



Teaching Guide

Identifying Data					2023/24
Subject (*)	Mathematics I	Code	631G03001		
Study programme	Grao en Máquinas Navais				
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 / results

Code	Study programme competences / results
A73	CE73 - Modelizar situacións e resolver problemas con técnicas ou ferramentas físico-matemáticas.
A74	CE74 - Avaliar de forma cualitativa e cuantitativa os datos e resultados, así como a representación e interpretación matemáticas de resultados obtidos experimentalmente.
A75	CE75 - Interpretar e representar correctamente o espazo tridimensional, coñecendo os obxectivos e o emprego dos sistemas de representación gráfica.
B1	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 vangarda do seu campo de estudo
B3	CB3 - Ter a capacidade de reunir e interpretar datos relevantes para emitir xuícos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
B4	CB4 - Poder transmitir información, ideas, problemas e solucións a un público tanto especializado como non especializado.
B5	CB5 - Ter desenvolvido aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores con un alto grao de autonomía.
B6	CG01 - Capacidade para xestionar os propios coñecementos e utilizar de forma eficiente técnicas de traballo intelectual.
B7	CG02 - Resolver problemas de forma efectiva.
B8	CG03 - Comunicarse de maneira efectiva nunha contorna de traballo.
B9	CG04 - Traballar de forma autónoma con iniciativa.
B10	CG05 - Traballar de forma colaborativa.
B11	CG06 - Comportarse con ética e responsabilidade social como cidadán e como profesional.
B12	CG07 - Capacidade para interpretar, seleccionar e valorar conceptos adquiridos noutras disciplinas do ámbito mariño, mediante fundamentos físico-matemáticos.
B13	CG08 - Capacidade para a aprendizaxe de novos métodos e teorías, que lle doten dunha gran versatilidade para adaptarse a novas situacións.
B14	CG09 - Comunicar por escrito e oralmente os coñecementos procedentes da linguaxe científica.
B15	CG10 - Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos habilidades e destrezas.



B16	CG11 - Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
B17	CG12 - Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.
B18	CG13 - Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.
C1	CT01 - Expresarse correctamente, tanto de forma oral como escrita, nas linguas oficiais da comunidade autónoma.
C3	CT03 - 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.
C7	CT07 - Desenvolver a capacidade de traballar en equipos interdisciplinares ou transdisciplinares, para ofrecer propostas que contribúan a un desenvolvemento sostible ambiental, económico, político e social.
C8	CT08 - Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.
C9	CT09 - Ter a capacidade de xestionar tempos e recursos: desenvolver plans, priorizar actividades, identificar as críticas, establecer prazos e cumprilos.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Escribir e transmitir coñecementos correctamente.		B3 B4 B11	C1
Realizar eficazmente as tarefas asignadas como parte dun grupo.		B4 B8 B10	C1 C7
Ser capaz de resolver e analizar os resultados dos problemas matemáticos que poidan plantexarse na enxeñaría.	A73 A74 A75	B3 B6 B7 B9 B12 B13 B15	C3 C9
Usar modelos matemáticos e identificar o caso no que deben aplicarse.	A73 A74 A75	B1 B3 B6 B7 B13 B15	
Coñecer os conceptos fundamentais e aplicacións da Álgebra Lineal, Xeometría do Plano e do Espacio Afín e Euclídeo, Análisis de Funcións Reais dunha Variable Real e Variable Complexa.	A73 A74 A75	B1 B3 B5 B6 B7 B9 B13 B15	
Manexar con soltura as ferramentas básicas da Álgebra e o Cálculo.	A73 A74 A75	B1 B7 B9 B11	C3 C7 C8 C9



Mellorar habilidades na aprendizaxe e desenvolvemento de novos métodos e tecnoloxías necesarias para continuar a súa formación.		B3 B5 B11 B13 B16 B17 B18	C8
Traballar con material bibliográfico e recursos informáticos.			C3 C8
Elaborar unha memoria/informe de modo científico, estruturado, rigoroso e conciso.		B3 B4 B7 B8 B9 B14	C1 C8 C9

Contents	
Topic	Sub-topic
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 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 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 E3. 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 E3. 7.8.- Orientation in E3. 7.9.- Vector product in R3 . 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 R3: Angle of Two Planes, Angle of Two Straight Lines, Angle of Straight Line and Plane. 8.3.- Distance between Linear Manifolds in R3: 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 R3.
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 / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A75 B3 B5 B6 B17 B18 C8 C9	28	28	56
Problem solving	A73 A74 A75 B1 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B17 C1 C7 C8	24	36	60
Supervised projects	A73 B1 B3 B4 B6 B8 B9 B10 B14 B15 B16 C1 C3 C7 C8	0	10	10
Seminar	B1 B3 B5 B6 B7 B8 B9 B10	0	10	10
Document analysis	B9 B10 B13 B16 C3 C7 C8 C9	0	3	3
Introductory activities	B1 B4 B5	2	2	4



Objective test	B1 B8 B11 B14 B15 C1 C7 C8 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	<p>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.</p> <p>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.</p>

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Supervised projects	A73 B1 B3 B4 B6 B8 B9 B10 B14 B15 B16 C1 C3 C7 C8	Traballos propostos.	15
Objective test	B1 B8 B11 B14 B15 C1 C7 C8 C9	Comprobación dos coñecementos e capacidade de resolución de problemas.	60
Guest lecture / keynote speech	A75 B3 B5 B6 B17 B18 C8 C9	Preguntas sobre cuestións teóricas	10
Problem solving	A73 A74 A75 B1 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B17 C1 C7 C8	Resolver problemas.	15

Assessment comments



The students participating in the EHEA should take a minimum of 75% of the continuous assessment (c.a.) tests done in the classroom. These c.a. test might be posed either on keynote lectures or problem solving sessions, and they represent the 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)

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 the sessions where c.a. tests were taken, they should attend tutorials at the professor office or by TEAMS, where they will perform equivalent tests.

Both opportunities: Fraud in tests or evaluation activities, once verified, will directly imply failing the subject in which it has been committed: the student will receive a final mark equal to 0, whether the commission of the fraud happens on the first opportunity or on the second. To do this, the qualification of the first opportunity will be modified, if necessary.

Sources of information

Basic	<ul style="list-style-type: none"> - 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 - R.E. Larson, R.P. Hostetler, B.H. Edwards (1999). Cálculo. McGraw Hill
Complementary	<ul style="list-style-type: none"> - 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 ALGEBRA LINEAL. GLAGSA - Granero, F (). ALGEBRA 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/631G03003

Subjects that continue the syllabus

Numerical and Statistical Methods/631G03011

Mathematics II/631G03006

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.