Universitat Autònoma de Barcelona

2022/2023

Calculus 1

Code: 104844
ECTS Credits: 6

Degree	Type	Year	Semester
2503852 Applied Statistics	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: Yes
Some groups entirely in Spanish: No

Teachers

Joaquim Bruna Floris

Prerequisites

It is a basic course whose aim is to get students familiar with the key concepts of the one variable calculus (functions, limits, continuity, derivatives, integration and series) and the corresponding practical applications to real -life specific situations.

Those students who have a high-school mathematical background do not need any additional requirements. For those who haven't studied mathematics for a long time, it is advisable to refresh some basic stuff as calculus with fractions, polynomials, powers, trigonometric functions...

Objectives and Contextualisation

This is a basic course whose aim is to get the students familiar with the key concepts of calculus of a single variable: functions, limits, continuity, derivatives, integration and power series. They should gain technical skill in computing derivatives, limits, computations with powers, logarithms, trigonometric functions, primitives ... It is also a goal to apply the concepts studied to the resolution of specific problems.

Competences

- Calculate and reproduce certain mathematical routines and processes with agility.
- Critically and rigorously assess one's own work as well as that of others.
- Make efficient use of the literature and digital resources to obtain information.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Use quality criteria to critically assess the work done.

Learning Outcomes

1. Critically assess the work done on the basis of quality criteria.
2. Make effective use of references and electronic resources to obtain information.
3. Master the basic language and tools of calculus (one or more variables).
4. Reappraise one's own ideas and those of others through rigorous, critical reflection.
5. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
6. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.

Content

Unless the requirements enforced by the health authorities demand a priorization or reduction, the contents are:

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.

4. Integral Calculus.

4.1 Definite integral. Fundamental theorems of integral calculus.
4.2 Fundamental theorems of integral calculus.
4.3 Calculus of primitives.
4.4 Aplications

3. Series and power series

3.1 Numerical series and convergence.
3.2 Series of positive terms and absolutely convergent series.

Methodology

The learning process must be essentially based on the personal student work. We remark the importance that students attend as many theoretical and practical classes as possible. The classroom activities are distributed in the following way:

Development of conepts (theory): At the theoretical classes the teacher introduces the basic concepts and techniques corresponding to the course, showing examples and applications. It is highly reccomended to complete the study by using books at the bibliography. Some notes on the course will be uploaded at the Moodle Virtual Campus, which will be useful to follow the course.

Resolution of exercises (problem sessions): The lists of problems will be uploaded at the CV and those problems will be discussed in the classes. It is useful that students have previously worked on the problems in advance. Thinking and solving problems is essential to correctly understand the concepts and results of the course.

Appliction to concrete situations (seminars): The seminar sessions are devoted to discuss a selection of "real-life" problems that can be solved by applying the techniques of the course. One of the main golas is that students get familiar with the different steps of this process: translation to mathematical language, use of concepts and techniques of the course, resolution and , finally, interpretation.

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			
Problems classes	20	0.8	4, 3, 6, 5, 2
Seminars	8	0.32	4, 1, 3, 6, 5, 2
Theoretical classes	28	1.12	4, 3, 5, 2
Type: Supervised			
Tutoring	18	0.72	4, 3, 6, 5, 2
Type: Autonomous			
Personal study	60	2.4	4, 3, 6, 5, 2

Assessment

Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authoritues.

Grading activities (with values from 0 to 10):

- There will be a written mid-term exam with qualification A1.
- There will be a final written exam with qualification A2.
- There will also be a two problems delivery, with qualification P.

Following this procedure, the following qualification Q1 is computed:

$Q1 = 0,2*P + 0,3*A1 + 0,5*A2$

The course is passed if the student has performed the two written exams (A1, A2), $A2 \geq 3.5$ and $Q1 \geq 5$. If $5 > Q1 \geq 2,5$ a second-chance exam will be offered, with qualification R, which will provide the qualification

$Q2 = 0,2*P + 0,8*R$

In this case, the course is passed if $Q2 \geq 5$.

All grading activities will be previously announced at the CV to all the enrolled students of the course. Once announced, the dates of all grading activities will not be subject of any changes, unless some very exceptional, properly justified situation happens.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final exam	50	4	0.16	4, 1, 3, 5
Mid term exam	30	3	0.12	4, 1, 3, 5
Problem delivery	10	6	0.24	4, 1, 3, 6, 5, 2
Seminar grading activity	10	3	0.12	4, 1, 3, 6, 5, 2

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.

These three boks contain many problems, examples and applications. Furthermore, the concepts are introduced in a clear and illuminating way.

4. D. Pestana-J. M. Rodríguez et al. Curso práctico de Cálculo y Precàlculo. Ariel Ciencia. 2000.
5. B. Demidovich. 5000 problemas de Análisis Matemático. Thomson. 2002.

The last two books are calculus problems collections.

Digital books:

1. M. Brokate, P.Manchanda,A.H.Siddiqi, Calculus for Scientists and Engineers, http://link.springer.com/openurl?genre=book&isbn=978-981-13-8464-6
2. A.I. Khuri, Advanced Calculus with Applications in Statistics, https://onlinelibrary.wiley.com/doi/book/10.1002/0471394882

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.