SUBJECT TEACHING GUIDE

M1512 - Biomathematics

Master's Degree in Mathematics and Computing

Academic year 2022-2023

1. IDENTIFYING DATA					
Degree	Master's Degree in Mathematics and Computing			Type and Year	Optional. Year 1
Faculty	Faculty of Sciences				
Discipline					
Course unit title and code	M1512 - Biomathematics				
Number of ECTS credits allocated	3	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION
Name of lecturer	JOSE JAVIER SEGURA SALA
E-mail	javier.segura@unican.es
Office	Facultad de Ciencias. Planta: + 1. DESPACHO PROFESORES (1045)
Other lecturers	AMPARO GIL GOMEZ RAFAEL GRANERO BELINCHON

3.1 LEARNING OUTCOMES
- Knowledge of mathematical models of interest in physiology, neurobiology and cancer research.
- Knowledge of analytical and computational methods involved in the analysis of mathematical models in biology

4. OBJECTIVES
The main goal is the study of mathematical models of interest in biology. In most cases, differential equations will be the main mathematical tool.

6. COURSE ORGANIZATION

CONTENTS	
1	Action potential in nerve cells: the Hodking-Huxley model. Applications in physiology and neurophysiology.
2	Stochastic description of diffusion processes. Random walk. Models of neurotransmitter release.
3	Free boundary problems in biology. Models of tumoral growth,

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Computer lab assignments	Others	No	Yes	100,00
TOTAL				100,00

Observations

Observations for part-time students

Part time students will be given the option to follow the computer practice remotely (the qualifications are based on these computer exercises)

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

1) J.D. Murray, "Mathematical Biology: I. An Introduction", Third Edition. Springer, 2001.

2) J.P. Keener, J. Sneyd, "Mathematical Physiology", Second Edition, Springer, 2009.

3) L. Evans, Partial Differential Equations, Graduate studies in mathematics, 1998

4) Cristini, V., & Lowengrub, J. (2010). Multiscale modeling of cancer: an integrated experimental and mathematical modeling approach. Cambridge University Press.

5) H. Greenspan. Models for the growth of a solid tumor by diffusion. Studies in Applied Mathematics, 51(4):317–340, 1972.

6) H. Greenspan. On the growth and stability of cell cultures and solid tumors. Journal of theoretical biology, 56(1):229–242, 1976

7) R. A. Gatenby and E. T. Gawlinski. A reaction-diffusion model of cancer invasion. Cancer research, 56(24):5745–5753, 1996

8) V. Cristini, J. Lowengrub, and Q. Nie. Nonlinear simulation of tumor growth. Journal of mathematical biology, 46(3):191–224, 2003.

9) H. Byrne and M. A. Chaplain. Modelling the role of cell-cell adhesion in the growth and development of carcinomas. Mathematical and Computer Modelling, 24(12):1–17, 1996.

10) H. Byrne and M. A. J. Chaplain. Growth of nonnecrotic tumors in the presence and absence of inhibitors. Mathematical biosciences, 130(2):151–181, 1995