

SUBJECT TEACHING GUIDE

G84 - Further Differential Calculus

Double Degree in Physics and Mathematics Degree in Mathematics

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Degree in Mathematics			Type and Year	Compulsory. Year 2 Compulsory. Year 2
Faculty	Faculty of Sciences				
Discipline	Subject Area: Mathematical Analysis and Differential Equations Module: Compulsory Subjects				
Course unit title and code	G84 - Further Differential Calculus				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web	https://personales.unican.es/lafernandez				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION				
Name of lecturer	LUIS ALBERTO FERNANDEZ FERNANDEZ				
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Office	Facultad de Ciencias. Planta: + 3. DESPACHO DE PROFESORES (3007)				
Other lecturers					

3.1 LEARNING OUTCOMES
- Understand the meaning of the properties of limit and continuity of functions of one and several variables. Know the proofs and apply the theorems to solve problems about continuity and uniform continuity of functions of one and several variables. Construct proofs of some simple results on continuity.
- Understand the properties of differentiability of functions together with their geometric interpretation . Know the proofs and apply the theorems to solve problems of differentiability of functions of one and several variables . Construct proofs of simple results on differentiability.
- Know the fundamental theorems of differential calculus and its application to approach and solve basic problems of inverse and implicit functions, and approximation of functions by power series.

4. OBJECTIVES

Understand the mathematical method in theoretical development: definitions and axioms, propositions and theorems, examples and counter-examples.

Know different mathematical methods of proving results and be able to apply them for construct proofs of simple results .
Distinguish between correct and incorrect reasoning in simple proofs.

Acquire a certain fluency in the use of mathematical language for the formal expression of properties of sets and functions, as an initiation in the ability to communicate in the context of this branch of science to an expert audience.

Acquire some skill in the handling and interpretation of sets and functions by means of their properties and graphical interpretation.

Know some fundamental theorems of differential calculus, and their proofs.

6. COURSE ORGANIZATION

CONTENTS

1	1.1 Topology of \mathbb{R} and \mathbb{R}^n . 1.2 Vector sequences. Cauchy sequences. Completeness of \mathbb{R}^n . 1.3 Compact sets: Heine-Borel theorem and Bolzano-Weierstrass theorem.
2	2.1 Limits and continuity of functions of several variables. 2.2 Uniform continuity of functions. Heine-Cantor theorem.
3	3.1 Differentiable functions of several real variables . 3.2 Partial derivatives. Gradient vector, Jacobian matrix and Hessian matrix. 3.3 Equality of the crossed derivatives. 3.4 A sufficient condition of differentiability . 3.5 Chain rule. 3.6 Changes of coordinates.
4	4.1. Mean Value Theorem. 4.2. Functions of class p . 4.3 Taylor's Theorem. 4.4 Extremes of real functions.
5	5.1. Implicit function theorem. 5.2. Inverse function theorem. 5.3. Conditional extremes and Lagrange multipliers.

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Partial exam during the course (50% of the final grade)	Written exam	No	Yes	50,00
Final exam scheduled by the Faculty. (50% of the grade)	Written exam	Yes	Yes	50,00
TOTAL				100,00
Observations				
<p>The final mark for the course will be the weighted average of the marks obtained in the two exams. In order to pass the course, a final mark of 5 or more is required.</p> <p>In the extraordinary exam, the exam will have a value of 100%..</p>				
Observations for part-time students				
Part-time students will be assessed in the same way as other students.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
J.E. Marsden y A.J. Tromba. "Cálculo Vectorial". Ed. Addison-Wesley Longman, 2004.
T. E. Apostol, "Calculus Volume II - Multivariable Calculus and Linear Algebra, with Applications to Differential Equations and Probability", Wiley, 1969.