Teaching Guide				
Identifying Data				2021/22
Subject (*)	Fundamentals of Mathematics		Code	610G04001
Study programme	Grao en Nanociencia e Nanotecnoloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	First	Basic training	6
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Matemáticas			
Coordinador	Suarez Taboada, Maria	E-mail	maria.suarez3@udc.es	
Lecturers	García Rodríguez, José Antonio Suarez Taboada, Maria	E-mail	jose.garcia.rodriguez@udc.es maria.suarez3@udc.es	
Web	https://campusvirtual.udc.gal/course/view.php?id=15393			
General description	This course aims to develop skills providing the student the ability to develop a critical knowledge of: differential calculus, integral calculus, numerical and functional series, Fourier series and a short introduction to linear algebra.			
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	CE3 - Reconocer y analizar problemas físicos, químicos, matemáticos, biológicos en el ámbito de la Nanociencia y Nanotecnología, así como plantear respuestas o trabajos adecuados para su resolución, incluyendo el uso de fuentes bibliográficas.
A7	CE7 - Interpretar los datos obtenidos mediante medidas experimentales y simulaciones, incluyendo el uso de herramientas informáticas, identificar su significado y relacionarlos con las teorías químicas, físicas o biológicas apropiadas.
B2	CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean 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
B4	CB4 - Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado
B5	CB5 - Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía
B6	CG1 - Aprender a aprender
B7	CG2 - Resolver problemas de forma efectiva.
B8	CG3 - Aplicar un pensamiento crítico, lógico y creativo.
B9	CG4 - Trabajar de forma autónoma con iniciativa.

B10	CG5 - Trabajar de forma colaborativa.
B11	CG6 - Comportarse con ética y responsabilidad social como ciudadano/a y como profesional.
B12	CG7 - Comunicarse de manera efectiva en un entorno de trabajo.
C3	CT3 - Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida
C7	CT7 - Desarrollar la capacidad de trabajar en equipos interdisciplinares o transdisciplinares, para ofrecer propuestas que contribuyan a un desarrollo sostenible ambiental, económico, político y social.
C8	CT8 - Valorar la importancia que tiene la investigación, la innovación y el desarrollo tecnológico en el avance socioeconómico y cultural de la sociedad
C9	CT9 - Tener la capacidad de gestionar tiempos y recursos: desarrollar planes, priorizar actividades, identificar las críticas, establecer plazos y cumplirlos

Learning outcomes			
Learning outcomes	Study programme competences		
Remember sets of numbers and especially handle complex numbers. Know and handle with ease the differential calculus in a variable: successive derivatives, chain's rule, Taylor expansion, calculation of extremes and local study of functions. Know how to apply knowledge to real problems	A3 A7	B2 B4 B5 B6 B7 B8 B9 B10 B11 B12	C3 C7 C8 C9
Know and acquire fluency in the techniques of integration of functions of a variable. Improper integrals. Know how to apply knowledge to real problems.	A3 A7	B2 B4 B5 B6 B7 B8 B9 B10 B11 B12	C3 C7 C8 C9
Know the numerical and functional sequences and series, determine their convergence and acquire fluency in the calculation of limits. Know and handle the Fourier series. Know how to apply knowledge to real problems.	A3 A7	B2 B5 B6 B7 B8 B9 B10 B11 B12	C3 C7 C8 C9

Know and handle matrix calculus, systems of linear equations and vector spaces with ease. Know how to apply knowledge to real problems.	A3 A7	B2 B5 B6 B7 B8 B9 B10 B11 B12	C3 C8 C9
Manage software tools that implement the methodologies studied and know how to analyze the results.	A3 A7	B2 B4 B5 B6 B7 B8 B9 B10 B11 B12	C3 C7 C8 C9

Contents	
Topic	**Sub-topic**
Unit 0: Set of numbers.	Real numbers. Complex numbers.
Unit 1: Differential calculus of one variable.	Differentiable functions. Chain's rule. Increasing and decreasing functions. Local extrema. Concavity and convexity. Inflection points. Graph representation of functions. Newton's method. Taylor's polynomial. Applications.
Unit 2: Integral calculus of one variable.	Definite integral. Fundamental theorem of Calculus. Integration rules. Computation of flat areas and volumes. Numerical integration: trapezoid's method. Improper integrals. Applications.
Unit 3: Sequences and series.	Numerical sequences. Numerical series. Function sequences. Function series. Series of Taylor. Series of Fourier. Applications.

Unit 4: Vector spaces. Linear algebra.	Matrix algebra. Solving linear system equations. Gauss' method. Vector spaces. Diagonalization. Eigenvalues and eigenvectors. Applications.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A3 A7 B6 B7 B8 C3	28	56	84
ICT practicals	B2 B4 B5 B6 B7 B9 B10 B11 B12 C7 C8 C9	12	25	37
Mixed objective/subjective test	A3 B2 B4 B7	3	0	3
Problem solving	A3 A7 B6 B7 C3	8	16	24
Personalized attention		2	0	2
(*)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	Exhibition of the contents specified in the program of the subject, for this, audiovisual media or blackboard will be used.
ICT practicals	Interactive practices in which relevant problems in the field of Science and Engineering will be solved, for this the Python programming language will be used
Mixed objective/subjective test	Development of issues and problems of the subject.
Problem solving	Sessions where relevant problems in the field of Sciences and Engineering will be presented, which will be solved both analytically and numerically. The student must be able to reach the solution of any problem by hand or alternatively using computer tools, and compare the results.

