



Teaching Guide

Teaching Guide				
Identifying Data			2022/23	
Subject (*)	Mathematics I		Code	631G02151
Study programme	Grao en Tecnoloxías Mariñas			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	First	Basic training	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Matemáticas			
Coordinador	Cao Rial, María Teresa	E-mail	teresa.cao@udc.es	
Lecturers	Calvo Garrido, María Del Carmen Cao Rial, María Teresa	E-mail	carmen.calvo.garrido@udc.es teresa.cao@udc.es	
Web	www.nauticaymaquinas.es/			
General description	This course is devoted to the study of the basic results and applications of classical subjects in mathematics: Linear Algebra, Euclidean Geometry, Functional Analysis and Complex Variable. The student will learn to use these specific mathematical tools, but also they will improve their skills in developing new methods and acquiring new technologies, to consult bibliographic references and online resources, to elaborate a memory in a rigorous and systematic manner, to give lectures to others and collaborate with other colleagues, etc. In general they will develop a sense of scientific and rational thinking, capable to adapt to unexpected situations which may arise in their future practice as an engineer.			

Study programme competences

Code	Study programme competences
A12	CE12 - Interpretar e representar correctamente o espazo tridimensional, coñecendo os obxectivos e o emprego dos sistemas de representación gráfica.
A14	CE14 - Avaliación cualitativa e cuantitativa de datos e resultados, así como a representación e interpretación matemáticas de resultados obtidos experimentalmente.
A17	CE17 - Modelizar situacións e resolver problemas con técnicas ou ferramentas físico-matemáticas.
B1	CT1 - Capacidad para gestionar los propios conocimientos y utilizar de forma eficiente técnicas de trabajo intelectual
B2	CT2 - Resolver problemas de forma efectiva.
B3	CT3 - Comunicarse de xeito efectivo nun ámbito de traballo.
B4	CT4 - Traballar de forma autónoma con iniciativa.
B5	CT5 - Traballar de forma colaboradora.
B6	CT6 - Comportarse con ética e responsabilidade social como cidadán e como profesional.
B7	CT7 - Capacidade para interpretar, seleccionar e valorar conceptos adquiridos noutras disciplinas do ámbito marítimo, mediante fundamentos físico-matemáticos.
B8	CT8 - Versatilidade.
B9	CT9 - Capacidade para a aprendizaxe de novos métodos e teorías, que lle doten dunha gran versatilidade para adaptarse a novas situacións.
B10	CT10 - Comunicar por escrito e oralmente os coñecementos procedentes da linguaxe científica.
B11	CT11 - Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos habilidades e destrezas.
C1	C1 - Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
C3	C3 - Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C5	C5 - Entender a importancia da cultura emprendedora e coñecer os medios ao alcance das persoas emprendedoras.
C6	C6 - Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C7	C7 - Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.



C8	C8 - Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.
C9	CB1 - Demostrar que posúen e comprenden coñecementos na área de estudo que parte da base da educación secundaria xeneral, e que inclúe coñecementos procedentes da vangardia do seu campo de estudo
C10	CB2 - Aplicar os coñecementos no seu traballo ou vocación dunha forma profesional e poseer competencias demostrables por medio da elaboración e defensa de argumentos e resolución de problemas dentro da área dos seus estudos
C11	CB3 - Ter a capacidade de reunir e interpretar datos relevantes para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
C12	CB4 - Poder transmitir información, ideas, problemas e solucións a un público tanto especializado como non especializado.
C13	CB5 - Ter desenvolvido aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores con un alto grao de autonomía.

Learning outcomes			
Learning outcomes		Study programme competences	
Escribir e transmitir coñecementos correctamente.		A12 A14 A17	B3 B4 B10 C1 C10
Realizar eficazmente as tarefas asignadas como parte do grupo.			B3 B5
Ser capaz de resolver e analizar os resultados dos problemas matemáticos que poidan plantexarse na enxeñaría.		A14 A17	B2 B7 B11 C1 C9 C11
Usar modelos matemáticos e identificar o caso no que deben aplicarse.		A17	B1 B2 B7 B9
Coñecer os conceptos fundamentais e aplicacións de Álgebra Lineal, Xeometría do Plano e do Espazo Afín e Euclídeo, Análise de Funcións Reais dunha Variable Real e Variable Complexa.		A12 A14 A17	B1 B2 B7 B9 B11 C9 C11 C12
Manexar con soltura as ferramentas básicas de Álgebra e Cálculo.		A12 A14 A17	B1 B2 B7 B9 B11 C1 C10 C11 C12
Mellorar habilidades na aprendizaxe e desenvolvemento de novos métodos e tecnoloxías necesarias para continuar a súa formación.			B6 B8 C3 C5 C6 C7 C8 C13
Traballar con material bibliográfico e recursos informáticos.			C3 C6 C8 C11 C13



