Teaching Guide				
Identifying Data				2021/22
Subject (*)	Métodos Numéricos I		Code	614455106
Study programme	Mestrado Universitario en Enxeñaría Matemática			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Obligatory	3
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Matemáticas			
Coordinador		E-mail		
Lecturers		E-mail		
Web	https://campusvirtual.udc.es/moodle/			
General description	Nesta asignatura presentanse métodos numéricos elementáis para resolver sistemas de ecuacións lineáis e non lineáis, e para aproximar funcións, as súas derivadas e integráis.			
Contingency plan	1. Modifications to the contents 2. Methodologies *Teaching methodologies that are maintained *Teaching methodologies that are modified 3. Mechanisms for personalized attention to students 4. Modifications in the evaluation *Evaluation observations: 5. Modifications to the bibliography or webgraphy			

Study programme competences	
Code	Study programme competences
A3	Ser capaz de seleccionar el conjunto de técnicas numéricas más adecuadas para resolver un modelo matemático.
A4	Conocer los lenguajes y herramientas informáticas para implementar los métodos numéricos.
A5	Conocer y manejar las herramientas de software profesional más utilizadas en la industria y en la empresa para la simulación de procesos.
A6	Tener habilidades para integrar los conocimientos de los puntos anteriores con vistas a la simulación numérica de procesos o dispositivos surgidos en la industria o en la empresa en general, y ser capaz de desarrollar nuevas aplicaciones informáticas de simulación numérica.
B1	Adquirir habilidades de aprendizaje que les permitan integrarse en equipos de I+D+i del mundo empresarial.
B2	Adquirir habilidades de inicio a la investigación para seguir con éxito los estudios de doctorado.
B3	Ser capaz de realizar un análisis crítico, evaluación y síntesis de ideas nuevas y complejas.
B4	Saber comunicarse con sus colegas, con la comunidad académica en su conjunto y con la sociedad en general en el ámbito de la Matemática Aplicada.
B5	Ser capaz de fomentar en contextos académicos y profesionales el avance tecnológico.

Learning outcomes	
Learning outcomes	Study programme competences

1. To know the elementary numerical methods for solving systems of linear and nonlinear equations, and to aproximate a function, its derivatives and its definite integral.	AC3	BJ1 BR1 BC1 BC2 BC3	
2. Be able to effitiently use the calculus package MatLab for solving the problems studied in this subject.	AC4 AC5 AC6	BJ1 BR1 BC1 BC2 BC3	
3. Have a good predisposition for solving problems.		BR1 BC1 BC3	
4. Be able to evaluate the difficulties involved in the process of solving a given problem, and taking them into account, be able to choose the more appropriate numerical method for solving it (among the studied ones).	AC3	BJ1 BR1 BC1 BC3	
5. Be able to look up in the bibliography, to read and to understand the necessary information for solving a given problem.	AC3 AC4	BJ1 BR1 BC1 BC2 BC3	

Contents	
Topic	**Sub-topic**
1. Numerical solution of systems of linear equations	1. Condicitioning of a system of linear equations. 2. Direct methods: LU, LL^t, LDL^t y QR. 3. Classic iterative methods: Jacobi, Gauss-Seidel, SOR and SSOR.
2. Numerical solution of systems of nonlinear equations	1. Revision of methods for solving nonlinear equations. 2. Fixed Point Method. 3. Newton Method.
3. Interpolation, derivation and numerical integration	1. Lagrange inerpolation. 2. Hermite interpolation. 3. The Runge effect. 4. Spline approximation. 5. Numerical derivation of polynomial interpolation type. 6. Numerical integration of polynomial interpolation type. 6.1 Newton-Cotes fromulae. 6.2 Gauss formulae. 6.3 Compound quadrature rules.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech		14	21	35
Problem solving		0	10	10
Laboratory practice		7	14	21
Objective test		3	0	3
Personalized attention		6	0	6
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	In the theoretical sessions the teacher will present the theoretical contents of the subject, using illustrative examples for motivating the students and helping the comprenssion and assimilation of the contents. The teacher will use dynamic presentations that the students will be able to download on beforehanddende from the virtual site of the subject in Moodle (And, if necessary, the data will be sent by e-mail).
Problem solving	During the course, the students must solve several assignments, that will be corrected by the teachers of the subject. These homeworks will be taken into account for the evaluation of the subject.
Laboratory practice	During the course, several pactical assignments will be proposed to the students. The students must implement in Matlab some of the numerical methods studied in this subject, validate their programs and prepare a report describing the developed codes. Also practical problems will be propposed using the numerical methods studied in the subject. All this practices will be taken into account for thre final evaluation.
Objective test	This is the final exam of the subject, and it has two parts. In the first part, several theoretical exercises will be proposed relating, for example, the range of application of the studied methods and their convergence properties. In the second part, the students will solve a practical case using the studied commands and the programs developed in Matlab or, if this is the case, implementing the necessary algorithms.

Personalized attention	
Methodologies	Description
Problem solving Laboratory practice	Students will be able to ask the teachers of the subject any doubt arising during problems solving and also during the implementation of the laboratory practices.

Assessment			
Methodologies	Competencies	Description	**Qualification**
Problem solving		The proficiency of the students to correctly solve the proposed problems is evaluated, as well as the clarity of the answers and their presentation.	33.33
Laboratory practice		The hability of student to solve the problems studied in the subject using the calculus package MatLab is evaluated, as well as, and their skills to efficiently implement the studied numerical methods. We also evaluate the kwnoledge of the students to apply the studied theoretical results.	16.67
Objective test		The theoretical and practical knowledges learnt by the student are evaluated.	50

Assessment comments

Sources of information	
Basic	- Epperson, J.F. (2007). An introduction to numerical methods and analysis. John Wiley & Sons - Kincaid, D. y Cheney, W. (1994). Análisis numérico. Las matemáticas del cálculo científico. Addison Wesley Iberoamericana - Quarteroni, A. y Saleri, F. (2006). Cálculo Científico con MATLAB y Octave. Springer El libro de Quarteroni y Saleri es el que se sigue para la mayor parte de los contenidos.El libro de Quarteroni y Saleri es el que se sigue para la mayor parte de los contenidos.
Complementary	- Viaño, J.M. (1997). Lecciones de métodos numéricos. 2.- Resolución de ecuaciones numéricas. Tórculo Edicións - Viaño, J.M. y Burguera, M. (1999). Lecciones de métodos numéricos. 3.- Interpolación. Tórculo Edicións - Golub, G.H. y van Loan, C.F. (1996). Matrix Computations. John Hopkins, University Press - Kiusalaas, J. (2005). Numerical Methods in Engineering with MATLAB. Cambridge University Press - Kelley, C.T. (2003). Solving Nonlinear Equations with Newton?s Method. SIAM

Recommendations
Subjects that it is recommended to have taken before
Elementos Finitos I/614455102 Diferenzas Finitas/614455205 Elementos de Contorno/614455207 Elementos Finitos II/614455208 Métodos Numéricos en Optimización/614455210 Métodos Numéricos II/614455211 Métodos Numéricos para Ecuacións Diferenciais Ordinarias (EDO)/614455212 Cálculo Paralelo/614455202
Subjects that are recommended to be taken simultaneously
Linguaxes e Contornos de Programación I/614455104
Subjects that continue the syllabus
Other comments
To be able toi understand the methods presented in this subject it is necessary to have elemental knowledge of linear algebra and diferential and integral calculus. It is also recomended to study the contents developed in the subject at the time they are introduced, making the assigments and the proposed practices, and making use of the thutories and consulting recommended bibliography.