UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2024/25
Subject (*)	Calculus and Numerical Analysis		Code	614G03002
Study programme	Grao en Intelixencia Artificial			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	First	Basic training	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Matemáticas			
Coordinador	Gonzalez Taboada, Maria	E-mail	maria.gonzalez.taboada@udc.es	
Lecturers	Cendan Verdes, Jose Jesus Gonzalez Taboada, Maria	E-mail	jesus.cendan.verdes@udc.es maria.gonzalez.taboada@udc.es	
Web	campusvirtual.udc.es			
General description	In this subject students will learn basic techniques from differential and integral calculus in one variable, and an introduction to the calculus in several variables. Moreover, we will present some basic numerical methods to solve nonlinear equations, approximate functions of one variable and their derivatives and integrals, and to solve linear systems of equations.			

Study programme competences / results	
Code	Study programme competences / results
A1	Capacidad para utilizar los conceptos y métodos matemáticos y estadísticos para modelizar y resolver problemas de inteligencia artificial.
B2	Que el alumnado sepa aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posea las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio.
B3	Que el alumnado tenga la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética.
B5	Que el alumnado haya desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía.
B7	Capacidad para resolver problemas con iniciativa, toma de decisiones, autonomía y creatividad.
B9	Capacidad para seleccionar y justificar los métodos y técnicas adecuadas para resolver un problema concreto, o para desarrollar y proponer nuevos métodos basados en inteligencia artificial.
C3	Capacidad para crear nuevos modelos y soluciones de forma autónoma y creativa, adaptándose a nuevas situaciones. Iniciativa y espíritu emprendedor.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Know the basics from mathematics that support the remaining subjects of this degree.	A1	B2 B3 B5 B7 B9	C3
Identify, model and solve problems from differential and integral calculus.	A1	B2 B3 B5 B7 B9	C3

Learn the conceptual basis of the mathematical techniques that make up the skeleton of the methods of analysis and modelisation from artificial intelligence.	A1	B2 B3 B5 B7 B9	C3
To handle the concepts of function of several real variables, gradient of a function and approximation of functions, as well as their application to real problems.	A1	B2 B3 B5 B7 B9	C3

Contents	
Topic	**Sub-topic**
Functions of one variable.	Real functions of one real variable. Elementary functions. Limits. Continuity. Bisection method to solve nonlinear equations.
Derivatives	Derivative of a function at one point. Physical and geometrical meaning. Derivability. Calculus of derivatives. Lagrange Mean Value Theorem. Extrema. Concavity and convexity. Newton-Raphson method to solve nonlinear equations. Lagrange interpolation. Numerical differentiation.
Integration	Indefinite integrals: primitives. Riemann's integral. Numerical quadrature. Calculus of areas of plane regions. Calculus of volumes.
Functions of several variables	Functions of several variables. Visualization. Limits and continuity. Differentiability: gradient vector, approximation by the tangent plane, chain rule, directional derivative. Derivatives of higher order. Schwarz's Theorem. Extrema of real functions of several variables.
Numerical solution of linear systems	Condition number of a system of linear equations. Direct and iterative methods.

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
ICT practicals	A1 B2 B3 B5 B7 B9 C3	20	10	30
Problem solving	A1 B2 B3 B5 B7 B9 C3	10	25	35
Objective test	A1 B2 B3 B5 B7	3	7	10
Guest lecture / keynote speech	A1 B3 B5 B9 C3	30	45	75
Personalized attention		0		0
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
ICT practicals	In these lectures students will solve problems related with the subject contents using Python.
Problem solving	In these lectures students will solve problems related with the subject contents by hand, with the aim of easing concepts and methods comprehension.
Objective test	To evaluate learning outcomes, there will be a written test on the dates set by the Faculty Board. The test will be oriented essentially to problem solving.
Guest lecture / keynote speech	During these lectures, the teacher will present the subject contents making use of examples to help to the comprehension of the different concepts and methods.

Personalized attention	
Methodologies	**Description**
ICT practicals Problem solving	During ICT practicals with Python and Problem solving sessions, lecturers will solve students questions about theoretical concepts and their practical applications, reviewing and discussing with each student him/her progress in the assigned practice or problem. In addition, lecturers will solve the doubts raised by the students in their respective tutorial hours. With the aim of facilitating following the subject, teachers will make tutorial attention to part-time students and those with an academic dispensation of attendance exemption.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
ICT practicals	A1 B2 B3 B5 B7 B9 C3	During ICT practicals lecturers will propose exercises that will qualify up to 40% of the final mark.	40
Objective test	A1 B2 B3 B5 B7	There will be a written exam on the dates set by the Faculty Board. This exam will qualify 60% of the final mark.	60

Assessment comments
In order to pass the subject, it is mandatory to attain at least a qualification of 50%. In the extraordinary call there will be an objective test. It will not be possible to recover the part of the final mark corresponding to continuous assessment. Part-time students and those with academic dispensation of attendance exemption that have not been evaluated of ICT practicals can do a specific exam to recover 40% of the final mark; they can obtain the remaining 60% with the objective test. All aspects related with "academic dispensation", "dedication to study", "permanence" y "academic fraud" will be driven by the current academic regulations at UDC.

Sources of information	
Basic	- R.L. Burden, D.J. Faires & A.M. Burden (2017). Análisis Numérico. CENCAGE Learning - C. Neuhauser (2004). Matemáticas para ciencias. Pearson - R. Johansson (2019). Numerical Python. Apress
Complementary	- J.E. Marsden & A. Tromba (2018). Cálculo vectorial. Pearson - G. Strang & E. Herman (2022). Cálculo (Volumen 1). http://openstax.org/books/cálculo-volumen-1/ - G. Strang & E. Herman (2022). Cálculo (Volumen 2). http://openstax.org/books/cálculo-volumen-2/ - G. Strang & E. Herman (2022). Cálculo (Volumen 3). http://openstax.org/books/cálculo-volumen-3/

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Programming I/614G03006 Algebra/614G03001
Subjects that continue the syllabus
Automata and Formal Languages/614G03017 Fundamentals of Machine Learning/614G03018 Mathematical Optimisation/614G03005
Other comments

Students are recommended to take the subject up to date and consult with the teachers any doubts that may arise.We will encourage the development of a critical, open and respectful citizenship with diversity in our society, emphasizing the equal rights of students without discrimination based on gender or sexual condition. We will use inclusive language in the material and in the development of the sessions. We will work to identify prejudices and sexist attitudes, and influence the environment to modify them and to promote values ??of respect and equality. The full integration of students who, for physical, sensory, psychological or sociocultural reasons, experience difficulties in having adequate, equal and beneficial access to university life will be facilitated.

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.