UNIVERSIDADE DA CORUÑA

Teaching Guide					
Identifying Data					2020/21
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	Suarez Taboada, Maria		E-mail	maria.suarez3@udc.es	
Lecturers	Suarez Taboada, Maria		E-mail	maria.suarez3@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	1. Modifications to the contents No changes will be made. 2. Methodologies *Teaching methodologies that are maintained Collaborative learning, Schemes, Supervised projects, Document analysis, Online discussion, Directed discussion, Introductory activities. *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 and collections of solved exercises available to students in OneNote. 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 with the possibility of oral defense of any of the proposed problems.

*Evaluation observations:
Students who take the second itinerary (without continuous evaluation) will be examined in the entire subject and must achieve a minimum of 35% in the objective test to be able to do the problem solving part.

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 / results	
Code	Study programme competences / results
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 vanguardia 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 xuicios 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 / results		
	A12 A14 A17		

		B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11	
			C1 C3 C5 C6 C7 C8 C9 C10 C11 C12 C13

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 / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Problem solving	A12 A14 A17 B1 B2 B3 B4 B5 B7 B8 B9 B10 B11 C3 C6 C7 C8 C9 C10 C11 C12 C13	6	24	30
Guest lecture / keynote speech	A12 A14 A17 B1 B2 B3 B4 B5 B6 B7 B9 C1 C3 C5 C7 C8	24	24	48
Objective test	A12 A14 A17 B1 B2 B3 B4 B6 B7 B8 B10 B11 C1 C3 C5 C6 C8	4	0	4
Document analysis	A12 A17 B1 B3 B4 B5 B7 B8 B9 B11 C3	0	2	2
Collaborative learning	A12 A14 A17 B1 B2 B3 B5 B6 B7 B8 B9 B10 B11 C1 C3 C5 C6 C7 C8	9	9	18
Supervised projects	A12 A14 A17 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C3 C5 C6 C7 C8	4	20	24
Online discussion	A12 A14 A17 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C3 C5 C6 C7 C8	0	6	6
Directed discussion	A12 A14 A17 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C5 C6 C7 C8	2	0	2
Diagramming	A14 A17 B1 B2 B4 B5 B7 B8 B9 B10 C9 C11 C12	2	4	6
Introductory activities	A12 A14 A17 B1 B4 B6 B7 B9 B10 C1 C3 C5 C6 C7	3	3	6
Personalized attention		4	0	4

(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	**Description**
Problem solving	En cada tema, vanse propoñer exercicios para resolver.
Guest lecture / keynote speech	Exposición na aula dos conceptos fundamentais.
Objective test	Proba de coñecementos.
Document analysis	Seleccionar libros e páxinas web a utilizar
Collaborative learning	Traballo en grupo con exposición dos resultados no seu caso
Supervised projects	Traballos propostos individuais e grupais
Online discussion	Plantexar e resolver dudas en Moodle
Directed discussion	Discusión na aula do plantexado previamente en Moodle ou en clase.
Diagramming	Facer esquemas
Introductory activities	Tema 0: Conceptos básicos que se deben recordar

Personalized attention	
Methodologies	**Description**
Supervised projects Collaborative learning Guest lecture / keynote speech Problem solving	The students are encouraged to attend in small groups or individually to the professors' office to solve questions that may arise, thus obtaining a more specific guidance, acoording to their specific difficulties.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Directed discussion	A12 A14 A17 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C5 C6 C7 C8	Participación nos debates na aula. Se avaliarán as competencias A12, A14, A17, B1, B2, B3, B5, B6, B7, B8, B9, B10, B11, C1, C3, C5, C6, C7 y C8.	5
Supervised projects	A12 A14 A17 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C3 C5 C6 C7 C8	Traballos propostos. Se avaliarán as competencias A12, A14, A17, B1, B2, B4, B6, B7, B8, B9, B10, B11, C1, C5, C6, C7 y C8.	20
Collaborative learning	A12 A14 A17 B1 B2 B3 B5 B6 B7 B8 B9 B10 B11 C1 C3 C5 C6 C7 C8	Participación en traballos grupais. Se avaliarán as competencias A12, A14, A17, B1, B2, B5, B6, B7, B8, B9, B10, B11, C1, C6, C7 y C8.	5
Objective test	A12 A14 A17 B1 B2 B3 B4 B6 B7 B8 B10 B11 C1 C3 C5 C6 C8	Comprobación dos coñecementos e capacidade de resolución de problemas. Se avaliarán as competencias A12, A14, A17, B1, B2, B5, B6, B7, B8, B9, B10, B11, C1, C6, C7 y C8.	50
Problem solving	A12 A14 A17 B1 B2 B3 B4 B5 B7 B8 B9 B10 B11 C3 C6 C7 C8 C9 C10 C11 C12 C13	Resolver problemas. Se avaliarán as competencias A12, A14, A17, B1, B2, B4, B5, B6, B8, B9, B10, B11, C1, C3, C6, C7 y C8.	20

Assessment comments

The students participants in the EHEA should attend a minimum of 80% of the lessons, being the continuous assessment of 50% of the final score. The other 50% 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 as follows: 1) an objective test that includes an individual test of assimilation of practical-theoretical knowledge and 2) a problem solving test. Each test will be 50% of the final score. 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 stay on the path and benefit from continuous assessment must attend at least 50% of the course. They are exempt from attending the theoretical classes in case they are not able to attend. If they are not able to attend the practical test neither, they should attend tutorials at the professor office, where they will be asked to perform equivalent (similar) tests.

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