SUBJECT TEACHING GUIDE

G1902 - Measure Theory

Double Degree in Physics and Mathematics
Degree in Mathematics

Academic year 2026 - 2027

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Degree in Mathematics			Type and Year	Optional. Year 5 Optional. Year 4
Faculty	Faculty of Sciences				
Discipline	Subject Area: Further Mathematical Analysis and Differential Equations Mention in Pure and Applied Mathematics				
Course unit title and code	G1902 - Measure Theory				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web					
Language of instruction	English	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION
Name of lecturer	JESUS ARAUJO GOMEZ
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Other lecturers	

3.1 LEARNING OUTCOMES
To check and use the most important theorems in some concrete settings.
To achieve a basic level on the various notions introduced in the course, and be able to do proofs of different results derived from those given in the classroom.
To attain a level of abstraction allowing to put in the appropriate framework prior knowledge about integration theory.
To be able to determine if a family of sets is a sigma-algebra and construct sigma-algebras generated by families of subsets. To identify complete and non-complete sigma-algebras.
To compute integrals with respect to certain abstract measures.
To establish a relation between different Lp spaces (both with respect to different p and different measures). To calculate the norm in Lp of some particular functions, including the case p=infty.

4. OBJECTIVES
To develop a basic theory of abstract integration, both for positive-valued and complex-valued functions.
To develop the fundamental theorems on convergence and compare them with prior related results.
To know the most usual sigma-algebras and their completions.
To know the relafion of positive linear functionals and their representation as integrals.
To know Radón-Nikodym Theorem and related results
To study the relation between measurable and continuous functions.
To study the spaces Lp in the general case.

6. COURSE ORGANIZATION	
CONTENTS	
1	MEASURE SPACES AND ABSTRACT INTEGRATION Measure spaces The concept of measurability. Completeness and regularity of measures. Integration of positive functions. Integration of complex functions. Convergence theorems. Lp spaces: basic inequalities and completeness.
2	BOREL MEASURES AND SIGNED MEASURES. The Riesz Representation Theorem (positive measures) Regularity properties of Borel measures. Lebesgue measure and associated sigma-algebras Continuity properties of measurable functions. Signed measures and Hahn decomposition. Radon-Nikodym Theorem. Jordan and Lebesgue decompositions. Product Measures and Fubini's Theorem.

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessment	%
Midterm exam	Written exam	No	Yes	50,00
Final exam	Written exam	Yes	Yes	50,00
TOTAL				100,00
Observations				
The following applies to both periods of exams: - The final exam will cover the whole course content. - The final grade will be the maximum of the result achieved in the final exam and that obtained by a weighted combination where the final exam accounts for 50% and the continuous assessment also accounts for 50%.				
Observations for part-time students				
Evaluation of part-time students will be conducted according to the norms given for full-time students				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC

G. de Barra. Introduction to measure theory. Van Nostrand, 1974