Teaching Guide				
Identifying Data				2018/19
Subject (*)	Computational Methods Applied to Marine Engineering		Code	631480201
Study programme	Mestrado Universitario en Enxeñaría Mariña			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Ciencias da Navegación e Enxeñaría Mariña			
Coordinador	Baaliña Insua, Alvaro	E-mail	alvaro.baalina@udc.es	
Lecturers	Baaliña Insua, Alvaro	E-mail	alvaro.baalina@udc.es	
Web				
General description	The subject focuses on the knowledge and application of computational methods in processes of heat transfer and fluid mechanics to the design and calculation of marine equipment and systems installations. Limitations of the method and the accuracy of the results will be detected, taking into account the starting hypothesis, using software CFD-FloEFD			

Study programme competences	
Code	Study programme competences
A20	Capacidade para desenrolar tarefas de análise e síntese de problemas teórico-prácticos en base a conceptos adquiridos noutras disciplinas do ámbito marítimo, mediante fundamentos físico-matemáticos.
A21	Operar, reparar, manter, reformar, deseñar e optimizar a nivel de xestión as instalacións industriais relacionadas coa enxeñaría mariña.
A22	Capacidade para desenrolar métodos e procedementos para gañar competitividade na industria marítima.
B1	Aprender a aprender.
B2	Resolver problemas de forma efectiva.
B3	Comunicarse de maneira efectiva nun entorno de traballo.
B4	Traballar de forma autónoma con iniciativa.
B5	Traballar de forma colaborativa.
B6	Comportarse con ética e responsabilidade social como cidadán e como profesional.
B7	Capacidade para interpretar, seleccionar e valorar conceptos adquiridos noutras disciplinas do ámbito marítimo, mediante fundamentos físico-matemáticos.
B10	Comunicar por escrito e oralmente os coñecementos procedentes da linguaxe científica.
B11	Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas.
B12	Posuír e comprender coñecementos que aporten unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, a miúdo nun contexto de investigación
B13	Que os estudantes saiban aplicar os coñecementos adquiridos e a sua capacidade de resolución de problemas en contornas novas ou pouco coñecidas dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo
B14	Que os estudantes sexan capaces de integrar coñecementos e enfrontarse á complexidade de formular xuízos a partires dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vencelladas á aplicación dos seus coñecementos e xuízos
B15	Que os estudantes saiban comunicar as súas conclusións e os coñecementos e razóns últimas que as sustentan a públicos especializados e non especializados dun xeito claro e sin ambigüidades
B16	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que haberá de ser en grande medida autodirixido ou autónomo.
C1	Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
C2	Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.

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.
C9	Falar ben en público

Learning outcomes			
Learning outcomes	Study programme competences		
Analysis and synthesis of the concepts of computational methods and their application in practical cases with heat transfer and fluid flow processes combined. Capability for modeling processes by means computational methods. .	AC20 AC21 AC22	BC1 BC2 BC3 BC4 BC5 BC6 BC7 BC10 BC11 BC12 BC13 BC14 BC15 BC16	CC1 CC2 CC4 CC6 CC7 CC8 CC9
Critical reasoning about applicable physical models. Study habits, structuring information and management of specialized software.		BC1 BC2 BC3 BC4 BC5 BC6 BC7 BC10 BC11	CC1 CC2 CC4 CC6 CC7 CC8

Contents	
Topic	Sub-topic
1.- The governing equations of Fluid Dynamics and Heat Transfer.	1.1 Conservation equations. Integral and differential form. 1.2. Conduction, convection and radiation
2.-Partial Differential Equations.	2.1. Classification 2.2. Behavior
3.- Grids	3.1. Transformation of equations 3.2. Grid generation
4.- CFD Techniques	4.1. Lax-Wendroff 4.2. Maccormack's
5.- Applications. Use of CFD software FloEFD	5.1. Fluid flow applications 5.2. Heat Transfer applications

Planning

Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	B1 B2 B3 B4 B5 B6 B7 B10 B11 C1 C2 C4 C6 C7 C8 C9	14	14	28
Problem solving	A20 A21 A22 B1 B2 B4 B5 B7 B11 B13 B14 B16	7	14	21
Supervised projects	A20 A21 A22 B2 B3 B4 B5 B6 B7 B10 B11 B12 B15 C1 C6	7	7	14
Objective test	A20 A21 A22 B1 B2 B3 B4 B5 B6 B7 B10 B11 B12 B13 B14 B15 B16 C1 C2 C4 C6 C7 C8 C9	2	6	8
Personalized attention		4	0	4
(*)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	There will be a detailed explanation of the contents of the material, distributed across topics. The student will have a typed copy of the subject matter in each keynote session. Students are encouraged to participate in class, through comments linking the theoretical contents with real life experiences.
Problem solving	Problems will be solved for each item proposed, allowing the application of mathematical models appropriate to each case, including managing software of FloEFD de Mentor Graphics, applying the most appropriate assumptions, the theoretical relation developed in lectures and relation with professional practice
Supervised projects	Problems more difficult than those solved in class or issues of special relevance.
Objective test	The degree of acquired knowledge about the contents assessed, taking into account both theory and problem solving.

