UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: NONLINEAR ANALYSIS AND DIFFERENTIAL EQUATIONS
Code: 310938
Type: ELECTIVE
ECTS credits: 6
Degree: 2351 - MASTER DEGREE PROGRAMME IN PHYSICS AND MATHEMATICS-FISYMAT
Academic year: 2023-24
Center: 602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL
Group(s): 20
Year: 1
Duration: C2
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **ALBERTO DONOSO BELLON** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Edificio Politécnico/2-B17	MATEMÁTICAS	926295251	alberto.donoso@uclm.es	

Lecturer: **PABLO PEDREGAL TERCERO** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
2-A21	MATEMÁTICAS	926295436	pablo.pedregal@uclm.es	

2. Pre-Requisites

Previous knowledge of multivariable calculus, linear algebra, and ordinary and partial differential equations is required

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

This course pretends to be a first contact to the field of optimization through mathamatical programming, calculus of variations and optimal control. It will be of great help not only for students with mathematical background but also for physicians and engineers interested in modeling some problems as optimization ones.

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
CE03	Have the ability to build and develop advanced mathematical reasoning, and delve into the different fields of mathematics
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
CT03	Develop critical reasoning and the ability to criticize and self-criticize

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Become familiar with the different techniques of Nonlinear Analysis

Be able to apply the acquired knowledge to treat different non-linear differential equations

To conceive the need for weak derivation in the environment of Sobolev spaces

6. Units / Contents

Unit 1: Linear programming

Unit 2: Non-linear programming

Unit 3: Calculus of Variations

Unit 4: Optimal control

Unit 5: Variational methods for non-linear analysis

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	CB06	1.2	30	N	-	
Class Attendance (practical) [ON-SITE]	Problem solving and exercises	CB07 CB08	0.6	15	N	-	
Writing of reports or projects [OFF-SITE]	Self-study	CB10 CE03 CG05	1.2	30	N	-	
Study and Exam Preparation [OFF-SITE]	Self-study	CG05 CT03	2.4	60	N	-	
Project or Topic Presentations [ON-SITE]	Assessment tests	CB09	0.04	1	Y	Y	
Individual tutoring sessions [ON-SITE]	Guided or supervised work	CB10	0.52	13	N	-	
Final test [ON-SITE]	Assessment tests	CB07 CB08 CB09 CB10 CE03	0.04	1	Y	Y	
Total:			**6**	**150**			
Total credits of in-class work: 2.4			**Total class time hours: 60**				
Total credits of out of class work: 3.6			**Total hours of out of class work: 90**				

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
Final test	40.00%	50.00%	Regular tests
Assessment of problem solving and/or case studies	10.00%	0.00%	Exercises to support the main concepts
Projects	50.00%	50.00%	Oral presentation of a case study
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][Self-study]	75
Unit 1 (de 5): Linear programming	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Unit 2 (de 5): Non-linear programming	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Unit 3 (de 5): Calculus of Variations	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Unit 4 (de 5): Optimal control	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Unit 5 (de 5): Variational methods for non-linear analysis	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Global activity	
Activities	**hours**
Writing of reports or projects [AUTÓNOMA][Self-study]	75
Class Attendance (theory) [PRESENCIAL][Lectures]	75
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Pablo Pedregal	Introduction to Optimization	Springer		0-387-40398-1	2004	