



## Teaching Guide

| Identifying Data           |  |               |  |         | 2021/22 |
|----------------------------|--|---------------|--|---------|---------|
| <b>Subject (*)</b>         | Mathematics II   | <b>Code</b>   | 631G03006  |         |         |
| <b>Study programme</b>     | Grao en Máquinas Navais  |               |  |         |         |
| Descriptors                |  |               |  |         |         |
| Cycle                      | Period   | Year          | Type   | Credits |         |
| Graduate                   | 2nd four-month period  | First         | Basic training                                   | 6       |         |
| <b>Language</b>            | Spanish  |               |  |         |         |
| <b>Teaching method</b>     | Face-to-face   |               |  |         |         |
| <b>Prerequisites</b>       |  |               |  |         |         |
| <b>Department</b>          | Matemáticas  |               |  |         |         |
| <b>Coordinador</b>         | Cao Rial, María Teresa   | <b>E-mail</b> | teresa.cao@udc.es                                |         |         |
| <b>Lecturers</b>           | Calvo Garrido, María Del Carmen<br>Cao Rial, María Teresa  | <b>E-mail</b> | carmen.calvo.garrido@udc.es<br>teresa.cao@udc.es |         |         |
| <b>Web</b>                 | www.nauticaymaquinas.es/   |               |  |         |         |
| <b>General description</b> | <p>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.</p> |               |  |         |         |



**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, Seminars, 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 xuícos 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                         |  |



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|  |  |  |  | B16 |    |
|  |  |  |  | B17 |    |
|  |  |  |  | B18 |    |
|  |  |  |  |     | C1 |
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|  |  |  |  |     | C7 |
|  |  |  |  |     | C8 |
|  |  |  |  |     | C9 |

| Contents   |  |
|--|--|
| Topic  | Sub-topic  |
| Lesson 1.- Bilinear forms. Quadratic forms.                    | 1.1.- Bilinear forms. Associated Matrix<br>1.2.- Symmetrical bilinear forms<br>1.3.- Quadratic forms<br>1.4.- Canonical Quadratic form. Reduction to the Canonical Form<br>1.5.- Classification of the Quadratic Forms         |
| Lesson 2.- Loci in the Plane. Conic sections                   | 2.1.- Loci in the plane<br>2.2.- Circumference<br>2.3.- Elipse<br>2.4.- Hyperbola. Equilateral hyperbola.<br>2.5.- Parabola<br>2.6.- Conic sections.   |
| Lesson 3.- General Equation of a Conic Section. Canonical Form | 3.1.- General equation<br>3.2.- Invariants<br>3.3.- Classification<br>3.4.- Reduction to the Canonical Form<br>3.5.- Obtention of Relevant Elements: Centre, Axes, Asymptotes, Focus, Vertices<br>3.6.- Graphic representation |



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| Lesson 4.- Loci in the space. Quadric surfaces  | 4.1.- Loci in the Space<br>4.2.- Ruled surfaces. Surfaces of Revolution<br>4.3.- Spherical surface<br>4.4.- Ellipsoid<br>4.5.- Hyperboloids<br>4.6.- Paraboloids<br>4.7.- Cylindrical surfaces<br>4.8.- Conical Surfaces |
| Lesson 5.- Functions of several real variables. Limits and Continuity. 10.1.- General definitions | 5.1.- General definitions<br>5.2.- Limits<br>5.3.- Continuity  |
| Lesson 6.- Partial and Directional Derivatives  | 6.1.- Partial Derivatives. Tangent Plane<br>6.2.- Directional Derivatives<br>6.3.- On Partial Derivatives, Directional Derivatives and Continuity<br>6.4.- Higher Order Partial derivatives.                             |
| Lesson 7.- Differentiation  | 7.1.- General definitions<br>7.2.- Differentiability, Continuity and Partial Derivatives<br>7.3.- Chain Rules. Implicit Differentiation<br>7.4.- Higher order Differentiation  |
| Lesson 8. Taylor's Theorem. Optimization  | 8.1.- Taylor's polynomial and theorem<br>8.2.- Relative extrema<br>8.3.- Conditioned extrema. Lagrange Multipliers.  |
| Lesson 9.- Multiple Integrals. Applications   | 9.1.- General definitions and Properties<br>9.2.- Iterated Integrals. Fubini's Theorem.<br>9.3.- Change of Variables<br>9.4.- Applications   |
| Lesson 10.- Line Integral and Surface Integral  | 10.1.- Introduction<br>10.2.- Line Integral<br>10.3.- Green's Theorem<br>10.4.- Surface Integral<br>10.5.- Surface Integral in Curvilinear Coordinates<br>10.6.- Stoke's Theorem. Gauss-Ostrogradski's Theorem           |
| Lesson 11.- Ordinary Differential Equations of First Order  | 11.1.- General definitions<br>11.2.- Ordinary Differential Equations of First Order<br>11.3.- Main Types of ODE of First Order   |
| Lesson 12.- Higher Order Ordinary Differential Equations  | 12.1.- Homogeneous and Nonhomogeneous Second Order ODE's<br>12.2.- Second Order Linear ODE with constant coefficients<br>12.3.- Higher order Nonhomogeneous ODE of n-th Order  |
| Lesson 13.- Systems of Ordinary Differential Equations  | 13.1.- Systems of Ordinary Differential Equations<br>13.2.- Systems of Linear Differential Equations with Constant Coefficients  |
| Lesson 14.- Laplace Transform. Integration by Series  | 14.1.- Laplace Transform<br>14.2.- Applications of the Laplace Transform<br>14.3.- Integration of Ordinary Differential Equations by Series  |



