



Teaching Guide

Identifying Data					2017/18
Subject (*)	Advanced mathematics	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				
Teaching method	Face-to-face				
Prerequisites					
Department	Matemáticas				
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Lecturers	Brozos Vázquez, Miguel García Rodríguez, José Antonio	E-mail	miguel.brozos.vazquez@udc.es jose.garcia.rodriguez@udc.es		
Web	campusvirtual.udc.es/moodle				
General description	Nesta asignatura ampliaranse os conceptos matemáticos estudados nos graos de enxeñaría. Así, traballárase con curvas e superficies, comprendendo a súa xeometría e os elementos que a describen xunto coas ferramentas que usamos habitualmente para estudialas. Introdúciñanse conceptos básicos de cálculo tensorial e a súa aplicación na formulación e estudo de ecuacións en derivadas parciais que aparecen na física e na enxeñaría, con especial atención á mecánica de medios continuos.				

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
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.
B5	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun modo que haberá de ser en boa medida autodirixido ou autónomo.
B6	Ser capaz de realizar unha análise crítica, avaliación e síntese de ideas novas e complexas.

Learning outcomes

Learning outcomes	Study programme competences
Ability to work with curves and surfaces and study their geometric properties: curvature, geodesics, ...	BC1 BC2 BC4 BC5 BC6
Application of tensor calculus to the formulation of partial differential equations from Physics.	BC1 BC2 BC5
Knowledge of elementary tensor calculus	BC1 BC2
Capability to face typical problems in the context of naval engineering using basic differential geometry of curves and surfaces.	BC1 BC5 BC6



Contents	
Topic	Sub-topic
Os seguintes temas desenvolven os contidos establecidos na ficha da Memoria de Verificación, que son:	XEOMETRÍA DIFERENCIAL E TENSORES: Curvas: - Triedro de Frenet.- Recta tanxente, normal e binormal.- Curvatura e torsión. Superficies: - Curvatura de Gauss e curvatura media. - Xeometría intrínseca: xeodésicas. Tensores. SERIES DE FOURIER: - Funcións ortogonais. -Series de Fourier. - Series de Fourier de cosenos e senos. ECUACIONES DIFERENCIAIS EN DERIVADAS PARCIAIS: -Ecuaciones en derivadas parciais clásicas e problemas de valor na fronteira. - Resolución analítica. Resolución numérica: método de elementos finitos.
Curves	Parametrized curves. Regular curves. Arc length. Curvature. Torsion. Frenet trihedron. Famous curves.
Surfaces	Parametrized surfaces. Regular surfaces. Tangent plane. First fundamental form. Surface area. Tensor fields. The metric tensor. Second fundamental form. Christoffel symbols. Gauss curvature and mean curvature. Ruled surfaces and minimal surfaces. Appendix 1: Einstein notation. Appendix 2: bilinear forms and quadratic forms.
Mathematics of continuum mechanics. Conservations laws	- Continuum cinematics - Gradient of strain tensor. Green-Saint Venant Strain tensor - Transformation of areas and volumes - Reynolds theorem of transport. - Mass conservation law. - Law of conservation of momentum - Thermodynamics. Law of conservation of energy - Control volumens and conservation laws
Partial differential equations	- Partial differential equations. Boundary conditions. - Constitutive laws - Fluid mechanics. Derivation of some important equations in fluid mechanics. Equations for incompressible fluids. - Elastic solids. Cauchy Theorem. Stress and strain tensors. Principal components. Eigenvalues and eigenvectors. Partial differential equations para for elastic solids.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	B1 B2 B5 B6	24	36	60
Problem solving	B1 B2 B4 B5 B6	12	12	24
Supervised projects	B2 B4 B5 B6	0	24	24
Objective test	B1 B2 B4 B5 B6	3.5	0	3.5
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	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
Problem solving	Technique of group work which purpose is the in-depth study of a subject. It involves discussion, participation, documents 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. 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 instrument of measure, rigorously developed, that allows to evaluate knowledges, capacities, skills, performances, aptitudes, attitudes, etc.

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	Competencies	Description	Qualification
Objective test	B1 B2 B4 B5 B6	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
Supervised projects	B2 B4 B5 B6	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. This work will be qualified and will allow to pass the subject.	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/she wants to obtain a better qualifications, he/she will be able to give up the obtained qualification and do the final exam in the 1st or the 2nd opportunity.
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Sources of information

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