Personalized attention	
Methodologies	Description
Supervised projects Problem solving	The personalized attention related with the methodologies that contemplate it, aims to encourage maximum interaction with students, in order to optimize their effort and improve their learning. Through this interaction, together with the other evaluation processes, the degree of learning of the subject competences will be determined, allowing personalized attention to those students who most need it through individualized tutoring, whose convocation will be held in with involved students. Regardless of the face-to-face tutoring programmed by the teacher, the student can go to tutoring, as many times as he wants, and at a time compatible with teaching, research and management professor activities. In accordance with the "norma que regula o réxime de dedicación ao estudo dos estudantes de grao na UDC" (Art.3.b e 4.5) and ""normas de avaliación, revisión e reclamación das cualificacións dos estudos de grao e mestrado universitario? (Art. 3 e 8b), students with part-time recognition and academic exemption from attendance exemption may participate in a personalized and flexible system of mentoring and evaluation tutorials in order to determine the degree of competency learning achieved. Regarding with this matter, the tutorials will serve to carry out those activities included within the methodology of supervised projects and problems solution.

Assessment			
Methodologies	Competencies	Description	**Qualification**

Supervised projects	A20 A21 A22 B2 B3 B4 B5 B6 B7 B10 B11 B12 B15 C1 C6	Presentation and defense of the work. Structure, neatness, originality and expository method are valued. Assessed comptencies: A20; A21; A22; B2; B3; B4; B5; B6; B7; B10; B11; C1;C6	10
Problem solving	A20 A21 A22 B1 B2 B4 B5 B7 B11 B13 B14 B16	Problem solving, if possible, with software. Assessed competencies: A20; A21; A22; B2; B4; B5; B7; B11	10
Objective test	A20 A21 A22 B1 B2 B3 B4 B5 B6 B7 B10 B11 B12 B13 B14 B15 B16 C1 C2 C4 C6 C7 C8 C9	The degree of acquired knowledge about the learning contents is assessed, taking into account both the theoretical part and the problems. Understanding of basic topics, problem solving strategies , evolution and capacity to analyse criticaly are assessed. Two term exams contribute to 70% of the qualification. Final objetive test with the same contribution is programmed for students who failed term exams. Assessed competencies: A20; A21; A22; B1; B2; B3; B4; B5; B6; B7; B10; B11; C1; C2; C4; C6; C7; C8	70
Guest lecture / keynote speech	B1 B2 B3 B4 B5 B6 B7 B10 B11 C1 C2 C4 C6 C7 C8 C9	Attendance at the sessions will count as part of the final grade Assessed competencies: B1, B2, B3, B4, B5, B6, B7, B10, B11, C1, C2, C4, C6, C7, C8	10

Assessment comments
The official tests of the first chance (May-June) will collect the different assessment methodologies and must be completed by those students who have not fully passed the continuous assessment. This test will be designed in such a way that the student can deal with the methodologies of problem-solving and objective test, where he has not reached 30% of the total rating. The students required to attend the official tests of the second chance (June-July) will retain the qualification achieved in all methodologies, except for the one obtained in the objective tests of the first chance, which will be replaced by the 2nd. In the same way, you can only opt for honours if the maximum number of these for the corresponding course is not covered in full at the first chance.For the students with recognition of part-time dedication and academic exemption of attendance exemption, the qualification obtained in the activities associated with the personalized tutoring system will correspond to the evaluation of the methodology of problem-solving and objective tests, with 30 % and 70 % of total rating, respectively.

Sources of information	
Basic	- Patankar, Suhas V. (1980). Numerical heat transfer and fluid flow. Taylor & Francis - John D. Anderson (1995). Computational Fluid Dynamics. McGrawHill - Post, Scott (2011). Applied and computational fluid mechanics . Jones and Bartlett Publishers
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
It would be desirable the student has a laptop for installing FloEFD software.

(*)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.