Teaching Guide				
Identifying Data				2015/16
Subject (*)	Métodos numéricos aplicados a medios continuos		Code	730496022
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	Enxeñaría Naval e Oceánica			
Coordinador	Fariñas Alvariño, Pablo	E-mail	pablo.farinas@udc.es	
Lecturers	Fariñas Alvariño, Pablo Mendez Diaz, Abel	E-mail	pablo.farinas@udc.es abel.mendez@udc.es	
Web				
General description	In this subject the fundamentals and theoretical background of computational naval mechanics, as well as its applicability are studied. The course is based on the finite volume methods and the main objective is to allow the pupils to acquire a knowledge level which permits them to develop their own basic naval models.			

Study programme competences / results	
Code	Study programme competences / results
A2	Coñecemento avanzado da hidrodinámica naval para a súa aplicación á optimización de carenas, propulsores e apéndices.
A3	Coñecemento da dinámica do buque e das estruturas navais, e capacidade para realizar análise de optimización da estrutura da integración dos sistemas a bordo, e do comportamento do buque no mar e da súa manobrabilidade.
A7	Capacidade para proxectar plataformas e artefactos oceánicos.
A10	Coñecemento dos sistemas de posicionamento e da dinámica de plataformas e artefactos.
A13	Coñecemento da enxeñaría de sistemas aplicada á definición dun buque, artefacto ou plataforma marítima mediante a análise e optimización do seu ciclo de vida.
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.
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.
B7	Falar ben en público
C1	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.

Learning outcomes	
Learning outcomes	Study programme competences / results

Knowing and understanding the numerical model based on the fundamental equations. Modelling and understanding the fundamental phenomenologies which govern the naval hydrodynamics. Analyzing the computational results, from a general perspective, in complex ship hydrodynamic cases.	AC2 AC3 AC7 AC10 AC13	BC1 BC2 BC3 BC4 BC5 BC6 BC7	CC1

Contents	
Topic	**Sub-topic**
Remembering conservation laws:	Conservation laws (mass and momentum). Combined convection / diffusion
Pressure velocity coupling algorithms:	Introduction to the closure problem. Numerical versus physical incompressibility. Staggered grids. SIMPLE/ER/C and PISO methods for staggered grids. SIMPLE/ER/C and PISO methods for collocated grids. Implementing cases.
Linear equations systems:	Sparse matrix systems. Point to point, line to line and plane to plane methods. High and low frequency errors. Multigrid methods. Conjugate gradient method. Implementing cases
Unsteady problems:	Explicit, implicit and fully implicit schemes in 1D transient pure diffusive case. Extension to 3D case. Combined advection diffusion transient case. Transient pressure velocity coupling. Implementing cases.
Special Boundaries:	Remembering Dirichlet and von Newmann boundaries. Combined boundary conditions. Wall laws. Special boundaries. Free surface.
Cases over commercial software:	Proposed cases by the professor.

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Introductory activities	A2 A3 A7 A10 A13 B2 B3 B5 B6 C1	2	1	3
Guest lecture / keynote speech	A2 A3 A7 A10 A13 B1 B2 B3 B5 B6 C1	25	25	50
Case study	A2 A3 A7 A10 A13 B1 B2 B3 B5 B6 C1	8	8	16
Simulation	A2 A3 A7 A10 A13 B2 B3 B4 B5 B6 B7 C1	7	31.5	38.5
Objective test	B2 B6 C1	3	0	3
Personalized attention		2	0	2
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Introductory activities	Remembering mechanics fundamentals.
Guest lecture / keynote speech	Are the typical lectures.
Case study	Cases resolutions solved during the lectures.
Simulation	Running a commercial solver.
Objective test	Is the exam.

Personalized attention	
Methodologies	**Description**
Guest lecture / keynote speech Simulation	Is the support for the homework development.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Simulation	A2 A3 A7 A10 A13 B2 B3 B4 B5 B6 B7 C1	It is compulsory, under professor demand, to deliver the proposed home tasks and simulations on time along this course. The delivered tasks and simulations will be assessed by the professor and will be considered for the final qualification.	40
Objective test	B2 B6 C1	Is the exam.	60

Assessment comments
In order to pass this subject it is necessary to achieve a qualification above four over ten in the exam. It is also necessary to deliver the required homework in the correct manner and up to the limiting required time. In case the homework is not delivered in the correct way and time the pupil will loose the possibility to pass this subject.

Sources of information	
Basic	- Pablo Fariñas (2013). Apuntes de clase. - Maliska C.R. (1995). Transferencia de calor e mecánica de fluidos computacional.. LTC editora - Versteeg H.K. & Malalasekera W. (1995). Computational fluid dynamics, the finite volume method.. Longmann - Hildebrand F.B. (1976). Advanced calculus for applications. Prentice hall
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Hidrodinámica naval avanzada/730496002 Deseño e optimización de estructuras navais/730496003 Ampliación de hidrostática e hidrodinámica/730496020
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.