Teaching Guide

Identifying Data				2016/17
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	FB	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Métodos Matemáticos e de Representación			
Coordinador	Rodriguez Aros, Angel Daniel	E-mail	angel.aros@udc.es	
Lecturers	Rodriguez Aros, Angel Daniel	E-mail	angel.aros@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.			

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	
Do listado de competencias da titulación	A2 A8 A9	
Do listado de competencias da titulación		B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B19 B22 B23 B24
Do listado de competencias da titulación		C10

Contents	
Topic	Sub-topic
Lesson 1.- Espazos Vectoriais	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.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Document analysis	A2 A8 B1 B2 B3 B4 B5 B6 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B19 B22 C3 C8	0	2	2
Collaborative learning	A9 B1 B3 B4 B6 B7 B8 B9 B10 B11 B12 B13 B17 B23 B24 C1 C3 C6 C7 C8 C10	9	9	18
Online discussion	A8 A9 B2 B3 B4 B5 B6 B8 B9 B10 B11 B12 B13 B14 B15 B17 B19 B22 B24 C3 C6 C8 C10	0	6	6
Diagramming	A8 A9 B1 B2 B4 B5 B8 B9 B11 B12 B13 B14 B16 C1 C3	2	4	6
Directed discussion	A2 A8 A9 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B19 B22 B23 B24 C1 C3 C6 C7 C8 C10	2	0	2
Supervised projects	A2 A8 A9 B1 B2 B3 B4 B5 B6 B8 B9 B12 B13 B14 B15 B16 B17 B19 B22 B23 B24 C1 C3 C6 C7 C10	4	20	24

Guest lecture / keynote speech	A2 A8 B1 B2 B3 B4 B15 B22 C1 C6 C8 C10	24	24	48
Objective test	A2 A8 A9 B2 B4 B5 B11 B12 B13 B14 B16 B17 B19 B22 B23 C1 C3 C10	4	0	4
Problem solving	A2 A8 A9 B2 B5 B6 B10 B11 B12 B13 B15 B16 B17 B19 C1 C3 C6 C10	6	24	30
Introductory activities	B1 B3 B4 B6 B7 B8 B14 B15 B23 C10	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**
Document analysis	Seleccionar libros e páxinas web a utilizar
Collaborative learning	Traballo en grupo con exposición dos resultados no seu caso
Online discussion	Plantexar e resolver dudas en Moodle
Diagramming	Rematar cada tema con un esquema dos conceptos básicos aprendidos.
Directed discussion	Discusión na aula do plantexado previamente en Moodle ou en clase.
Supervised projects	Traballos propostos individuais e grupais
Guest lecture / keynote speech	Exposición na aula dos conceptos fundamentais.
Objective test	Proba de coñecementos.
Problem solving	En cada tema, se propondrán exercicios para resolver.
Introductory activities	Tema 0: Conceptos básicos que se deben recordar

Personalized attention	
Methodologies	**Description**
Problem solving Supervised projects	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**	**Description**	**Qualification**
Problem solving	A2 A8 A9 B2 B5 B6 B10 B11 B12 B13 B15 B16 B17 B19 C1 C3 C6 C10	Resolver problemas.	10
Objective test	A2 A8 A9 B2 B4 B5 B11 B12 B13 B14 B16 B17 B19 B22 B23 C1 C3 C10	Proba para amosar os coñecementos teóricos e prácticos adquiridos.	70
Collaborative learning	A9 B1 B3 B4 B6 B7 B8 B9 B10 B11 B12 B13 B17 B23 B24 C1 C3 C6 C7 C8 C10	Participación en traballos grupais.	5

Supervised projects	A2 A8 A9 B1 B2 B3 B4 B5 B6 B8 B9 B12 B13 B14 B15 B16 B17 B19 B22 B23 B24 C1 C3 C6 C7 C10	Traballos propostos.	10
Directed discussion	A2 A8 A9 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B19 B22 B23 B24 C1 C3 C6 C7 C8 C10	Participación nos debates na aula.	5

Assessment comments
The students that do not participate in the EEES will be evaluated through an Objective Proof that will constitute 100% of the evaluation.
The course is divided in two parts: Part 1 (lessons 1-8) and part 2 (lessons 9-17). To pass it, it will be necessary to reach in each part a minimum of 3,5 points and afterwards obtain an average of, at least, 5 points.
In the unlikely case to reach an arithmetic average of 5 but not having, at least, 3,5 points in each one of the parts, the result of the evaluation will be of fail and the final qualification will be calculated with a suitable geometric average.
The criteria of evaluation contemplated in the framewor A-III/1 and A-III/2 of the Code STCW and his amendments related with this matter have been taken into account for the design of this qualification methodology.

Sources of information	
Basic	- García Gómez - Gutiérrez Castro (). ALGEBRA LINEAL. Pirámide
	- 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
	- Fernández Viña, J.A (). EJERCICIOS Y COMPLEMENTOS DE ANÁLISIS MATEMÁTICO I. Tecnos
	- Granero, F. (). EJERCICIOS Y PROBLEMAS DE CÁLCULO (I y II) . Tébar Flores
	- García Gómez - Gutiérrez Castro. (). GEOMETRÍA . Pirámide
	- Villa, A. de la (). PROBLEMAS DE ALGEBRA LINEAL. GLAGSA
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Phisics/631G01103
Subjects that continue the syllabus
Mathematics II/631G01106
Other comments

(*)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.