

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	447 - Degree in Physics
ECTS	6.0
Year	1
Semester	First semester
Subject Type	Basic Education
Module	---

1.General information**1.1.Introduction****1.2.Recommendations to take this course****1.3.Context and importance of this course in the degree****1.4.Activities and key dates****2.Learning goals****2.1.Learning goals****2.2.Importance of learning goals****3.Aims of the course and competences****3.1.Aims of the course****3.2.Competences****4.Assessment (1st and 2nd call)****4.1.Assessment tasks (description of tasks, marking system and assessment criteria)****5.Methodology, learning tasks, syllabus and resources****5.1.Methodological overview**

The learning process designed for this module is based in the following:

Theoretical classes for explaining the concepts and fundamentals of the module, and the modes of reasoning and argumentation in general and in particular cases.

Problem resolution as a way to put these concepts into practice.

Class notes and exercises will be available to the students in the Anillo Digital Docente of the Universidad de Zaragoza.

5.2.Learning tasks

The course includes 6 ECTS organized according to:

- Theory sessions (4 ECTS): 40 hours
- Problem sessions (1.7 ECTS): 17 hours
- Assessments (0.3 ECTS): 3 hours

5.3.Syllabus

- **Natural numbers and the principle of induction; integer and rational numbers** .
- **Real numbers** . Inequalities. Absolute value. Bernoulli's inequality, Cauchy-Schwarz inequality, geometric mean - arithmetic mean inequality.
- **Complex numbers** . Real and imaginary parts, conjugate number, modulus and argument, complex exponential, polar representation, de Moivre's formula, roots of a complex number, logarithms.
- **Elementary functions** . Real functions of a real variable. Injective and bijective functions, inverse function. Monotonic, bounded, even, odd, periodic functions. Factorization of polynomials. Rational functions; partial fraction decomposition. Properties of the elementary functions.
- **Sequences** . Limit of a sequence. Domination hierarchy, equivalences, squeeze rule. Bounded and monotonic sequences.
- **Series** . The non-null test. Series with positive terms. Comparison test; limit comparison test. Absolute convergence. Ratio or D'Alembert test, root or Cauchy test, the Leibniz test for alternating series. Sum of series: telescopic series, series with rational terms.
- **Limits of functions and continuity** . Limits and inequalities, equivalences, domination hierarchy. Bolzano's theorem. Weierstrass' extreme values theorem. Continuity of the inverse function.
- **Differentiation** . Derivative and continuity. Chain rule. Derivative of the inverse function. L'Hôpital's rule. The mean value theorem. The intermediate value theorem for the differential. Differential and growth. Higher-order derivatives. Extreme values of functions. Convex and concave functions. Young and Taylor's formulas.
- **Antiderivatives and integration** . Methods of computation of antiderivatives. Riemann sums. Integrals and inequalities. Fundamental theorem of the integral calculus, Barrow's rule, integration by parts, change of variable. Computation of areas, lengths, volumes, centers of gravity.
- **Power series** . Radius and interval of convergence. Continuity. Derivative. Higher-order derivatives. The general term formula. Antiderivatives of a power series. Power series expansion of elementary functions.

5.4.Course planning and calendar

Presencial sessions: continuously throughout the semester, during the tutorial hours and in concerted sessions.

Exams: written exams in the official periods (January-February and September).

5.5.Bibliography and recommended resources

- BB Abellanas Rapun, Lorenzo. Teoría y problemas de métodos de cálculo / Lorenzo Abellanas Rapún, Alberto Galindo Tixaire . - [1a ed.] Madrid [etc] : McGraw-Hill, 1989
- BB Apostol, Tom M.. Calculus. Vol.1, Cálculo con funciones de una variable, con una introducción al álgebra lineal /

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- Tom M. Apostol. - 2ª ed. reimp. Barcelona [etc.] : Reverté, cop. 2002
- BB Bradley, Gerald L.. Cálculo de una variable / Gerald L. Bradley, Karl J. Smith ; traducción, José Luis Vicente Córdoba ; revisión técnica, Pedro Paúl Escolano . - [1a. ed. en español] Madrid [etc.] : Prentice Hall, cop. 1998
 - BB Curso práctico de cálculo y precálculo / Domingo Pestana...[et al.] Barcelona : Ariel, D.L. 2000
 - BB Demidovich, B.P.. 5000 problemas de análisis matemático / B. P. Demidóvich ; traducido del ruso por Emiliano Aparicio Bernardo . - 5ª ed. Madrid : Paraninfo, 1993
 - BB Fuertes García, Jesús. Problemas de cálculo infinitesimal / Jesús Fuertes García , Jesús Martínez Hernando Madrid [etc.] : McGraw-Hill, D.L. 2006
 - BB Kaczor, Wieslawa J.. Problems in mathematical analysis. I, Real numbers, sequences and series / W.J. Kaczor, M.T. Nowak Providence, R.I : American Mathematical Society, cop. 2000
 - BB Kaczor, Wieslawa J.. Problems in mathematical analysis. II, Continuity and differentiation / W.J. Kaczor, M.T. Nowak Providence, R.I. : American Mathematical Society, cop. 2001
 - BB Maron, Isaak A.. Problemas sobre cálculo de una variable : elementos y teoría / I.A. Maron ; traducción de Emilio Romero Ros Madrid : Paraninfo, 1975