UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course:	CELL MOBILITY AND DYNAMICS: INTRODUCTION TO THE DYNAMICS OF TUMORAL GROWTH	**Code:**	310221
Type:	ELECTIVE	**ECTS credits:**	6
Degree:	2351 - MASTER DEGREE PROGRAMME IN PHYSICS AND MATHEMATICS-FISYMAT	**Academic year:**	2021-22
Center:	602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL	**Group(s):**	20
Year:	1	**Duration:**	First semester
Main language:	Spanish	**Second language:**	
Use of additional languages:		**English Friendly:**	Y
Web site:		**Bilingual:**	N

Lecturer: **JUAN JIMÉNEZ SÁNCHEZ** - Group(s): **20**

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Lecturer: **VICTOR MANUEL PEREZ GARCIA** - Group(s): **20**

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2. Pre-Requisites

Basic knowledge of ordinary and partial differential equations

3. Justification in the curriculum, relation to other subjects and to the profession

This subject addresses topics in cellular motility and cellular population dynamics, specifically in the context of tumor growth from a mathematical perspective. Cancer is one of the major health problems in industrialized societies and there is a global perception that mathematical models will play a relevant role in the design of efficient therapeutical strategies. This subject introduces this field of knowledge and uses techiques related to other master' topics in the field of cancer modelling such as partial differential equations, dynamics systems and numerical methods.

4. Degree competences achieved in this course

Course competences

Code	Description
CB06	Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context.
CB07	Apply the achieved knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to the area of study
CB08	Be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of knowledge and judgments
CB09	Know how to communicate the conclusions and their supported knowledge and ultimate reasons to specialized and non-specialized audiences in a clear and unambiguous way
CB10	Have the learning skills which allow to continue studying in a self-directed or autonomous way
CE02	Develop the ability to decide the appropriate techniques to solve a specific problem with special emphasis on those problems associated with the Modeling in Science and Engineering, Astrophysics, Physics, and Mathematics
CE06	Prove the necessary capacity to perform a critical analysis, evaluation and synthesis of new and complex results and ideas in the field of astrophysics, physics, mathematics and biomathematics
CE07	Ability to understand and apply advanced knowledge of mathematics and numerical or computational methods to problems of biology, physics and astrophysics, as well as to build and develop mathematical models in science, biology and engineering
CE08	Ability to model, interpret and predict from experimental observations and numerical data
CG02	Ability to generate and independently develop innovative and competitive proposals in research and professional activity in the scientific field of Physics and Mathematics
CG03	Present publicly the research results or technical reports, to communicate the conclusions to a specialized court, interested persons or organizations, and discuss with their members any aspect related to them
CG05	Gain the ability to develop a scientific research work independently and in its entirety. Be able to search and assimilate scientific literature, formulate hypotheses, raise and develop problems and draw conclusions from the obtained results
CT01	Promote the innovative, creative and enterprising spirit
CT04	Understand and reinforce the ethical and deontological responsibility and commitment in the performance of the professional and research activity and as a citizen
CT05	Autonomous learning and responsibility (analysis, synthesis, initiative and teamwork)

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Public exhibition and critical analysis of a research article related to the subject of the course.
Interpretation of phenomenological results and ability to model them
Modeling in biological processes. Active particles
Treatment of biological data
Critical analysis of classic models based on linear diffusion
Understanding of a scientific article on topics related to the course
Understanding of individual behavior versus collective behavior in biomedical and social sciences

Additional outcomes

6. Units / Contents

Unit 1: Introduction to cancer for mathematicians.
Unit 2: Elementary mathematical models of tumor growth.
Unit 3: Mathematical models of response to therapies: radiotherapy, chemotherapy and novel therapies.
Unit 4: Models with spatio-temporal dependences.
Unit 5: Multiscale models.
Unit 6: Mathematical models of the development of resistances.
Unit 7: Mathematical models in neuro-oncology.
Unit 8: Mathematical models of leukemias.
Unit 9: Fractals and scaling laws in cancer.
Unit 10: Other examples of applications: Breast cancer, prostate cancer.

