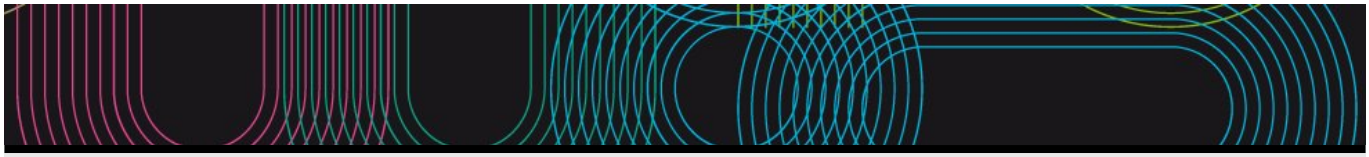

IDENTIFYING DATA				
(*)Mecánica de fluídos				
Subject	(*)Mecánica de fluídos			
Code	V12G380V01405			
Study programme	(*)Grao en Enxeñaría Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language				
Department				
Coordinator	Paz Penín, María Concepción			
Lecturers	López Veloso, Marcos Martín Ortega, Elena Beatriz Meis Fernández, Marcos Paz Penín, María Concepción			
E-mail	cpaz@uvigo.es			
Web				
General description	This syllabus presents information the Fluid mechanics course that belongs to the 2nd year of the degree in Mechanical Engineering, 2013-2014, in accordance to the marked guidelines by the European Space of Upper Education. This is a first course in fluid mechanics, focusing on the topics that are relevant to Mechanical Engineering applications. The course is intended to acquire essential knowledge needed to analyze devices with fluid as a working material, such us hydraulic machinery, lubrication devices, heating and cooling systems, pipes systems, pneumatic systems, aero and hydrodynamics devices, windturbines, etc. It includes stress and strain rate descriptions, fluid statics, use of differential and finite control volume analysis with continuity, momentum, and energy equations, Bernoulli and Euler equations, incompressible viscous flow using Navier-Stokes equations, dimensional analysis, laminar and turbulent pipe flow.			

Competencies	
Code	
A4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering.
A5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
A21	RI2 Knowledge of the basic principles of fluid mechanics and their application to solving problems in the field of engineering. Calculation of pipes, channels and fluid systems.
B2	CT2 Problems resolution.
B9	CS1 Apply knowledge.
B10	CS2 Self learning and work.

Learning aims	
Expected results from this subject	Training and Learning Results
CG4 Capacity to: solve problems with initiative and creativity, take decisions, develope critical reasoning and capacity to communicate and transmit knowledge and skills in the field of the industrial engineering.	A4
CG5 Knowledge for the realisation of measurements, calculations, assessments, evaluations, studies, reports, plans of works and other analogous works.	A5

RI2 Knowledge of the basic principles of the fluid mechanics and his application to the resolution of problems in the field of the engineering. A21

Intended learning outcomes are, understanding of the basics of flow behaviour in engineering systems, awareness of the physical laws that govern fluid motion and development of analytical skills for simple flow systems, e.g. calculation of pipes, channels and fluid systems

CT2 Resolution of problems.	B2
CS1 Application of knowledge.	B9
B10 CS2 Self learning process and work.	B10

