SUBJECT TEACHING GUIDE

G102 - Workshop on Modelling

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	Compulsory. Year 4 Compulsory. Year 3
Faculty	Faculty of Sciences				
Discipline	Subject Area: Modelling Module: Compulsory Subjects				
Course unit title and code	G102 - Workshop on Modelling				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web	https://moodle.unican.es/course/info.php?id=12308&lang=es				
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION
Name of lecturer	FRANCISCO SANTOS LEAL
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Office	Facultad de Ciencias. Planta: + 3. DESPACHO PROFESORES (3013)
Other lecturers	DIANA STAN

3.1 LEARNING OUTCOMES

- 1) Students will know the interest of differential equations in order to obtain models in Biology and Health Science .
2) Students will use theoretical and numerical results in order to obtain useful information from differential equation models .
3) Students will understand the differences between geometrical design using Bézier curves and the notions of approximation and interpolation.
4) Students will use Bézier curves and B-splines to geometric aided computer design.
5) Students will know statistical simulation in order to evaluate proposals and to understand phenomena in real life.
6) Students will be able to do criticisms about hypothesis in simulation and modelization.

4. OBJECTIVES

1) Use different mathematical models of several types (deterministic/stochastic, finite/infinite-dimensional, etc) to have a good approximation of real problems.
2) Distinguish the most accurate model to study a problem.
3) Find or define a new model when the usual models are not accurate to study a problem.
4) Obtain results of with models and compare them with real data.
5) Use mathematical software to obtain numerical outputs.
6) Be able to show the main characteristics and limitations of the used model to a wide audience.

6. SUBJECT PROGRAM

CONTENTS	
1	Geometric modelling: Bernstein polynomials. Baricentric combinations. Bézier curves and de Casteljau`s algorithm. B-splines. Aplications to geometric aided computer design.
2	Modelling with EDOs: Simple differential equation models related with population dynamics, in Biology and Health Science.
3	Stochastic modelling: Simulation of random phenomena. Random number generation. Validation of statistical models. Applications to problems in real life.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Practical exam about modelization with ODEs	Laboratory evaluation	No	Yes	25,00
A practical work of geometric modelling.	Work	No	Yes	25,00
Practical exam about stochastic modelization	Laboratory evaluation	No	Yes	25,00
Final exam	Written exam	Yes	Yes	25,00
TOTAL				100,00

Observations

The overall grade may be increased by up to 10% for active participation during classes.

In the extraordinary period students will repeat the parts of the continuous evaluation that they failed, plus the final exam.

Observations for part-time students

The system for part-time students will be the same, but flexibility will be given with the dates of the different evaluation parts, if there are good reasons for it.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

N. M. Patrikalakis, T. Maekawa, "Shape interrogation for computer aided design and manufacturing", Springer-Verlag, 2010.

J. A. Cuesta Albertos. "Simulación de fenómenos aleatorios". Universidad de Cantabria, 2018.

R. B. Banks, "Growth and Diffusion Phenomena", Springer-Verlag, 1994.