to be interviewed will be chosen at the discretion of the professors. In the event of a second submission of problem assignments (which will also be decided at the discretion of the professors), the grade from the second submission can be used to recover the grade of the first problem assignment, P. If there is no second submission of problem assignments, the grade P will not be recoverable.

The course grade is calculated using the following formula:

Q1 = 0.1P + 0.4A1 + 0.5*A2.

That is, the problem assignments will account for 10% of the total course grade, the first midterm 40%, and the second midterm 50%.

The course will be successfully passed if the grade Q1 is greater than or equal to 5, and a minimum grade of 3.5 for each of the midterms A1 and A2 is required. The assignment of honors will be decided at this point.

Students with grade Q1 lower than 5 will have the opportunity to take a recovery exam, either for the first part of the course, the second part, or the entire course. If only the first or second part is recovered, the previous grade A1 or A2 will be replaced, respectively (i.e., the previous grade is forfeited). If the entire course is recovered, the new grade will be

Q2 = 0.1P + 0.9R,

where R is the grade of the recovery exam for the entire course. Students who, having taken the recovery exam (whether for the first or secondpart, or the entire course), achieve a corresponding Q1 or Q2 grade greater than or equal to 5 will pass the course, although the final course grade will be 5 if passed during the recovery period (regardless of the final Q1 or Q2 grade).

All assessment dates will be announced in advance through the Virtual Campus/Moodle to enrolled students.

Individuals who attend only one or none of the regular assessment evidences (A1, A2, or P), and who also do not attend the recovery exam (R) will receive the grade of "no avaluable".

Unique Evaluation

Students who opt for the single assessment modality must take a final written exam (resulting in a grade A). They must then submit the problem assignment(s) (resulting in a grade P). The faculty reserves the right to conduct an interview regarding the assignment(s).

The final grade will be Q = 0.1P + 0.9A.

If the grade Q is lower than 5, there will be another opportunity to pass the course through the recovery exam, which will be held on the date specified in the exam calendar. This exam will allow the student to recover the A grade. The P grade is not recoverable. If after the recovery period the final grade Q is greater than or equal to 5, the course will be succesfully passed, although in this case, the final course grade will be 5 *(regardless of the final grade Q). Not attending the unique evaluation written test nor its recovery will result in the grade of "no avaluable."*

Bibliography

1. Larson-Hostetler-Edwards, Cálculo I, Ed. Pirámide. 2002.
2. S. Salas, E. Hill, G. Etgen, Calculus volum I, Ed. Reverté, Barcelona 2002
3. J. Rogawski. Cálculo (una variable). Ed. Reverté. 2008.

Software

During the course there will be no sessions with specific software but it is highly recommended to use the software tools available from other courses to work the concepts of the course.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan	first semester	afternoon
(TE) Theory	1	Catalan	first semester	afternoon