



## Teaching Guide

| Identifying Data         |  |        |  |         | 2014/15 |
|--------------------------|--|--------|--|---------|---------|
| Subject (*)              | Ampliación de matemáticas  | Code   | 730496015  |         |         |
| Study programme          | Mestrado Universitario en Enxeñaría Naval e Oceánica (plan 2012)   |        |  |         |         |
| Descriptors              |  |        |  |         |         |
| Cycle                    | Period   | Year   | Type   | Credits |         |
| Official Master's Degree | 1st four-month period  | First  | Optativa   | 4.5     |         |
| Language                 | SpanishGalicianEnglish   |        |  |         |         |
| Prerequisites            |  |        |  |         |         |
| Department               | Matemáticas  |        |  |         |         |
| Coordinador              | Brozos Vázquez, Miguel   | E-mail | miguel.brozos.vazquez@udc.es                                 |         |         |
| Lecturers                | Brozos Vázquez, Miguel<br>García Rodríguez, José Antonio   | E-mail | miguel.brozos.vazquez@udc.es<br>jose.garcia.rodriquez@udc.es |         |         |
| Web                      | campusvirtual.udc.es/moodle  |        |  |         |         |
| General description      | Nesta asignatura ampliaranse os conceptos matemáticos estudados nos graos de enxeñaría. Así, traballarase con curvas e superficies, comprendendo a súa xeometría e os elementos que a describen xunto coas ferramentas que usamos habitualmente para estudialas. Introduciranse conceptos de cálculo tensorial e a súa aplicación na formulación e estudo de ecuacións en derivadas parciais que aparecen na física e na enxeñaría |        |  |         |         |

## Study programme competences

| Code | Study programme competences   |
|------|---|
| B1   | Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, a miúdo nun contexto de investigación   |
| B2   | Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en ámbitos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo   |
| B3   | Que os estudantes sexan capaces de integrar coñecementos e enfrontarse á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos |
| B4   | Que os estudantes saiban comunicar as súas conclusións e os coñecementos e razóns últimas que as sustentan a públicos especializados e non especializados dun modo claro e sen ambigüidades.  |
| B9   | Adquirir unha formación metodolóxica que garante o desenvolvemento de proxectos de investigación (de carácter cuantitativo e/ou cualitativo) cunha finalidade estratéxica e contribúan a situarnos na vangarda do coñecemento.  |
| C4   | Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.                                      |
| C6   | Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.   |
| C7   | Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.  |
| C8   | Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.   |

## Learning outcomes

| Subject competencies (Learning outcomes) | Study programme competences |     |
|--|-----------------------------|-----|
| Knowledge of elementary tensor calculus  | BC1                         | CC4 |
|  | BC2                         | CC6 |
|  | BC3                         | CC7 |
|  | BC4                         | CC8 |
|  | BC9                         |     |



|  |                                 |                          |
|--|---------------------------------|--------------------------|
| Ability to work with curves and surfaces and study their geometric properties: curvature, geodesics, ... | BC1<br>BC2<br>BC3<br>BC4<br>BC9 | CC4<br>CC6<br>CC7<br>CC8 |
| Application of tensor calculus to the formulation of partial differential equations from Physics.        | BC1<br>BC2<br>BC3<br>BC4<br>BC9 | CC4<br>CC6<br>CC7<br>CC8 |