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures		1.6	40	N	-	
Class Attendance (practical) [ON-SITE]	Project/Problem Based Learning (PBL)		0.32	8	Y	Y	
Practicum and practical activities report writing or preparation [OFF-SITE]	Problem solving and exercises		0.6	15	Y	Y	
Problem solving and/or case studies [ON-SITE]	Case Studies		0.24	6	N	-	
Study and Exam Preparation [OFF-SITE]	Collaborative on line international learning (COIL)		2.4	60	N	-	
Writing of reports or projects [OFF-SITE]	Reading and Analysis of Reviews and Articles		0.84	21	N	-	
		Total:	**6**	**150**			
		Total credits of in-class work: 2.16					**Total class time hours: 54**
		Total credits of out of class work: 3.84					**Total hours of out of class work: 96**

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Assessment of problem solving and/or case studies	70.00%	0.00%	
Oral presentations assessment	20.00%	0.00%	
Assessment of active participation	10.00%	0.00%	
Theoretical exam	0.00%	100.00%	
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Writing of reports or projects [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	21

Unit 1 (de 10): Introduction to cancer for mathematicians.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	40
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	8
Practicum and practical activities report writing or preparation [AUTÓNOMA][Problem solving and exercises]	15
Problem solving and/or case studies [PRESENCIAL][Case Studies]	6
Study and Exam Preparation [AUTÓNOMA][Collaborative on line international learning (COIL)]	60
Writing of reports or projects [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	21

Unit 2 (de 10): Elementary mathematical models of tumor growth.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	4
Practicum and practical activities report writing or preparation [AUTÓNOMA][Problem solving and exercises]	7
Study and Exam Preparation [AUTÓNOMA][Collaborative on line international learning (COIL)]	12
Unit 3 (de 10): Mathematical models of response to therapies: radiotherapy, chemotherapy and novel therapies.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	4
Practicum and practical activities report writing or preparation [AUTÓNOMA][Problem solving and exercises]	8
Study and Exam Preparation [AUTÓNOMA][Collaborative on line international learning (COIL)]	12
Unit 4 (de 10): Models with spatio-temporal dependences.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	7
Study and Exam Preparation [AUTÓNOMA][Collaborative on line international learning (COIL)]	10
Unit 7 (de 10): Mathematical models in neuro-oncology.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	7
Problem solving and/or case studies [PRESENCIAL][Case Studies]	3
Study and Exam Preparation [AUTÓNOMA][Collaborative on line international learning (COIL)]	8
Unit 10 (de 10): Other examples of applications: Breast cancer, prostate cancer.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	8
Problem solving and/or case studies [PRESENCIAL][Case Studies]	3
Study and Exam Preparation [AUTÓNOMA][Collaborative on line international learning (COIL)]	6
Global activity	
Activities	**hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	74
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	16
Practicum and practical activities report writing or preparation [AUTÓNOMA][Problem solving and exercises]	30
Problem solving and/or case studies [PRESENCIAL][Case Studies]	12
Study and Exam Preparation [AUTÓNOMA][Collaborative on line international learning (COIL)]	108
Writing of reports or projects [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	42
Total horas:	282

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
P. M. Altrock, L. L. Liu, F. Michor	The mathematics of cancer: integrating quantitative models	Nature Reviews Cancer, 15, 730-745	Londres		2015	Un review reciente sobre modelos en cancer
Y. Kuang, J. D. Nagy, S. E. Eikenberry	Introduction to mathematical oncology	CRC Press	Nueva York	9781584889908	2016	Un libro sobre distintos tipos de modelos matemáticos en cancer. No hay contraste con datos.
D. Wodarz, N. L. Komarova	Dynamics of Cancer: Mathematical Foundations of Oncology	World Scientific	Singapur	978-981-4566-36-0	2014	Libro centrado en los aspectos evolutivos del cancer desde un punto de vista matemático. No correlaciona con datos.