



IDENTIFYING DATA

Optimisation and Control

Subject	Optimisation and Control			
Code	V05M135V01106			
Study programme	(*)Máster Universitario en Matemática Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Martínez Varela, Áurea María			
Lecturers	Martínez Varela, Áurea María Vázquez Méndez, Miguel Ernesto			
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Web	http://www.m2i.es/docs/modulos/EModelizacion/MAplicada/4.%20Optimizacion%20y%20Control.pdf			
General description	This course tries to introduce the student in the mathematical modeling and in the numerical resolution of different problems of optimization and optimal control that arise within the scope of the engineering and of the industry.			

Competencies

Code	
B1	CG1 Poseer conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación, sabiendo traducir necesidades industriales en términos de proyectos de I+D+i en el campo de la Matemática Industrial
B4	Saber comunicar las conclusiones, junto con los conocimientos y razones últimas que las sustentan, a públicos especializados y no especializados de un modo claro y sin ambigüedades
B5	Poseer las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo, y poder emprender con éxito estudios de doctorado
C2	(*)Modelar ingredientes específicos y realizar las simplificaciones adecuadas en el modelo que faciliten su tratamiento numérico, manteniendo el grado de precisión, de acuerdo con requisitos previamente establecidos.
C3	(*)Determinar si un modelo de un proceso está bien planteado matemáticamente y bien formulado desde el punto de vista físico.
C4	(*)Ser capaz de seleccionar un conjunto de técnicas numéricas, lenguajes y herramientas informáticas, adecuadas para resolver un modelo matemático.
C5	(*)Ser capaz de validar e interpretar los resultados obtenidos, comparando con visualizaciones, medidas experimentales y/o requisitos funcionales del correspondiente sistema físico/de ingeniería.
C6	(*)Ser capaz de extraer, empleando diferentes técnicas analíticas, información tanto cualitativa como cuantitativa de los modelos

Learning outcomes

Expected results from this subject	Training and Learning Results
(*)Poseer coñecementos que aporten unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, a miúdo nun contexto de investigación, sabendo traducir necesidades industriais en termos de proxectos de I+D+i no campo da Matemática Industrial.	B1
(*)Saber comunicar as conclusións, xunto cos coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun modo craro e sen ambigüedades.	B4

(*)Poseer as habilidades de aprendizaxe que lles permitan continuar estudando dun modo que haberá de B5 ser en grande medida autodirixido o autónomo, e poder emprender con éxito estudos de doutoramento.

(*)Determinar se un modelo de un proceso está ben formulado matematicamente e desde o punto de vista físico. C3

(*)Ser capaz de validar e interpretar os resultados obtidos, comparando con visualizacións, medidas experimentais e/ou requisitos funcionais do correspondente sistema físico/de enxeñaría . C5

(*)Prantexar, en termos de problemas de optimización/control óptimo, problemas que xorden no ámbito da enxeñaría e da industria. C2

(*)Saber aplicar distintos métodos numéricos para resolver problemas de optimización discretos. C4

(*)- Utilizar técnicas básicas para tratar de resolver problemas de control óptimo gobernados por sistemas discretos, ecuacións diferenciais ordinarias e ecuacións en derivadas parciais. C6

Contents

Topic

1. Optimization	Unit I: Introduction to the Numerical Optimization. Unit II: Unconstrained Optimization. Unit III: Constrained Optimization. Unit IV: Global Optimization.
2. Optimal Control	Unit V: Introduction to the Optimal Control. Unit VI: Optimal Control of Discrete Systems. Unit VII: Optimal Control of Ordinary Differential Equations. Unit VIII: Optimal Control of Partial Differential Equations. Elliptic and Parabolic Systems.

Planning

	Class hours	Hours outside the classroom	Total hours
Troubleshooting and / or exercises	3	6	9
Master Session	45	90	135
Troubleshooting and / or exercises	1	2	3
Long answer tests and development	1	2	3

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Troubleshooting and / or exercises	In these hours of work the professor will resolve problems of each of the subjects and will enter new methods of resolution not given in the master classes from a practical point of view. The student also will have to resolve problems proposed by the professor with the objective of applying the knowledges purchased.
Master Session	The professor will expose in this type of classes the theoretical contents of the subject.

Personalized attention

Methodologies	Description
Master Session	The professor will attend personally the doubts and queries of the students. He will solve doubts in his office, in the classes of problems, and in the laboratory. Also the Web platform Fatic will be used to help the students. They will have occasion of to attend tutorial sessions in a timetable established at the beginning of the course and which will be published in the Web page of the department.
Troubleshooting and / or exercises	The professor will attend personally the doubts and queries of the students. He will solve doubts in his office, in the classes of problems, and in the laboratory. Also the Web platform Fatic will be used to help the students. They will have occasion of to attend tutorial sessions in a timetable established at the beginning of the course and which will be published in the Web page of the department.

Assessment

Description	Qualification Training and Learning Results
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Troubleshooting and / or exercises	Individual theoretical exercises: short exercises that the professor will propose along the development of the themes in the theoretical hours. Works of laboratory: The corresponding programming will be realized in distinct packages of software and must be completed with a presented writing report related with the practical exercises.	50	C2 C3 C4 C5 C6
Long answer tests and development	Final examination of the course	50	C2 C3 C4 C5 C6

Other comments on the Evaluation

Sources of information

Basic Bibliography

J. NOCEDAL - S.J. WRIGHT, **Numerical Optimization**, 2006,

E. CERDÁ, **Optimización dinámica**, 2001,

K. OGATA, **Ingeniería de control moderna**, 2010,

Complementary Bibliography

D. BERTSEKAS, **Nonlinear Programming**, 2016,

Recommendations