UNIVERSIDADE DA CORUÑA

Teaching Guide					
Identifying Data					2021/22
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 studenst will learn to use these specific mathematical tools, but also they will improve their skills in developing new methods and adquiring new technlolgies, to consult bibliographic references and online resources, to elaborate a memory in a rigourous and sistematic 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.				

Contingency plan	In this section, we collect the adaptations that will be carried out in teaching and evaluation, were we faced with a scenario of non-presence due to a new clash of the pandemic. 1. Modifications to the contents No changes will be made. 2. Methodologies *Teaching methodologies that are maintained Collaborative learning, Seminaries, Supervised projects, Document analysis. *Teaching methodologies that are modified Guest lecture/ keynote speech. they will be replaced by virtual videos and videoconferences with students through the Teams platform. They will be recorded in Stream. They will always be held at the official time set by the calendar's classroom. ? Solving problems. They will become virtual sessions about doubts in solving problems. They will always be held at the official time set by the School Board. ? Objective test. If it cannot be done in person, the objective test will be carried out with the online assessment tools that the University makes available to the community. 3. Mechanisms for personalized attention to students - E-mail: During working hours. To make brief questions and request virtual meetings to solve doubts during supervising hours. - Moodle: Daily. According to the needs of the students. They have ?thematic forums associated with the modules ?of the subject, to formulate the necessary queries. - Teams: Weekly single group sessions and interactive teaching groups for the advancement of theoretical and practical content in the time slot assigned to the subject in the faculty classroom calendar. This dynamic allows a standardized follow-up and adjusted to the learning needs of the students to develop the works of the subject. 4. Modifications in the evaluation Two possible itineraries are established: 1) Students who have carried out continuous assessment during the course: a) Methodology: supervised project and problem solving Qualification weight: 50% Description: Students who take the continuous assessment tests during the course (face-to-face and / or virtual) will be qualified with the weighted average mark they obtained b)Methodology: objective test Qualification weight: 50% Description: Individual test of assimilation of theoretical-practical knowledge and problem solving, with the possibility of oral defense of any of the proposed problems. 2) Students who did not carry out continuous assessment during the course or renounce to it. 2a) Methodology: objective test Qualification weight: 50% Description: Individual test of assimilation of theoretical-practical knowledge. 2b) Methodology: Solving exercises.

Qualification weight: 50%
Description: Resolution of practical problems.

*Evaluation observations: IF any online material was requested, oral defense might be necessary to prove authorship.

5. Modifications to the bibliography or webgraphy No changes will be made. They already have all the materials for the subject Digitized in Moodle as well as various links to electronic books available through the UDC Library to facilitate access to the bibliography for students.

Study programme competences	
Code	Study programme competences
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 xuicios 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		
	A73 A74 A75		

		B1 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18	
			C1 C3 C7 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 12.- Graphic representation of Real Valued Functions.	12.1.- Domain and Continuity 12.2.- Symmetries 12.3.- Periodicity. 12.4.- Intersection with the coordinates axis. 12.5.- Use of successive derivatives and applications: Monotonicity. Extremal values. Concavity and Convexity. Inflection points. 12.6.- Asymptotes and Parabolic Branches
Lesson 13.- Sequences and Series.	13.1.- General definitions. Types of Sequences. 13.2.- Practical calculation of Limits 13.3.- General definitions. Main Types of Numerical Series. 13.4.- Properties of the Numerical Series. Criteria of Convergence for Series of Positive Terms. 13.5.- Series of Positive and Negative Terms. Alternated Series.
Lesson 14.- Functional Sequences and Series. Series of powers.	14.1.- General definitions. 14.2.- Series of Powers. Convergence. 14.3.- Series expansions. 14.4.- Series of Taylor and Mac Laurin. 14.5.- Binomial Series. 14.6.- Method of the Undetermined Coefficients.
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	A75 B3 B5 B6 B17 B18 C9 C8	28	28	56
Collaborative learning	B1 B3 B4 B5 B6 B7 B8 B9 B10 B11 B13 B17 C8 C1	16	32	48
Problem solving	A73 A74 A75 B3 B4 B5 B6 B7	8	12	20
Supervised projects	A73 B1 B3 B4 B6 B8 B9 B10 B12 B14 B15 C9 C3 C1	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
Objective test	B1 B8 B11 B14 B15 C9 C8 C1	2	0	2
Personalized attention		1	0	1
(*)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.
Collaborative learning	Group work with presentation of the results when appropriate.
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
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, acoording 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
Collaborative learning	B1 B3 B4 B5 B6 B7 B8 B9 B10 B11 B13 B17 C8 C1	Participación en traballos grupais	5
Supervised projects	A73 B1 B3 B4 B6 B8 B9 B10 B12 B14 B15 C9 C3 C1	Traballos propostos.	15
Objective test	B1 B8 B11 B14 B15 C9 C8 C1	Comprobación dos coñecementos e capacidade de resolución de problemas.	60
Problem solving	A73 A74 A75 B3 B4 B5 B6 B7	Resolver problemas.	20

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. 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 proffesor office or by TEAMS, where they will perform equivalent tests.

Sources of information	
Basic	- S. Grossman, J. Ibarra (). Matemáticas 4. Álgebra Lineal. McGraw Hill - Granero, F. (). EJERCICIOS Y PROBLEMAS DE CÁLCULO (I y II) . Tébar Flores - Granero, F. (). CÁLCULO . Mac Graw-Hill - Granero, F (). ALGEBRA Y GEOMETRÍA ANALÍTICA . Mac Graw-Hill - Villa, A. de la (). PROBLEMAS DE ALGEBRA LINEAL. GLAGSA - Fernández Viña, J.A (). ANÁLISIS MATEMÁTICO I . Tecnos - García , A.y otros. (). CÁLCULO I (Teoría y Problemas) . Librería I.C.A.I - 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	

Recommendations
Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments
Attend the optional introductory course 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.