Personalized attention	
Methodologies	Description
Problem solving ICT practicals	a) During practical and solving problems lessons, professors will help students to develop purposed problems as well as applications to problems outside the scope of Science and Engineering. b) As specific personalized attention measures for "Students with partial time dedication recognition and academic exemption from attendance exemption" for the study of the subject, the continuous assessment of practical lessons through ICT and problem solving will be carried out through online tests. b)As medidas de atención personalizada específicas para o ?Alumnado con recoñecemento de dedicación a tempo parcial e dispensa académica de exención de asistencia? para o estudo da materia, a avaliación continua das prácticas a través de TIC e da resolución de problemas realizarase mediante probas parciais online.

Assessment			
Methodologies	Competencies	Description	**Qualification**

Mixed objective/subjective test	A3 B2 B4 B7	Proba que inclúe a resolución de cuestións e problemas da materia	60
Problem solving	A3 A7 B6 B7 C3	Resolución de problemas de carácter práctico.	20
ICT practicals	B2 B4 B5 B6 B7 B9 B10 B11 B12 C7 C8 C9	Resolución de problemas de carácter práctico empregando o lenguaxe de programación Python	20

Assessment comments
The final qualification of the subject consists of three parts: Practical qualifications by ITC (CP): between 0 and 2 pointsSolving problems qualifications (CR): between 0 and 2 points Objective test qualification (CE): between 0 and 6 points. The final qualification will be the sum of the three parts CP + CR + CE, if the qualification of the objective test is greater than 2 (over 10 points). In other situation, the final qualification will be the qualification of the objective test, CE. The qualifications of the practical lessons by ITC (CR) and solving problems (CP) will be kept for the second opportunity of the assessment. The qualifications of the practical lessons by ITC (CR) and solving problems (CP) of the academic year 20/21 will be authomatically kept for the academic year 21/22. The participation in the continuous assessment of 21/22 will mean the rejectment to the qualifications of CR and CP of the previous year. In the proceedings, the students who do not attend the final test will be considered as "Not presented".

Sources of information	
Basic	Bibliografía: Ron Larson, Bruce Edwards. "Cálculo. Tomo I". Cengage Learning, Edición 10ª.2018. Denis G. Zill, Warren S. Wright. "Ecuaciones Diferenciales con problemas con valores en la frontera". Brooks/Cole Cencage Learningl. 2013; (Capítulo 11)Claudia Neuhauser, "Calculus for Biology and Medicine", Prentice Hall.Edición 2ª. 2004.Robert G. Mortimer. "Mathematics for Physical Chemistry". Pearson. Edición 4ª. 2013.Edward Jen Herman, Gilbert Strang. "Calculus. Volumen 1". OpenStax. Rice University. Disponible gratuitamente en https://openstax.org/details/books/calculus-volume-1Edward Jen Herman, Gilbert Strang. "Calculus. Volumen 2". OpenStax. Rice University. Disponible gratuitamente en :https://openstax.org/details/books/calculus-volume-2W. Keith Nicholson. "Linear Algebra with Applications". Disponible gratuitamente en: https://lyryx.com/linear-algebra-applications/Saturnino L. Salas, Finar Hille, Garret J. Etgen. "Calculus I. Una y varias varialbles" (Vol. nº 1). Reverté. Edición 4ª. 2018.Claudia Neuhauser. "Matemáticas para Ciencias". Pearson-Prentice Hall. Edición 2ª. 2020.Bernard Kolman, David R. Hill. "Álgebra Lineal". México: Pearson Educación. Edición 8ª. 2006.Stanley Grossman. "Álgebra Lineal". McGraw-Hill. Edición 7ª. 2012.Jay Abramson. "Precalculus". Disponible gratuitamente en: https://openstax.org/details/books/precalculus Bibliografía para prácticas a través de TIC: Jeffrey J. Heys. "Chemical and Biomedical Engineering Calculations using Python". Wiley. 2017.Anders Malthe-Sorenssen. "Elementary Mechanics Using Python". Springer.2015Svein Linge, Hans P. Langtangen. "Programming for Computations - Python. A Gentle Introduction to Numerical Simulations with Python". Springer. Texts in Computational Science and Engineering. Edición 1ª. 2017.Anders Mathe-Sorenssen."Elementary Mechanics Using Python: A Modern Course Combining Analytical and Numerical Techniques (Undergraduate Lecture Notes in Physics)". Springer. 2015.Robert Johansson. "Numerical Python: Scientific Computing and Data Science Applications with Numpy, Scipy and Matplotlib". Apress. . Edición: 2ª. 2018.Rubin H. Landau, Manuel J. Paez, Christian C. Bordeiany. "Computational Physics: Problem Solving with Computers". Wiley VCH Verlag GmbH. Edición 2ª. 2007.
Complementary	

Recommendations
Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Advanced Calculus /610G04009
Other comments
It is recommended to have knowledge of the second year of high schoolDaily study of the contents treated in the classroom, complementing them with the recommended bibliography.Gender perspective: as stated in the transversal competences of the title (C4), the development of a critical, open and respectful citizenship with diversity in our society will me promoted, highlighting the equal rights of students without discrimination based on gender or sexual condition. An inclusive language will be used in the material and during the development of the lessons. Green Campus Program of the Faculty of Science In order to achieve an inmediate and sustainablem and to fullfill the point 6 of the "Declaración Ambiental da Facultade de Ciencias (2020)", the work carried out in this subject will be requested in virtual format or computer support.

(*)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.