



Real functions of a single variable

Syllabus

Course code:	6070
Number of ECTS credits:	12
Semester:	Full year (September-June)
Prerequisites:	None
Recommended components:	None
Language of instruction:	Spanish

Course description

This course treats the study of real numbers and real functions of one real variable. The course covers fundamental properties of the real numbers field, sequences and series, limits of functions, continuity, differentiability and Riemann integration.

The goal of this course is not only the student learns the contents of it, it is also to provide the student with solid foundations and a good insight of these essential topics of real analysis. The concepts we work with along the course constitute an important part of the basis any mathematics student should have on real functions. A comprehensive and good understanding of the topics of this course will be extremely useful in future courses.

Learning outcomes and competences

After completion of this course you will:

1. understand the properties of real numbers and have the skills to use them to solve problems that involve the supremum of a set, inequalities and mathematical induction,
2. will be able to discuss the convergence of sequences and series,
3. understand the concept of limit of a function, the continuity and be able to use main results about continuous functions on closed intervals,
4. know the basics of differentiation and Taylor's formula, and their applications.
5. know the basics of Riemann integration and improper integrals and their applications,
6. know how to use some mathematical software with graphic resources, symbolic and numeric calculus to view the geometrical meaning of these concepts.

Course contents

- I. Real numbers.
Axiomatic definitions, first properties, absolute value.
- II. Sequences of real numbers.
Convergent sequences. Monotone sequences. Infinite limits. Computation of limits.
- III. Limits of functions and continuity
Continuity at a point and global continuity. Bolzano's theorem and intermediate value theorem. Continuity and monotonicity. Inverse functions. Weierstrass' theorem.
- IV. Derivatives
Derivatives. Chain rule. Rolle's theorem and mean value theorem. Maxima and minima of differentiable functions. L'Hôpital's rule.
- V. Taylor's formula and applications.
Taylor's formula. Convex functions. Local study of functions. Asymptotes and graphs of functions.
- VI. Integration.
Riemann's integration. First and second fundamental theorems of calculus. Integration by parts. Change of variables. Computation and applications of integrals.
- VII. Improper integration.
Criteria for convergence and absolute convergence of integral and series.

References

Main texts

1. Cascales, B; Mira, J.M.; Sánchez-Pedredro, S. Análisis Matemático I
2. Demidovich, B. P.; 5000 problemas de Análisis Matemático 7a; Paraninfo ; 1998.
3. Fernández Viña, J.A. ; Sánchez Mañés, E.; Ejercicios y complementos de Análisis Matemático I ; Tecnos ; 1979.
4. Spivak, Calculus, Reverté
5. Mira, J.M. Manualico para Maxima
6. Ortega, J.M.; Introducción al Análisis Matemático ; UAB ; 1993.