26903 - Calculus

Información del Plan Docente

Academic Year	2018/19
Subject	26903 - Calculus
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.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

- Lectures 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.

Students are expected to participate actively in class throughout the semester. Class notes and exercises will be available to the students in the Anillo Digital Docente of the Universidad de Zaragoza.

Universidad Zaragoza

26903 - Calculus

4.2.Learning tasks

The 6 ECTS course includes the following learning tasks:

- Lectures (4 ECTS): 40 hours
- Problems solving sessions (1.7 ECTS): 17 hours
- Assessments tasks (0.3 ECTS): 3 hours

4.3.Syllabus

The course will address the following topics:

- **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.

4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Facultad de Ciencias web https://ciencias.unizar.es/grado-en-fisica-0

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

4.5.Bibliography and recommended resources