Elaborar unha memoria/informe de modo rigoroso e sistemático.	A14	B2 B3 B4 B7 B10	C1
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Contents	
Topic	Sub-topic
Lesson 3.- Determinants.	3.0.- Permutations. Class of a Permutation. 3.1.- Determinant of a Square Matrix. Sarrus Rule. 3.2.- Properties of Determinants. 3.3.- Methods for Calculation of Determinants. Cofactor Matrix. 3.4.- Product of Determinants. 3.5.- Some Particular Examples of Determinants. 3.6.- Reverse Matrix. 3.7.- Rank of a Matrix. 3.8.- Rank of a System of Vectors 3.9.- Expression of the Change of Base of a Vectorial Space in shape Matrix
Lesson 1.- Vector Space	1.1.- Vector space. Definition. Examples and Properties 1.2.- Vector subspace. 1.3.- System of Generators of a Subspace 1.4.- Linear Independence 1.5.- Basis of a Vector Space. Finite Dimensional Spaces. 1.6.- Change of Basis in a Vector Space 1.7.- Union and Intersection of Subspaces 1.8.- Sum of Subspaces. Direct sum. Supplementary Subspaces. 1.9.- Product of Vectorial Spaces
Lesson 2.- Linear Functions. Matrices.	2.1.- Linear Function: Definition, Examples, Properties and Types of Linear Functions. 2.2.- Kernel and Image of a Linear Function. 2.3.- Existence and obtention of an Associated Matrix to a Linear Function. 2.4.- Addition of Linear Functions. Product by a Scalar. Associated Matrices. 2.5.- Vector Spaces of Matrices 2.6.- Composition of Linear Functions. Associated Matrix. 2.7.- Product of Matrices. Ring of Square Matrices 2.8.- Some Particular Types of Matrices 2.9.- Transpose Matrix. Symmetric, Antisymmetric and Orthogonal Matrices. 2.10.- Matrices of Complex Elements.
Lesson 4.- Systems of Linear Equations.	4.1.- Definitions. Classification. Matrix notation. 4.2.- Equivalent systems. 4.3.- System of Cramer. Rule of Cramer 4.4.- General System of Linear Equations. Theorem of Rouché-Frobenius 4.5.- Homogeneous Systems. 4.6.- Methods of Resolution by Reduction. Gauss' Method.
Lesson 5.- Matrix Diagonalization.	5.1.- Eigenvectors and Eigenvalues. Properties. 5.2.- Characteristic polynomial. Properties. 5.3.- Diagonalizable Matrices. Diagonalization. 5.4.- Diagonalization Of Symmetric Matrices.



