



Teaching Guide

Teaching Guide				
Identifying Data				2022/23
Subject (*)	Mathematics I		Code	631G01101
Study programme	Grao en Náutica e Transporte Marítimo			
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	Arós Rodríguez, Angel Daniel	E-mail	angel.aros@udc.es	
Lecturers	Arós Rodríguez, Angel Daniel Cao Rial, María Teresa	E-mail	angel.aros@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
A2	Interpretar e representar correctamente o espazo tridimensional, coñecendo os obxectivos e o emprego de representación gráfica.
A8	Modelizar situacións e resolver problemas con técnicas ou ferramentas físico-matemáticas.
A9	Avaliación cualitativa e cuantitativa de datos e resultados, así como representación e interpretación matemática de resultados obtidos experimentalmente.
B1	Aprender a aprender.
B2	Resolver problemas de xeito efectivo.
B3	Aplicar un pensamento crítico, lóxico e creativo.
B4	Comunicarse de xeito efectivo nun ámbito de traballo.
B5	Traballar de forma autónoma con iniciativa.
B6	Traballar de forma colaboradora.
B7	Comportarse con ética e responsabilidade social como cidadán e como profesional.
B8	Aprender en ámbitos de teleformación.
B9	Capacidade para interpretar, seleccionar e valorar conceptos adquiridos noutras disciplinas do ámbito marítimo, mediante fundamentos físico-matemáticos.
B10	Versatilidade.
B11	Capacidade de adaptación a novas situacións.
B12	Uso das novas tecnoloxías TIC, e de Internet como medio de comunicación e como fonte de información.
B13	Comunicar por escrito e oralmente os coñecementos procedentes da linguaxe científica.
B14	Capacidade de análise e síntese.
B15	Capacidade para adquirir e aplicar coñecementos.
B16	Organizar, planificar e resolver problemas.
B17	Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma
B19	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.
B22	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.



B23	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.
B24	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.
C10	Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornas novas ou pouco coñecidas dentro de contextos máis amplas (ou multidisciplinares) relacionados coa súa área de estudo

Learning outcomes			
Learning outcomes		Study programme competences	
Write and share knowledge correctly.		B4 B13 B17	
Effectively perform assigned tasks as part of a group.		B1 B2 B3 B6 B14 B15 B19 B22 B23 B24	C10
To be able to solve and analyze the results of mathematical problems that may arise in engineering.		A2 A8 A9 B2 B3 B5 B9 B10 B11 B12 B16	C10
To use mathematical models and identify the case in which they should be applied.		A2 A8 A9 B1 B2 B3 B7 B8	C10
To know the fundamental concepts and applications of Linear Algebra, Affine and Euclidean Geometry, Mathematical Analysis of Real Functions of a Real Variable and Complex numbers.		A2 A8 A9 B1 B2 B3 B5 B8 B9 B11 B13 B14 B16 B22	



To know the basic tools of Algebra and Calculus.	A2 A8 A9	B2 B3 B5 B9 B14 B15 B16 B17	
To improve skills in learning and developing of new methods and technologies necessary to the following years of their career.		B1 B2 B4 B7 B9 B10 B11 B14 B15 B19 B22 B23 B24	C10
To work with bibliographic material and computer resources.		B1 B3 B12 B19 B22 B23 B24	
To prepare a report in a rigorous and systematic way.	A9	B13 B14 B15 B16 B17	

Contents	
Topic	Sub-topic
Lesson 1.- Matrices and Determinants.	1.1.- Matrices. Operations with matrices. 1.2.- Determinants.
Lesson 2.- Vector spaces.	2.1.- Introduction. 2.2.- Definition, examples and properties. 2.3.- Linear subspace. 2.4.- Linear dependence and linear independence. 2.5.- Generator systems. 2.6.- Bases. Dimension. 2.7.- Equations of a linear subspace. 2.8.- Range of a system of vectors.
Lesson 3.- Linear Mappings	3.1.- Introduction. 3.2.- Linear mappings. 3.3.- Matrix associated to a linear mapping. 3.4.- Change of basis matrix.



