

SUBJECT TEACHING GUIDE

G1894 - Advanced Probability

Double Degree in Physics and Mathematics

Degree in Mathematics

Degree in Mathematics

Academic year 2024-2025

1. IDENTIFYING DATA			
Degree	Double Degree in Physics and Mathematics Degree in Mathematics Degree in Mathematics		Type and Year Optional. Year 5 Optional. Year 4
Faculty	Faculty of Sciences		
Discipline	Subject Area: Further Probability and Statistics Mention in Pure and Applied Mathematics		
Course unit title and code	G1894 - Advanced Probability		
Number of ECTS credits allocated	6	Term	Semester based (1)
Web			
Language of instruction	English	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION		
Name of lecturer	ALICIA NIETO REYES		
E-mail	alicia.nieto@unican.es		
Office	Facultad de Ciencias. Planta: + 1. DESPACHO (1041)		
Other lecturers			

3.1 LEARNING OUTCOMES

- To have mastered advanced tools of the probability theory

4. OBJECTIVES

To master the key tools of the probability theory

6. SUBJECT PROGRAM	
CONTENTS	
1	THE STRONG LAW OF LARGE NUMBERS. Etemadi's proof of the Strong Law of Large Numbers. Glivenko-Cantelli theorem.
2	CONVERGENCE IN DISTRIBUTION. Relation to Convergence in Probability. Skorohod's representation theorem. Weak Convergence. Tightness of a family of probability measures. Helly's selection theorem.
3	CHARACTERISTIC FUNCTIONS. Definition and properties. Taylor expansion for characteristic functions. Inversion Theorem. The Continuity Theorem.
4	THE CENTRAL LIMIT THEOREM. The Central Limit Theorem for an independent sequence of random variables having the same distribution. Applications central limit theorem.
5	STOCHASTIC PROCESSES. Kolmogorov's existence theorem
6	BROWNIAN MOTION. Definition. Properties of Brownian motion paths. The Strong Markov Property. Law of the iterated logarithm
7	Tutorial
8	Final exam

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
There will be an exam for approximately the first third of the subject.	Written exam	No	Yes	30,00
There will be a final exam without the student's notes. If the group agrees and the size of it allows for it, the exam will be substituted by a project.	Written exam	Yes	Yes	60,00
The student work in class of the two last thirds of the subject will be evaluated in class.	Others	No	Yes	10,00
TOTAL				100,00
Observations				
The final exam will be the same for any student that takes part in it. However, it will simultaneously be the retake exam of those students that did not pass the mid-term exam. In the case the group agrees and its size allow for it, the exams can be substituted by projects in the subject topic.				
Observations for part-time students				
The assessment of part-time students follows the same rules as the one of full-time.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
BILLINGSLEY, P.(1986) Probability and Measure. Wiley.
BREIMAN, L.(1968) Probability. Addison Wesley.

