



Teaching Guide

| Teaching Guide | | | | |
|---------------------|---|--------|--|-----------|
| Identifying Data | | | 2023/24 | |
| 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 | 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

| Code | Study programme competences |
|------|--|
| A54 | RA1C-Write, explain and transmit the theoretical knowledge acquired both orally and in writing using scientific-technical language. |
| A55 | RA2C-Identify and relate acquired knowledge to other disciplines |
| A57 | RA4C-Collecting and interpreting relevant data |
| B30 | RA7H-Applying critical, logical and creative thinking |
| B31 | RA9H-Effectively solve practical problems associated with the subject by applying the knowledge acquired. |
| B32 | RA10H-Know, analyse, synthesise and apply the contents, fundamental concepts and applications of the subject. |
| B33 | RA11H-Develop both individual and group work |
| B34 | RA12H-Handle bibliographic material and computer resources. |
| B35 | RA13H-Handle with ease the tools, techniques, equipment and/or material/instrumental of each subject. |
| B36 | RA14H-Use information and communication technology (ICT) tools necessary for the exercise of their profession and for lifelong learning. |
| C14 | RA16X-Produce a report in a rigorous and systematic way. |

Learning outcomes

| Learning outcomes | Study programme competences | | |
|---|-----------------------------|-----|--|
| RA1C-Write, explain and transmit the theoretical knowledge acquired both orally and in writing using scientific-technical language. | A54 | | |
| RA2C-Identify and relate acquired knowledge to other disciplines | A55 | | |
| RA4C-Collecting and interpreting relevant data | A57 | | |
| RA7H-Applying critical, logical and creative thinking | | B30 | |
| RA9H-Effectively solve practical problems associated with the subject by applying the knowledge acquired. | | B31 | |
| RA10H-Know, analyse, synthesise and apply the contents, fundamental concepts and applications of the subject. | | B32 | |
| RA11H-Develop both individual and group work | | B33 | |
| RA12H-Handle bibliographic material and computer resources. | | B34 | |
| RA13H-Handle with ease the tools, techniques, equipment and/or material/instrumental of each subject. | | B35 | |



| | | | |
|--|--|-----|-----|
| RA14H-Use information and communication technology (ICT) tools necessary for the exercise of their profession and for lifelong learning. | | B36 | |
| RA16X-Produce a report in a rigorous and systematic way. | | | C14 |

| 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. Rouché-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 E^3 . 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 E^3 . 7.8.- Orientation in E^3 . 7.9.- Vector product in R^3 . Properties. Analytical expression. 7.10.- Mixed product. Analytical expression. Geometrical interpretation. |



| | |
|--|--|
| Lesson 8.- Metric Problems in Euclidean Spaces. | <p>8.1.- Normal equation of a Plane.</p> <p>8.2.- Angles between Linear Manifolds in R^3: Angle of Two Planes, Angle of Two Straight Lines, Angle of Straight Line and Plane.</p> <p>8.3.- Distance between Linear Manifolds in 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.</p> <p>8.4.- Cylindrical coordinates and Spherical coordinates in R^3.</p> |
| Lesson 9.-Real valued functions of a Real Variable. Continuity. | <p>9.1.- Basic definitions.</p> <p>9.2.- Functional limits.</p> <p>9.3.- Continuity. Types of Discontinuity.</p> <p>9.4.- Properties and Theorems on Continuous Functions.</p> |
| Lesson 10.- Differentiability and Applications of the Derivatives. | <p>10.1.- Derivative and Differential of a Function in a Point. Geometrical meaning.</p> <p>10.2.- Properties and Calculation of Derivatives.</p> <p>10.3.- Derivative function. Successive derivatives.</p> <p>10.4.- Applications of the Derivatives to the Local Study of a Function: Growth and Decreasing. Maxima and Minima. Concavity and Convexity. Inflection points.</p> <p>10.5.- Theorems of Rolle and Mean Value Theorem.</p> <p>10.6.- Rules of L'Hôpital</p> |
| Lesson 11.- Theorem of Taylor and Applications. Plot of a real function. | <p>11.1.- Expression of a Polynomial by means of his Derivatives in a Point.</p> <p>11.2.- Polynomial and Theorem of Taylor. Formulae of Taylor and Mac Laurin.</p> <p>11.3.- Expression of Lagrange for the Residual. Bounds for the residual.</p> <p>11.4.- Applications to the Local Study of a Function: Monotonicity. Extremal values. Concavity and Convexity. Inflection points. Plot of a real function.</p> |
| Lesson 12.- Indefinite integration of Functions of a Real Variable | <p>12.1.- General definitions. Table of Primitives.</p> <p>12.2.- Immediate integration</p> <p>12.3.- Integration by Parts</p> <p>12.4.- Integration of Rational Functions</p> <p>12.5.- Integration by Replacement or Change of Variable</p> |
| Lesson 13.- Definite Integration. Applications. | <p>13.1.- General definitions</p> <p>13.2.- Properties</p> <p>13.3.- Mean Value Theorem. Barrow's Rule.</p> <p>13.4.- Evaluation of Definite Integrals.</p> <p>13.5.- Improper Integral.</p> <p>13.6.- Applications of the Definite Integral</p> |
| Lesson 14.- Complex Numbers | <p>14.1.- General definitions</p> <p>14.2.- Fundamental operations</p> <p>14.3.- Powers and Roots</p> <p>14.4.- Exponential form of a Complex</p> <p>14.5.- Logarithms And Complex Powers.</p> |



| | |
|--|---|
| 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 | A55 A57 B30 B32 | 28 | 28 | 56 |
| Problem solving | A54 B30 B31 B32 B33 B35 B36 | 24 | 36 | 60 |
| Supervised projects | A54 A57 B30 B31 B32 B34 B35 B36 C14 | 0 | 10 | 10 |
| Seminar | A55 A54 B30 B31 B32 B33 B34 B35 | 0 | 10 | 10 |
| Document analysis | A55 A57 B34 B35 B36 | 0 | 3 | 3 |
| Introductory activities | B1 B3 B4 B7 B12 B14 B15 B22 | 2 | 2 | 4 |
| Objective test | A54 B30 B31 B32 | 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 | A54 B30 B31 B32 B33 B35 B36 | Resolver problemas. | 15 |
| Guest lecture / keynote speech | A55 A57 B30 B32 | Resolución de cuestións teóricas ou prácticas breves relacionadas cos contidos da sesión maxistral | 10 |
| Objective test | A54 B30 B31 B32 | Proba para amosar os coñecementos teóricos e prácticos adquiridos. | 60 |
| Supervised projects | A54 A57 B30 B31 B32 B34 B35 B36 C14 | Traballos propostos. | 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's 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"> - 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 - 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 - Villa, A. de la (). PROBLEMAS DE ALGEBRA LINEAL. GLAGSA - 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/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.