26903 - Calculus

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	447 - Degree in Physics
ECTS	6.0
Course	1
Period	First semester
Subject Type	Basic Education
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

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.

26903 - Calculus

5.2.Learning activities

5.3.Program

- **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 ar- gument, 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 func- tions, inverse function. Monotonic, bounded, even, odd, periodic functions. Factoriza- tion 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 compar- ison 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, domina- tion 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 funtions. Convex and concave functions. Young and Taylor's formulas.
- **Antiderivatives and integration** . Methods of computation of antiderivatives. Rie- mann 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.Planning and scheduling

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

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

5.5.Bibliography and recomended resources

T. M. Apostol: Calculus. Vol. I: One-variable calculus, with an introduction to linear algebra . Second edition Blaisdell Publishing Co. Ginn and Co., Waltham, Mass.- Toronto, Ont.-London 1967 xx+666 pp.

D. A. Brannan: A first course in mathematical analysis . Cambridge University Press, Cambridge, 2006. xii+459 pp. ISBN: 0-521-68424-2.

W. J. Kaczor, M. T. Nowak: Problems in mathematical analysis. I. Real numbers, sequences and series . Translated and revised from the 1996 Polish original by the au- thors. Student Mathematical Library, 4. American Mathematical Society, Providence, RI, 2000. xiv+380 pp. ISBN: 0-8218-2050-8

W. J. Kaczor, M. T. Nowak: Problems in mathematical analysis. II. Continuity and differentiation . Translated from the 1998 Polish original, revised and augmented by the authors. Student Mathematical Library, 12. American Mathematical Society, Providence, RI, 2001. xiv+398 pp. ISBN: 0-8218-2051-6

W. J. Kaczor, M. T. Nowak: Problems in mathematical analysis. III. Integration . Student Mathematical Library, 21. American Mathematical Society, Providence, RI, 2003. x+356 pp. ISBN: 0-8218-3298-0.