|  |  |
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| <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 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.</p> | <p>Table A-III / 2 of the STCW Convention.<br/>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.</p> |
|--|--|

| Planning                       |   |                      |                               |             |
|--------------------------------|---|----------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies  | Ordinary class hours | Student?s personal work hours | Total hours |
| Guest lecture / keynote speech | A75 B3 B5 B6 B17<br>B18 C8 C9                       | 28                   | 28                            | 56          |
| Collaborative learning         | B1 B3 B4 B5 B6 B7<br>B8 B9 B10 B11 B13<br>B17 C1 C8 | 16                   | 32                            | 48          |
| Problem solving                | A73 A74 A75 B3 B4<br>B5 B6 B7 B12                   | 8                    | 12                            | 20          |
| Supervised projects            | A73 B1 B3 B4 B6 B8<br>B9 B10 B14 B15 B16<br>C3 C1   | 0                    | 10                            | 10          |
| Seminar                        | B1 B3 B5 B6 B7 B8<br>B9 B10                         | 0                    | 10                            | 10          |
| Document analysis              | B9 B10 B13 B16 C3<br>C7 C8 C9                       | 0                    | 3                             | 3           |
| Objective test                 | B1 B8 B11 B14 B15<br>C1 C9 C8                       | 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 |



|  |   |
|--|---|
| Problem solving<br>Supervised projects | <p>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, according to their specific difficulties.</p> <p>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.</p> |
|--|---|

| Assessment             |   |  |               |
|------------------------|---|--|---------------|
| Methodologies          | Competencies  | Description  | Qualification |
| Collaborative learning | B1 B3 B4 B5 B6 B7<br>B8 B9 B10 B11 B13<br>B17 C1 C8 | Participación en traballos grupais.                                    | 5             |
| Objective test         | B1 B8 B11 B14 B15<br>C1 C9 C8                       | Comprobación dos coñecementos e capacidade de resolución de problemas. | 60            |
| Problem solving        | A73 A74 A75 B3 B4<br>B5 B6 B7 B12                   | Resolver problemas.  | 20            |
| Supervised projects    | A73 B1 B3 B4 B6 B8<br>B9 B10 B14 B15 B16<br>C3 C1   | Realización dos traballos propostos.                                   | 15            |
| Others                 |   |  |               |

| Assessment comments  |
|--|
| <p>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.</p> <p>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)</p> <p>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.</p> <p>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.</p> |

| Sources of information |  |
|------------------------|--|
| Basic                  | <ul style="list-style-type: none"> <li>- Fernández Viña, J.A (). EJERCICIOS Y COMPLEMENTOS DE ANÁLISIS MATEMÁTICO II. Tecnos</li> <li>- Fernández Viña, J.A. (). ANÁLISIS MATEMÁTICO II . Tecnos</li> <li>- García, Alfonso y otros (). CÁLCULO II . Librería ICAI</li> <li>- Larson-Hostetler-Edwards (). CÁLCULO (2) . Mac Graw Hill</li> <li>- James Stewart (). CALCULO MULTIVARIABLE. Thomson</li> <li>- Martínez Sagarzazu (). ECUACIONES DIFERENCIALES. APLICACIONES Y EJERCICIOS. Universidad del País Vasco</li> <li>- Gutiérrez Gómez-García Castro (). GEOMETRÍA. Pirámide</li> <li>- Granero, F. (). ALGEBRA LINEAL Y GEOMETRÍA. Mac Graw Hill</li> <li>- García García-López Pellicer (). ALGEBRA LINEAL Y GEOMETRÍA. Marfil</li> <li>- Villa, A. de la (). PROBLEMAS DE ÁLGEBRA LINEAL. Glagsa</li> <li>- D.G. Zill, W.S. Wright, J. Ibarra (). Matemáticas 3. Cálculo de Varias Variables. McGraw Hill</li> </ul> |
| Complementary          |  |





| Recommendations  |
|--|
| Subjects that it is recommended to have taken before     |
| Mathematics I/631G02151                                  |
| Subjects that are recommended to be taken simultaneously |
| Subjects that continue the syllabus                      |
| 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.