| Contents   |  |
|--|--|
| Topic  | Sub-topic  |
| Curves   | Parametrized curves.<br>Regular curves. Arc length.<br>Curvature. Torsion. Frenet trihedron.<br>Famous curves.   |
| Surfaces   | Parametrized surfaces.<br>Regular surfaces. Tangent plane.<br>First fundamental form. Surface area.<br>Second fundamental form.<br>Gauss curvature and mean curvature.<br>Ruled surfaces and minimal surfaces.<br><br>Appendix: bilinear forms and quadratic forms   |
| Tensors  | Definition and properties.<br>Einstein notation.<br>Tensor fields.<br>Operations with tensors.   |
| Mathematics of continuum mechanics. Conservations laws | <ul style="list-style-type: none"> <li>- Continuum cinematics</li> <li>- Gradient of strain tensor. Green-Saint Venant Strain tensor</li> <li>- Transformation of areas and volumes</li> <li>- Reynolds theorem of transport.</li> <li>- Mass conservation law.</li> <li>- Law of conservation of momentum</li> <li>- Thermodynamics. Law of conservation of energy</li> <li>- Control volumens and conservation laws</li> </ul>   |
| Partial differential equations                         | <ul style="list-style-type: none"> <li>- Partial differential equations. Boundary conditions.</li> <li>- Constitutive laws</li> <li>- Heat conduction. Fourier's law. Heat equation for solids.</li> <li>- Fluid mechanics. Derivation of some important equations in fluid mechanics. Equations for incompressible fluids.</li> <li>- Elastic solids. Cauchy Theorem. Stress and strain tensors. Principal components. Eigenvalues and eigenvectors. Partial differential equations para for elastic solids.</li> </ul> |

| Planning              |                      |                               |             |
|-----------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests | Ordinary class hours | Student?s personal work hours | Total hours |
|                       |                      |                               |             |



|                                |     |    |     |
|--------------------------------|-----|----|-----|
| Seminar                        | 15  | 15 | 30  |
| Supervised projects            | 0   | 3  | 3   |
| Objective test                 | 3.5 | 0  | 3.5 |
| Guest lecture / keynote speech | 30  | 45 | 75  |
| 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  |
| Seminar                        | Technique of group work which purpose is the in-depth study of a subject. It involves discussion, participation, edocuments elaboration and the conclusion reached by all the components of the seminar.   |
| Supervised projects            | Methodology designed to promote autonomous learning of the students, always under the teacher's guide. It is a technique based on the assumption by the students of the responsibility of their learning.<br>This learning technique is based in two basic elements: the autonomous learning and the continuous monitoring of this learning by the teachers. |
| Objective test                 | Written test to assess the obtained competencies. It is an instruments of measure, rigorously developed, that allows to evaluate knowledges, capacities, skills, performances, aptitudes, attitudes, etc.  |
| Guest lecture / keynote speech | Oral presentation complemented with the use of audiovisual media and the introduction of some questions to the students, in order to transmit knowledge and provide learning   |

| Personalized attention |   |
|------------------------|---|
| Methodologies          | Description   |
| Supervised projects    | Along the course several works will be proposed to the students, and that will allow them, in case of obtaining a positive evaluation, to pass the subject. |

| Assessment          |   |               |
|---------------------|---|---------------|
| Methodologies       | Description   | Qualification |
| Supervised projects | Students who wish to, can choose a topic from among those proposed by the teachers of the subject. They will do a work on this subject to deepen their concepts and techniques, and that they will have to expose later.<br>This work will be qualified and will allow to pass the subject. | 50            |
| Objective test      | At the end of the course, these students that have not done the proposed works or that want to obtain a better qualification, will do a written exam in the data fixed by the school.   | 50            |

| Assessment comments  |
|--|
| The works will be corrected and attending to this corrections students will be qualified. If a student does not present the proposed work or if he wants to obtain a better qualifications he will be able to give up the obtained qualification and realize the final written exam &nbsp; |

| Sources of information |   |
|------------------------|---|
| Basic                  | <ul style="list-style-type: none"> <li>- Alexandre J. Chorin, Jerrold E. Marsden. (2000). A Mathematical Introduction to Fluid Mechanics. Texts in Applied Mathematic, Springer</li> <li>- M. Gurtin (1981). An introduction to continuum mechanics. Academic Press</li> <li>- Manfredo P. do Carmo (1995). Geometría diferencial de curvas y superficies. Alianza Universidad Textos</li> <li>- M. Gurtin, Eliot Fried, Lallit Anand (2010). The mechanics and thermodynamics of continua. Cambridge</li> <li>- José A. Pastor González, M<sup>a</sup> Ángeles Fernández Cifre (2010). Un curso de geometría diferencial. Consejo Superior de Investigaciones Científicas</li> <li>- Rutherford Aris (1962). Vectors, tensors, and the basic equations of fluid mechanics.. Prentice-Hall</li> </ul> |
| 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   |
|  |

(\*)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.