UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2015/16
Subject (*)	Computational fluid dynamics I		Code	632844205
Study programme	Mestrado Universitario en Enxeñaría da Auga (plan 2012)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Optativa	6
Language	English			
Teaching method	Face-to-face			
Prerequisites				
Department	Métodos Matemáticos e de RepresentaciónTecnoloxía da Construción			
Coordinador	Rodríguez-Vellando Fernández-Carvajal, Pablo	E-mail	pablo.rodriguez-vellando@udc.es	
Lecturers	Fe Marques, Jaime Naves García-Rendueles, Acacia Rodríguez-Vellando Fernández-Carvajal, Pablo	E-mail	jaime.fe@udc.es acacia.naves@udc.es pablo.rodriguez-vellando@udc.es	
Web	http://caminos.udc.es/info/asignaturas/201/masterindex.html			
General description	Fundamentals of open channel flow and computational fluid dynamics. Fundamental equations: Saint-Venant, Navier-Stokes, potential flow, stream-vorticity, Stokes flow, shallow water, convection-diffusion, Darcy,... Fundamentals of Matlab programming. Finite element programming of hydrodynamic, porous media and geochemical models. Introduction to Finite Volumes.			

Study programme competences / results	
Code	Study programme competences / results
A3	Capacity to apply the mechanics of the fluids and the fundamental flow equations in calculate for conductions at pressure and in free layer
A10	Understanding of the fundaments of dynamic fluid computation (CFD). Capacity to elaborate codes that can resolve non-understandable flow on the surface as well as in the porous media
A11	Knowledge of numerical models applied to hydraulic engineering. Capacity to use and analyse the results of the hydraulic models. Capacity to design, develop and analyse numerical schemes used in a hydraulic models
B1	To resolve problems effectively
B2	To apply critical thinking, logic and creativity
B3	To work individually with initiative
B4	To communicate effectively in work surroundings
B5	Continuous recycling of knowledge in a general perspective in a global situation of water engineering
B6	Understanding of the need to analyse history to understand the present
B7	Facility to integrate in multidiscipline teams
B8	Capacity to organize and plan
B9	Capacity for analysis, synthesis and structure of information and ideas
C1	To understand the importance of the enterprising culture and to know the means at the reach of the enterprising people
C2	To value knowledge critically, technology and available information to resolve problems that they will face
C3	To assume as a professional and citizen the importance of learning throughout life
C4	To value the importance of the investigation, innovation and technology development in the social ?economic advance and cultural in society
C5	To posses and understand knowledge that gives a base or oportunity to be original in the development and for applications of ideas, often in the context of investigation
C6	The students must be able to apply the acquired knowledge and their capacity to resolve problems in new surrandings or not well known within wider contexts (or multidiscipline) related with the study area

C7	The students must be able to integrate knowledge and to affront the complexity to formulate judgements from information that, been incomplete or limited, include reflexions about social responsabilities and ethics related to the application of the knowledge and judments
C8	The students must be able to comunicate their conclusions, knowledge and the last reasons that support them, to spezialated publics and not spezialated in a clear and unambiguous way.
C9	The student must possess the learning ability with permits them to continues to study in a manner wich will be in a great measure self directed and individual

Learning outcomes			
Learning outcomes	Study programme competences / results		
Ability to apply the fluid mechanics and the fundamental equations of flow calculation pressure pipes and sheet free. Understanding the basics of computational fluid dynamics (CFD). Ability to develop codes that solve incompressible flow both free surface and porous medium. Knowledge of numerical models applied to hydraulic engineering. Capacity use and analyze the results of a hydraulic model. Ability to design, develop and analyze numerical schemes used in a hydraulic model.	AC3 AC10 AC11	BC1 BC2 BC3 BC4 BC5 BC6 BC7 BC8 BC9	CC1 CC2 CC3 CC4 CC5 CC6 CC7 CC8 CC9

Contents	
Topic	Sub-topic
Fundamentals of Open Channel flow (revision)	Open Channel flow
Fundamentals of Computational Fluid Dynamics	Computational Fluid Dynamics
Governing equations	Saint-Venant Navier-Stokes Potential flow Stream-vorticity Stokes flow Shallow water Convection-diffusion Darcy,...
Fundamentals of Matlab programming	Matlab programming
Finite Element programming of fluid models	Hydrodynamic models Porous media models Geochemical models
Fundamentals of Finite Volumes programming	Finite Volumes programming
Comercial programmes	Comercial programmes

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Seminar	A3 A10 A11 B1 B2 B3 B4 B5 B6 B7 B8 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	30	30	60

Guest lecture / keynote speech	A3 A10 A11 B1 B2 B3 B4 B5 B6 B7 B8 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	30	30	60
Personalized attention		30	0	30
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Seminar	Practical lectures related to the theoretical aspects regarded at the magistral lectures
Guest lecture / keynote speech	Regular lectures where the main theoretical contents of the subjects are regarded

Personalized attention	
Methodologies	**Description**
Seminar	Personalized attention to be provided for the semminars

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Guest lecture / keynote speech	A3 A10 A11 B1 B2 B3 B4 B5 B6 B7 B8 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	The knowledge of the concepts developed at the magistral lectures will be assesed and considered for the final mark	50
Seminar	A3 A10 A11 B1 B2 B3 B4 B5 B6 B7 B8 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	The attendance to the semminars and the work being developed at the semminars will be considered for the final mark	50

Assessment comments

Sources of information	
Basic	- G. Carey, J. Oden (1984). Finite Elements. Prentice-Hall - A. Chadwick (1986). Hydraulics in Civil Engineering. Allen&Unwin - J. Donea (2003). Finite Element Methods for Flow Problems. Wiley - P. Gresho, R Sani (2000). Incompressible flow and the finite element method. Wiley - O. Pironneau (1989). Finite Element Methods for Fluids. Wiley - J. Puertas Agudo (2000). Apuntes de Hidráulica de Canales. Nino - Singiresu Rao (2005). The Finite Element Method in Engineering. Elsevier - O. C. Zienkiewicz, R.L. Taylor (1982). The Finite Element Method. Vol 3, Fluid dynamics. Mc Graw Hill
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus

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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.