Lesson 6.- Affine Space E^3 . Problems of Incidence and Parallelism.	6.1.- Affine Space Associated to a Vector Space. System of Reference. Coordinates. 6.2.- Equations of Straight Lines. 6.3.- Relative positions of Straight Lines. 6.4.- Equations of a Plane. 6.5.- Relative positions of Planes. Bundles of Planes. 6.6.- Relative positions of Straight Lines and Planes.
Lesson 7.- Euclidean Vector Spaces. Scalar product, Vector product. Mixed Product.	7.1.- Scalar product 7.2.- Determination of a Scalar Product. Gram Matrix. 7.3.- Euclidean Vector Space. Definition. 7.4.- Norm of a Vector. Relevant Equalities and Inequalities. 7.5.- Angle of two Vectors. Orthogonality. 7.6.- Orthonormal Basis. Expression of the Scalar Product in an Orthonormal Basis. 7.7.- Euclidean Space E^3 . 7.8.- Orientation in E^3 . 7.9.- Vector product in R^3 . Properties. Analytical expression. 7.10.- Mixed product. Analytical expression. Geometrical interpretation. 7.11.- Combined Products.
Lesson 8.- Metric Problems in Euclidean Spaces.	8.1.- Normal equation of a Plane. 8.2.- Angles between Linear Manifolds in R^3 : Angle of Two Planes, Angle of Two Straight Lines, Angle of Straight Line and Plane. 8.3.- Distance between Linear Manifolds in R^3 : Distance of a Point to a Plane, Distance of a Point to a Straight Line. Distance between two Planes, Distance between Straight Line and Plane. Distance between two Straight Lines. Common Perpendicular to two Straight Lines. 8.4.- Cylindrical coordinates and Spherical coordinates in R^3 .
Lesson 9.-Real valued functions of a Real Variable. Continuity.	9.1.- Basic definitions. 9.2.- Functional limits. 9.3.- Continuity. Types of Discontinuity. 9.4.- Properties and Theorems on Continuous Functions.
Lesson 10.- Differentiability and Applications of the Derivatives.	10.1.- Derivative and Differential of a Function in a Point. Geometrical meaning. 10.2.- Properties and Calculation of Derivatives. 10.3.- Derivative function. Successive derivatives. 10.4.- Applications of the Derivatives to the Local Study of a Function: Growth and Decreasing. Maxima and Minima. Concavity and Convexity. Inflection points. 10.5.- Theorems of Rolle and Mean Value Theorem. 10.6.- Rules of L'Hôpital
Lesson 11.- Theorem of Taylor. Applications.	11.1.- Expression of a Polynomial by means of his Derivatives in a Point. 11.2.- Polynomial and Theorem of Taylor. Formulae of Taylor and Mac Laurin. 11.3.- Expression of Lagrange for the Residual. Bounds for the residual. 11.4.- Applications to the Local Study of a Function: Monotonicity. Extremal values. Concavity and Convexity. Inflection points.
Lesson 15.- Indefinite integration of Functions of a Real Variable	15.1.- General definitions. Table of Primitives. 15.2.- Immediate integration 15.3.- Integration by Parts 15.4.- Integration of Rational Functions 15.5.- Integration by Replacement or Change of Variable



Lesson 16.- Definite Integration. Applications.	16.1.- General definitions 16.2.- Properties 16.3.- Mean Value Theorem. Barrow's Rule. 16.4.- Evaluation of Definite Integrals. 16.5.- Improper Integral. 16.6.- Applications of the Definite Integral
Lesson 17.- Complex Numbers	17.1.- General definitions 17.2.- Fundamental operations 17.3.- Powers and Roots 17.4.- Exponential form of a Complex 17.5.- Logarithms And Complex Powers.
The development and overcoming of these contents, together with those corresponding to other subjects that include the acquisition of specific competencies of the degree, guarantees the knowledge, comprehension and sufficiency of the competencies contained in Table AIII / 2, of the STCW Convention, related to the level of management of First Engineer Officer of the Merchant Navy, on ships without power limitation of the main propulsion machinery and Chief Engineer officer of the Merchant Navy up to a maximum of 3000 kW.	Table A-III / 2 of the STCW Convention. Specification of the minimum standard of competence for Chief Engineer Officers and First Engineer Officers on ships powered by main propulsion machinery of 3000 kW or more.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A12 A14 A17 B1 B2 B3 B6 B7 B9 C6 C8	28	28	56
Problem solving	A12 A17 B2 B4 B6 B7 B8 B9 B10 B11 C1 C3 C9 C10 C11 C12 C13	24	36	60
Supervised projects	A12 A17 B2 B3 B4 B7 B9 B10 C1 C9 C10 C12	0	10	10
Seminar	A12 A14 A17 B2 C1 C3 C5 C6 C7 C8 C9 C10 C11 C12 C13	0	10	10
Document analysis	A12 A17 B1 B3 B4 B5 B7 B8 B9 B11 C3	0	3	3
Introductory activities	B1 B3 B4 B7 C1 C7 C11	2	2	4
Objective test	A12 A14 A17 B1 B2 B3 B4 B6 B7 B10 B11 C1 C9	2	0	2
Personalized attention		5	0	5
(*)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	Exposition in the classroom of the fundamental concepts.
Problem solving	In each topic, exercises will be proposed to solve.
Supervised projects	Proposed individual and group projects.
Seminar	Individual and / or very small group tutorships.
Document analysis	Select books and web pages to use
Introductory activities	Introducción á materia
Objective test	Knowledge assessment.

