



## Teaching Guide

| Identifying Data    |  |        |                   |         | 2016/17 |
|---------------------|--|--------|-------------------|---------|---------|
| Subject (*)         | Matemáticas II   | Code   | 631G02156         |         |         |
| Study programme     | Grao en Tecnoloxías Mariñas  |        |                   |         |         |
| Descriptors         |  |        |                   |         |         |
| Cycle               | Period   | Year   | Type              | Credits |         |
| Graduate            | 2nd four-month period  | First  | FB                | 6       |         |
| Language            | Spanish  |        |                   |         |         |
| Teaching method     | Face-to-face   |        |                   |         |         |
| Prerequisites       |  |        |                   |         |         |
| Department          | Métodos Matemáticos e de Representación  |        |                   |         |         |
| Coordinador         | Rodríguez Aros, Angel Daniel   | E-mail | angel.aros@udc.es |         |         |
| Lecturers           | Rodríguez Aros, Angel Daniel   | E-mail | angel.aros@udc.es |         |         |
| Web                 | www.nauticaymaquinas.es/   |        |                   |         |         |
| General description | <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> |        |                   |         |         |

## Study programme competences

| Code | Study programme competences  |
|------|--|
| 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. |
| 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 vangardía 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 xuícios 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 |     |
|                   |  | A12                         |     |
|                   |  | A14                         |     |
|                   |  | A17                         |     |
|                   |  |                             | B1  |
|                   |  |                             | B2  |
|                   |  |                             | B3  |
|                   |  |                             | B4  |
|                   |  |                             | B5  |
|                   |  |                             | B6  |
|                   |  |                             | B7  |
|                   |  |                             | B8  |
|                   |  |                             | B9  |
|                   |  |                             | B10 |
|                   |  |                             | B11 |
|                   |  |                             | C1  |
|                   |  |                             | C3  |
|                   |  |                             | C6  |
|                   |  |                             | C7  |
|                   |  |                             | C8  |
|                   |  |                             | C9  |
|                   |  |                             | C10 |
|                   |  |                             | C11 |
|                   |  |                             | C12 |
|                   |  |                             | C13 |

| 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 |



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|---|--|
| Lesson 2.- Loci in the Plane. Conic sections  | 2.1.- Loci in the plane<br>2.2.- Circumference<br>2.3.- Ellipse<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 |
| 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. Integraton by Series        | 14.1.- Laplace Transform<br>14.2.- Applications of the Laplace Transform<br>14.3.- Integration of Ordinary Differential Equations by Series                                   |

| Planning                       |  |                      |                               |             |
|--------------------------------|--|----------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies   | Ordinary class hours | Student?s personal work hours | Total hours |
| Collaborative learning         | A12 A14 A17 B2 B3<br>B5 B6 B8 B9 B10 B11<br>C1 C3 C6 C7 C8 C9<br>C10 C11 C12 C13 | 6                    | 6                             | 12          |
| Diagramming                    | A17 B1 B2 B3 B4 B7<br>B10 C1 C3 C6   | 2                    | 4                             | 6           |
| Objective test                 | A12 A14 A17 B1 B2<br>B3 B4 B6 B7 B8 B10<br>B11 C1 C3 C6 C8                       | 4                    | 0                             | 4           |
| Guest lecture / keynote speech | A12 A14 A17 B1 B2<br>B3 B4 B5 B6 B7 B9<br>B10 B11 C1 C3 C6<br>C7 C8              | 27                   | 27                            | 54          |
| Problem solving                | A12 A14 A17 B1 B2<br>B3 B4 B5 B6 B7 B8<br>B9 B10 B11 C3 C6<br>C7 C8              | 9                    | 27                            | 36          |
| Supervised projects            | A12 A14 A17 B1 B2<br>B3 B4 B5 B6 B7 B8<br>B9 B10 B11 C1 C3<br>C6 C7 C8           | 4                    | 20                            | 24          |
| Document analysis              | A12 A14 A17 B1 B4<br>B5 B7 B8 B9 B10 B11<br>C3 C6 C8                             | 0                    | 2                             | 2           |
| Online discussion              | A12 A14 A17 B1 B2<br>B3 B4 B5 B6 B7 B8<br>B9 B10 B11 C1 C3<br>C6 C7 C8           | 0                    | 6                             | 6           |
| Directed discussion            | A12 A14 A17 B1 B2<br>B3 B4 B5 B6 B7 B8<br>B9 B10 B11 C1 C3<br>C6 C7 C8           | 2                    | 0                             | 2           |
| 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  |
|--------------------------------|--|
| Collaborative learning         | Resolver cuestións propostas en grupo e plantexar dudas.                         |
| Diagramming                    | Resumir os conceptos máis importantes de cada tema.                              |
| Objective test                 | Resolver de forma individual un test de coñecementos teóricos e prácticos.       |
| Guest lecture / keynote speech | Exposición dos temas.  |
| Problem solving                | Resolución de exercicios tipo e proposta de outros a resolver por os estudantes. |
| Supervised projects            | Seguimento e corrección de traballos propostos.                                  |
| Document analysis              | Seleccionar libros e páxinas web a utilizar                                      |
| Online discussion              | Plantexar e resolver dudas en Moodle   |
| Directed discussion            | Discusión na aula do plantexado previamente en Moodle.                           |

## Personalized attention

| Methodologies  | Description   |
|--|---|
| Collaborative learning<br>Problem solving<br>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, according to their specific difficulties. |

## Assessment

| Methodologies          | Competencies   | Description  | Qualification |
|------------------------|--|--|---------------|
| Directed discussion    | A12 A14 A17 B1 B2<br>B3 B4 B5 B6 B7 B8<br>B9 B10 B11 C1 C3<br>C6 C7 C8           | Participación nos debates na aula.<br>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             |
| Collaborative learning | A12 A14 A17 B2 B3<br>B5 B6 B8 B9 B10 B11<br>C1 C3 C6 C7 C8 C9<br>C10 C11 C12 C13 | Participación en traballos grupais.<br>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<br>B3 B4 B6 B7 B8 B10<br>B11 C1 C3 C6 C8                       | Proba individual de asimilación de coñecementos teórico-prácticos.<br>Se avaliarán as competencias A12, A14, A17, B1, B2, B5, B6, B7, B8, B9, B10, B11, C1, C6, C7 y C8. | 70            |
| Problem solving        | A12 A14 A17 B1 B2<br>B3 B4 B5 B6 B7 B8<br>B9 B10 B11 C3 C6<br>C7 C8              | Capacidade para resolver problemas.<br>Se avaliarán as competencias A12, A14, A17, B1, B2, B4, B5, B6, B8, B9, B10, B11, C1, C3, C6, C7 y C8.                            | 10            |
| Supervised projects    | A12 A14 A17 B1 B2<br>B3 B4 B5 B6 B7 B8<br>B9 B10 B11 C1 C3<br>C6 C7 C8           | Realización dos traballos propostos.<br>Se avaliarán as competencias A12, A14, A17, B1, B2, B4, B6, B7, B8, B9, B10, B11, C1, C5, C6, C7 y C8.                           | 10            |
| Others                 |  |  |               |

## 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 1-4) and part 2 (lessons 5-14). 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 following the formula  $(part\ 1 + 2 * part\ 2) / 3$ .

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

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

### Recommendations

#### Subjects that it is recommended to have taken before

Matemáticas 1/631G02151

#### 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.