Teaching Guide				
Identifying Data				2015/16
Subject (*)	Hidrodinámica naval avanzada		Code	730496002
Study programme	Mestrado Universitario en Enxeñaría Naval e Oceánica (plan 2012)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Obligatoria	4
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	E-mail	pablo.farinas@udc.es	
Web				
General description	Parametric design of ship propellers and forms. This subject will provide the necessary knowledge to develope the propeller design under a particular vessel wake. The hydrodynamic fundamentals are based on the potential field theory and are applicable to any kind of flow under neglectable viscous effects.			

Study programme competences	
Code	Study programme competences
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.
A4	Capacidade para analizar solucións alternativas para a definición e optimización das plantas de enerxía e propulsión de buques.
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

Understand the theoretical background of fundamentals about potential flow	AC2 AC3 AC4 AC10 AC13	BC1 BC2 BC3 BC4 BC5 BC6	CC1
2D theory of thin hydrofoils. Linear theory.	AC2 AC3 AC4 AC10 AC13	BC1 BC2 BC3 BC4 BC5 BC6	
Applications of the potential flow solutions to a 3d design.	AC2 AC3 AC4 AC10 AC13	BC1 BC2 BC3 BC4 BC5 BC6	
Design tools based on lifting line theory	AC2 AC3 AC4 AC10 AC13	BC1 BC2 BC3 BC4 BC5 BC6 BC7	
Background of lifting line theory adapted to the propeller design	AC2 AC3 AC4 AC10 AC13	BC1 BC2 BC3 BC4 BC5 BC6	

Contents	
Topic	**Sub-topic**
Mathematics background	Singular integrals Trigonometric functions Glauert integrals Hilbert transform
2D potential flow theory. Fundamentals.	Complex potential Stream function Potential function Source Sink Vortex
Thin foils theory	Thickness effect Angle of attack effect Camber effect Zero lift angle Ideal angle of attack

Thin foil theory correction in the near leading edge region	Flux arround the apex of a parabola Velocity correction in high curvature regions Velocity prediction along the full foil wall
Cavitation	Pressure coefficient Cavitation number Pressure coefficient along the whole foil wall Bucket diagrams
Tridimensional effects	Tridimensional potential field Velocity field induced by a 3D differential vortex element Free vortex vorticity Bound and free vorticity relation
Lifting line	Induced velocities over a tridimensional foil Prandtl lifting line equation
Application to ship propellers	The open water case Prandtl lifting line theory adaptation to the ship propeller design case Induction coefficients
Optimum propeller performance	Goldstein factors Betz diagram

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Introductory activities	A2 A3 A4 A10 A13 B1 B2 B3 B4 B5 B6 C1	4	0	4
Problem solving	A2 A3 A4 A10 A13 B1 B2 B3 B4 B5 B6 B7 C1	5	20	25
Simulation	A2 A3 A4 A10 A13 B1 B2 B3 B4 B5 B6 B7 C1	2	4	6
Objective test	A4 B2 B4	3	0	3
Guest lecture / keynote speech	A2 A3 A4 A10 A13 B1 B2 B3 B4 B5 B6 C1	29	32	61
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
Introductory activities	Subject structure Evaluation method Previous concepts related to mathematical background
Problem solving	Autonomous home simple tasks
Simulation	Simulation tools based on potential flow will be provided along the course
Objective test	Is the exam
Guest lecture / keynote speech	Are the lectures

Personalized attention	
Methodologies	Description

Guest lecture / keynote speech Problem solving Simulation	In order the students to develop the proposed homework and to fully understand the introduced concepts it is necessary the continuous professor support

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Problem solving	A2 A3 A4 A10 A13 B1 B2 B3 B4 B5 B6 B7 C1	Are the simple problems proposed along the subject	20
Simulation	A2 A3 A4 A10 A13 B1 B2 B3 B4 B5 B6 B7 C1	Is the proposed project to be developed in an autonomous manner by the pupils	20
Objective test	A4 B2 B4	Is the exam	60

Assessment comments
In order to pass this subject it is compulsory to attain four points over ten in the exam qualification. Among that it is necessary to deliver the required homework on time and manner specified by the professor along the course. The presence in the classes is not compulsory, however, in case the proposed homework is not delivered on time and in the requested way will lead, automatically, to abandon this subject. In that case the students will not be allowed to pass this subject.

Sources of information	
Basic	- J. Kerwin (). Hydrofoils and propellers. MIT - SNAME (). Principles of naval arch. (Propulsion). SNAME - J.N. NEwman (1977). Marine Hydrodynamics. MIT press - G. Pérez (). Detailed desighn of ships propellers. FEIN - Apuntes de clase (). .
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Sistemas de propulsión/730496016 Máquinas e motores térmicos marinos/730496017 Ampliación de hidrostática e hidrodinámica/730496020 Métodos numéricos aplicados a medios continuos/730496022
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.