UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2017/18
Subject (*)	Numerical Methods fot continuous media		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 Industrial			
Coordinador	Fariñas Alvariño, Pablo	E-mail	pablo.farinas@udc.es	
Lecturers	Fariñas Alvariño, Pablo	E-mail	pablo.farinas@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	
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.
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		
Knowing and understanding the numerical model based on the fundamental equations. Modelling and understanding the fundamental phenomenologies which govern the naval hydrodynamics continuum mechanics. Analyzing the computational results, from a general perspective, in complex ship hydrodynamic cases.		BC1 BC2 BC4 BC5 BC6 BC7	CC1

Contents	
Topic	Sub-topic
Os bloques ou temas seguintes desarrollan os contidos establecidos na ficha da Memoria de Verificación	Ampliación de métodos numéricos basados en volúmes finitos. Ampliación de problemas de difusión. - convección combinados. Modelado de condicións de contorno. Acoplamentos p-v. Métodos numéricos basados en elementos finitos.

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	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	B1 B2 B5 B6 C1	25	13	38
Problem solving	B1 B2 B4 B5 B6 B7 C1	3.5	19	22.5
Laboratory practice	B1 B2 B4 B5 B6 B7 C1	3	17	20
Supervised projects	B1 B2 B4 B5 B6 B7 C1	4	26	30
Objective test	B6 B2 C1	1	0	1
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	Are the typical lectures.
Problem solving	Problems solving
Laboratory practice	Laboratory practise
Supervised projects	Running a commercial solver.
Objective test	Is the exam. Might be written, oral or a mix.

Personalized attention	
Methodologies	Description

Guest lecture / keynote speech Laboratory practice Supervised projects Problem solving	Is the support for the homework development. The students presence is not required and is not scored. Therefore there will be no difference between the partial time and full time students. All of them will develop the same work/requirements in order to pass the subject.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Laboratory practice	B1 B2 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.	20
Supervised projects	B1 B2 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.	20
Problem solving	B1 B2 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.	20
Objective test	B6 B2 C1	Is the exam.	40

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. The students presence is not required and is not scored. Therefore there will be no difference between the partial time and full time students. All of them will develop the same work/requirements in order to pass the 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
Advanced naval hydrodynamic/730496002 Design and optimization of marine structures/730496003 Advanced Hydrostatic and Hydrodynamic /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.