BASIC DETAILS:

Subject:	MATEMÁTICA COMPUTACIONAL Y SIMULACIÓN		
Id.:	33286		
Programme:	GRADUADO EN BIOINFORMÁTICA. PLAN 2019 (BOE 06/02/2019)		
Module:	MATEMÁTICAS		
Subject type:	OBLIGATORIA		
Year:	2	**Teaching period:**	Primer Cuatrimestre
Credits:	6	**Total hours:**	150
Classroom activities:	64	**Individual study:**	86
Main teaching language:	Inglés	**Secondary teaching language:**	Castellano
Lecturer:		**Email:**	

PRESENTATION:

This subject explains the principles of mathematical modeling and simulation. It provides definitions and illustrative examples of the important concepts as well as an overview of the main types of mathematical models. This subject is mainly focused on the mechanistic (process-oriented) models. These models are developed using ordinary and partial differential equation models (ODE and PDE respectively). This subject will cover how to solve simple models and and how to implement them to be solved by the computer.

PROFESSIONAL COMPETENCES ACQUIRED IN THE SUBJECT:

General programme competences	G01	Use learning strategies autonomously for their application in the continuous improvement of professional practice.
	G02	Perform the analysis and synthesis of problems of their professional activity and apply them in similar environments.
	G03	Cooperate to achieve common results through teamwork in a context of integration, collaboration and empowerment of critical discussion.
	G05	Communicate professional topics in Spanish and / or English both orally and in writing.
	G07	Choose between different complex models of knowledge to solve problems.
	G08	Recognise the role of the scientific method in the generation of knowledge and its applicability to a professional environment.
	G09	Apply information and communication technologies in the professional field.
	G10	Apply creativity, independence of thought, self-criticism and autonomy in the professional practice.
Specific programme competences	E01	Solve mathematical problems that may arise in bioinformatics, by integrating the knowledge acquired in algebra, geometry, differential and integral calculus, optimisation and numerical methods.
	E03	Apply the fundamental concepts of mathematics, logic, algorithmics and computational complexity to solve problems specific to bioinformatics.
	E18	Apply statistical and computational methods to solve problems in the fields of molecular biology, genomics, medical research and population genetics.

PRE-REQUISITES:

The only mathematical prerequisites are some calculus and linear algebra.

SUBJECT PROGRAMME:

Subject contents:

1 - Introduction
1.1 - Principles of Mathematical Modeling
1.2 - Phenomenological models
1.3 - Mechanistic models
2 - Ordinary differential equations
2.1 - ODE Models
2.2 - Initial value problems and boundary problems

	2.3 - Fitting ODE's to Data
	2.4 - Numerical solution
3 - Equations in partial derivatives	
	3.1 - Contour problems for parabolic equations
	3.2 - Contour problems for hyperbolic equations
	3.3 - Numerical solution

Subject planning could be modified due unforeseen circumstances (group performance, availability of resources, changes to academic calendar etc.) and should not, therefore, be considered to be definitive.

TEACHING AND LEARNING METHODOLOGIES AND ACTIVITIES:

Teaching and learning methodologies and activities applied:

Theory Sessions: Lectures will be used to explain the basis of the different chapters. Wherever possible, explanations will be accompained by images, text or sounds to be used as practical examples and discussion topics. During the sessions, the lecturer will propouse activities or to look for information out of the class and he will resolve doubts.

Practical Sessions:During practice, students will use problem-based learning methodological strategy. The student will have the slides of all the chapters of the course. They should be able to expand it with the content explained in class and other bibliographic resources.

The lecturer will be available to students during the tutorial schedule to help them in all matters concerning the course. On request, group tutorials may be programmed to control the work of the group. The course requires a significant effort by the student. The concepts explained in one chapter will be used in the followings.

Student work load:

Teaching mode	Teaching methods	Estimated hours
Classroom activities	Master classes	29
	Other theory activities	12
	Practical exercises	14
	Practical work, exercises, problem-solving etc.	5
	Assessment activities	4
Individual study	Tutorials	5
	Individual study	29
	Individual coursework preparation	20
	Group cousework preparation	24
	Project work	8
	Total hours:	150

ASSESSMENT SCHEME:

Calculation of final mark:

Written tests:	50	%
Individual coursework:	30	%
Group coursework:	20	%
TOTAL	100	%

*Las observaciones específicas sobre el sistema de evaluación serán comunicadas por escrito a los alumnos al inicio de la materia.

BIBLIOGRAPHY AND DOCUMENTATION:

Basic bibliography:

INGALLS, Brian. Mathematical Modelling in Systems Biology: An Introduction. University of Waterloo
VELTEN, Kai. Mathematical modeling and simulation. Introduction for Scientists and Engineers. Wiley, 2009. ISBN: 978-3-527-40758-8

Recommended bibliography:

ATKINSON, Kendall E.; HAN, Weimin; STEWART, David. Numerical Solution of Ordinary Differential Equations. John Wiley & Sons, Inc, 2009. ISBN: 9781118164495
ILIEV, O.P.; MARGENOV, S.D.; MINEV, P.D.; VASSILEVSKI, P.S.; ZIKATANOV, L.T. Numerical Solution of Partial Differential Equations: Theory, Algorithms, and Their Applications. Springer 2013. ISBN: 978-1-4614-7171-4

Recommended websites:

CellML	www.cellml.org
Mathematical Modelling in Systems Biology: An Introduction.	https://www.math.uwaterloo.ca/~bingalls/MMSB/

* Guía Docente sujeta a modificaciones