Lesson 4.- Systems of Linear Equations.	4.1.- Introduction. 4.2.- Definition, examples. 4.3.- Existence and uniqueness of solution. Rouche-Frobenius theorem. 4.4.- Cramer's rule. 4.5.- Gauss and Gauss-Jordan 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 \mathbb{R}^3 . Properties. Analytical expression. 7.10.- Mixed product. Analytical expression. Geometrical interpretation.
Lesson 8.- Metric Problems in Euclidean Spaces.	8.1.- Normal equation of a Plane. 8.2.- Angles between Linear Manifolds in \mathbb{R}^3 : Angle of Two Planes, Angle of Two Straight Lines, Angle of Straight Line and Plane. 8.3.- Distance between Linear Manifolds in \mathbb{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 \mathbb{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 and Applications. Plot of a real function.	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. Plot of a real function.
Lesson 12.- Indefinite integration of Functions of a Real Variable	12.1.- General definitions. Table of Primitives. 12.2.- Immediate integration 12.3.- Integration by Parts 12.4.- Integration of Rational Functions 12.5.- Integration by Replacement or Change of Variable
Lesson 13.- Definite Integration. Applications.	13.1.- General definitions 13.2.- Properties 13.3.- Mean Value Theorem. Barrow's Rule. 13.4.- Evaluation of Definite Integrals. 13.5.- Improper Integral. 13.6.- Applications of the Definite Integral
Lesson 14.- Complex Numbers	14.1.- General definitions 14.2.- Fundamental operations 14.3.- Powers and Roots 14.4.- Exponential form of a Complex 14.5.- 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 AII / 2, of the STCW Convention, related to the level of management of chief mates of the Merchant Navy, on ships without gross tonnage limitation and Master up to a maximum of 500 GT.	Table A-II / 2 of the STCW Convention. Mandatory minimum requirements for certification of masters and chief mates on chief on ships of 500 gross tonnage or more.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A2 A8 B1 B2 B3 B4 B15 B22 C10	28	28	56
Problem solving	A2 A8 A9 B2 B5 B6 B10 B11 B12 B13 B15 B16 B17 B19 C10	24	36	60
Supervised projects	A2 A8 A9 B1 B2 B3 B4 B5 B6 B8 B9 B12 B13 B14 B15 B16 B17 B19 B22 B23 B24 C10	0	10	10
Seminar	A2 A8 A9 B2 B5 B6 B10 B11 B12 B13 B15 B16 B17 B19 C10	0	10	10



Document analysis	A2 A8 B1 B2 B3 B4 B5 B6 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B19 B22	0	3	3
Introductory activities	B1 B3 B4 B7 B12 B14 B15 B22	2	2	4
Objective test	A2 A8 A9 B2 B4 B5 B11 B12 B13 B14 B16 B17 B19 B22 B23 C10	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
Problem solving 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, meetings with students will preferably be held online (MS Teams).

Assessment			
Methodologies	Competencies	Description	Qualification
Problem solving	A2 A8 A9 B2 B5 B6 B10 B11 B12 B13 B15 B16 B17 B19 C10	Resolver problemas.	15
Guest lecture / keynote speech	A2 A8 B1 B2 B3 B4 B15 B22 C10	Resolución de cuestións teóricas ou prácticas breves relacionadas cos contidos da sesión maxistral	10
Objective test	A2 A8 A9 B2 B4 B5 B11 B12 B13 B14 B16 B17 B19 B22 B23 C10	Proba para amosar os coñecementos teóricos e prácticos adquiridos.	60
Supervised projects	A2 A8 A9 B1 B2 B3 B4 B5 B6 B8 B9 B12 B13 B14 B15 B16 B17 B19 B22 B23 B24 C10	Traballos propostos.	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)

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. Pass a partial exams do not convalidate the corresponding lessons in case the student must do the final exam. A student who does not do at least one of the partial exams or a final exam will be qualified as Not Presented.

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.

Fraudulent conduct in tests or activities, once verified, will cause a final mark of 0, invalidating any mark obtained in the previous activities, as established in the current academic regulations at UDC.

Sources of information

Basic	<ul style="list-style-type: none"> - D.G. Zill, W.S. Wright, J. Ibarra (). Matemáticas 1. Cálculo Diferencial. McGraw Hill - D.G. Zill, W.S. Wright, J. Ibarra (). Matemáticas 2. Cálculo Integral. McGraw Hill - S. Grossman, J. Ibarra (). Matemáticas 4. Álgebra Lineal. McGraw Hill - Á.M. Ramos del Olmo, J.M. Rey Cabezas (2017). Matemáticas básicas para el acceso a la universidad. Pirámide
Complementary	

Recommendations

Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Physics/631G01103

Physics I/631G02153

Subjects that continue the syllabus

Mathematics II/631G01106

Other comments

Attend the optional introductory course which is given the first week.

(*)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.