Personalized attention

Methodologies	Description
Seminar Supervised projects	The students are encouraged to attend in small groups or individually to the professors' office, or by TEAMS, to solve questions that may arise, thus obtaining a more specific guidance, according to their specific difficulties. Due to the health situation caused by COVID-19, and following the recommendations of the Center, the attention to students will preferably be held through computer hardware and the Internet (email and meetings by MS Teams), in order to avoid face-to-face interaction in office.

Assessment

Methodologies	Competencies	Description	Qualification
Guest lecture / keynote speech	A12 A14 A17 B1 B2 B3 B6 B7 B9 C6 C8	Preguntas sobre cuestións teóricas	10
Objective test	A12 A14 A17 B1 B2 B3 B4 B6 B7 B10 B11 C1 C9	Comprobación dos coñecementos e capacidade de resolución de problemas.	60
Supervised projects	A12 A17 B2 B3 B4 B7 B9 B10 C1 C9 C10 C12	Traballos propostos.	15
Problem solving	A12 A17 B2 B4 B6 B7 B8 B9 B10 B11 C1 C3 C9 C10 C11 C12 C13	Resolver problemas.	15

Assessment comments

The students participants in the EHEA should attend a minimum of 80% of the lessons, being the continuous assessment of 40% of the final score. The other 60% of the score will be obtained from the partial tests that will take place throughout the term.

The students who have followed the continuous assessment but have not reached the 50% of the score through the partial tests will have a chance to reach it through a final test. This final test will include all topics of the term (the partial tests do not exclude topics). Students not passing after taking the partial tests, and not taking the final tests will be qualified as NOT ATTENDING.

The students who decide to not take part in the EHEA will be evaluated with an objective test that includes an individual test of assimilation of practical-theoretical knowledge and problem solving.

Those students with recognition of part-time dedication and academic exemption of attendance, as established by the norm that regulates the regime of dedication to the study of undergraduate students in the UDC (Arts 2.3, 3.b, 4.3 e 7.5) (04/05/2017), and want to stay on the path of the EHEA and benefit from continuous assessment, must INDICATE SUCH CONDITION AT THE BEGINNING OF THE COURSE and attend at least 50% of the interactive lectures. In case of not being able to attend these sessions, they should attend tutorials at the professor office or by TEAMS, where they will perform equivalent tests.

The fraudulent performance of the tests or evaluation activities, once verified, will directly imply the failure grade, numerical qualification of 0, in the corresponding call, invalidating any grade obtained in the tests or evaluation activities, as established in the academic regulations at the UDC.



Sources of information

Basic	- S. Grossman, J. Ibarra (). Matemáticas 4. Álgebra Lineal. McGraw Hill - D.G. Zill, W.S. Wright, J. Ibarra (). Matemáticas 2. Cálculo Integral. McGraw Hill - D.G. Zill, W.S. Wright, J. Ibarra (). Matemáticas 1. Cálculo Diferencial. McGraw Hill - Á.M. Ramos del Olmo, J.M. Rey Cabezas (2017). Matemáticas básicas para el acceso a la universidad. Pirámide
Complementary	- García, A. y otros (). Cálculo I (Teoría y problemas). Librería I.C.A.I - Fernández Viña, J. A. (). Análisis Matemático I. Tecnos - Villa, A. de la (). Problemas de Álgebra Lineal. GLACSA - Granero, F. (). Álgebra y Geometría Analítica. Mac Graw-Hill - Granero, F. (). Cálculo. Mac Graw-Hill - Granero, F. (). Ejercicios y Problemas de Cálculo (I y II). Tébar Flores

Recommendations

Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Physics I/631G02153

Subjects that continue the syllabus

Mathematics II/631G02156

Mathematics III/631G02260

Other comments

<p>Attend the optional introductory course the first week.</p>

(*)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.