Contents

Topic	
1. Introduction	1.1 Fundamental Concepts: 1.1.1 Stress tensor. Newton Law 1.2 The Fluid as a Continuum 1.3 Viscosity:1.3.1 Newtonian Fluids and non Newtonian fluids 1.4 Characteristics of the flows: 1.4.1 Different types of flows: 1.4.1.1 Geometrical conditions, 1.4.1.2 Kinematic conditions, 1.4.1.3 Mechanical conditions, 1.4.1.4 Compressibility 1.5 Stresses on a fluid: 1.5.1 Tensorial and vectorial magnitudes, 1.5.1.2 Volumetric Forces, 1.5.2.2 Surface Forces, 1.5.2.3 The stress tensor, 1.5.2.4 Concept of pressure
2. Basic Physical Laws of Fluid Mechanics	2.1 Velocity field 2.2 Streamlines and pathlines 2.3 Systems and Control volumes 2.4 Integrals extended to Fluid volumes. The Reynolds Transport Theorem 2.5 Conservation of Mass. Integral and Differential Equation 2.6 The Linear Momentum Equation. Integral and Differential Equation. 2.7 Navier-Poisson Law 2.8 The Energy Equation. Integral and Differential Equation. Frictionless Flow: The Bernoulli Equation
3. Dimensional Analysis. Similarity concepts	3.1 Introduction 3.2 The Pi Theorem 3.3 Applications 3.4 Fundamental Nondimensional Numbers in Fluid Mechanics: 3.4.1 Physical meaning of the nondimensional numbers 3.5 Similarity in Fluid dynamics: 3.5.1 Partial Similarity, 3.5.2 Scaling effect
4. Laminar viscous flow	4.1 Introduction 4.2. Fully developed flow: 4.2.1 Hagen-Poiseuille Flow, 4.2.2 Viscous flow in circular ducts, 4.2.3 Flow in Noncircular Ducts 4.3 Entrance region effect 4.4 Losses in Pipe Systems: 4.4.1 Friction coefficient 4.5 Stability of laminar flow
5. Turbulent Flow in ducts	5.1 Introduction 5.2 Pipe-head Loss in turbulent regime: 5.2.1 Nikuradse chart, 5.2.2 Moody chart, 5.2.3 Empirical Formulas for flow in circular ducts. Hydraulic diameter
6. Minor Losses in Pipe Systems	6.1 Introduction 6.2 Minor Losses: 6.2.1 Loss at the entrance of a pipe, 6.2.2 Loss at the exit of a pipe, 6.2.3 Loss at contractions, 6.2.4 Loss at expansions, 6.2.5 Loss at elbows, 6.2.6 Losses at bends, elbows, tees and valves
7. Pipe systems	7.1 Pipes in series 7.2 Pipes in parallel 7.3 The three-reservoir pipe junction problem 7.4 Pipings netwoks 7.5 Nonsteady effects in duct flows: 7.5.1 Emptying time of a tank, 7.5.2 Setting of the steady flow in a pipe, 7.5.3 Water hammer
8. Open-Channel Flow	8.1 Introduction 8.2 Uniform Flow: 8.2.1 Pipes used like channels 8.3 Non uniform flow: 8.3.1 The hydarulic jump, 8.3.2 Fast transitions, 8.3.3 Flow over a gate, 8.3.4 Flow under a gate, 8.3.5 Section of control
LABORATORY	1. Measurements of head and minor losses in a pipe system. Minor losses measuremens in a venturi device. Minor losses measurents in a holed-plate. Fricction coefficients measurements. Losses in elbows, bend, tees and valves

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	32.5	60.5	93
Troubleshooting and / or exercises	14	27	41
Laboratory practises	4	0	4
Long answer tests and development	3	0	3
Reports / memories of practice	0	3	3
Troubleshooting and / or exercises	0	6	6

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Master Session	They explain the foundations of each subject needed to solve practical problems. It includes mainly lectures baut can also includes: Readings bibliographic Review Solution of problems Conferences Oral Presentations
Troubleshooting and / or exercises	They will apply the concepts tackled in the lectures. It includes activities such as: Readings Seminars Solution of problems Team working Study of practical cases
Laboratory practises	Fundamentally, they will consist on activities of experimentation, although they also can include: Practical cases Simulation Solution of problems Team working

Personalized attention

Methodologies	Description
Master Session	
Laboratory practises	

Assessment

	Description	Qualification
Long answer tests and development	Written exam that can consist of: theoretical questions practical questions resolution of exercises/problems	80
Reports / memories of practice	Memory written of the activities carried out during the laboratory parctice, including results of the experimentation.	10
Troubleshooting and / or exercises	Resolution of problems and/or exercises proposed. It could include: - a number of weekly deliveries (no face-to-face) - face-to-face resolutions in the practices schedule	10

Other comments on the Evaluation

Sources of information

Frank M White, **Mecánica de Fluidos/Fluid Mechanics**, VI,

Philip M. Gerhart, Richard J Gross, , Jonh I. Hochstein, **FUNDAMENTOS DE MECANICA DE FLUIDOS**, II,

Antonio Crespo, **Mecánica de fluidos**,

Yunus A. Çengel, John M. Cimbala, **Mecánica de fluidos : fundamentos y aplicaciones**,

Elena Martín Ortega, Concepción Paz Penín, **Prácticas de laboratorio de mecánica de fluidos**,

A. Liñán Martínez, M. Rodríguez Fernández, F.J. Higuera Antón, **Mecánica de fluidos**,

Victor L. Streeter, E. Benjamin Wylie, Keith W. Bedford, **Mecánica de fluidos/Fluid Mechanics**, IX,

Robert W. Fox, Alan T. McDonald, **Introducción a la mecánica de fluidos**,

Robert L. Mott, **Mecánica de fluidos**, VI,

Merle C. Potter, David C. Wiggert ; con Miki Hondzo, Tom I.P. Shih, **Mecánica de fluidos/Mechanics of Fluids**, III,

Pijush K. Kundu , Ira M. Cohen, **Fluid Mechanics**, 4th Edition,

G. M. Homsy et al., **Multi-media Fluid Mechanics**,

Recommendations

Subjects that are recommended to be taken simultaneously

(*)Termodinámica e transmisión de calor/V12G380V01302

Subjects that it is recommended to have taken before

(*)Física: Física I/V12G380V01102
(*)Física: Física II/V12G380V01202
(*)Matemáticas: Álxebra e estatística/V12G380V01103
(*)Matemáticas: Cálculo I/V12G380V01104
(*)Matemáticas: Cálculo II e ecuacións diferenciais/V12G380V01204