ISEL
ADEM
Área Departamental de Engenharia Mecânica

Curricular Unit Form (FUC)

Course:	**FIRST CYCLE IN MECHANICAL ENGINEERING**					
Curricular Unit (UC)	**Fluid Mechanics**			Mandatory	**X**	
				Optional		
Scientific Area:	**Energy and Control System**					
Year: **2**	Semester: **2**	ECTS: **5.5**		Total Hours: **148.5**		
Contact Hours:	T: **45.0**	TP:**22.5**	PL:	S:	OT:	TT:
Professor in charge		Academic Degree /Title		Position		
Nuno Serra		**Doctor**		**Auxiliary Professor**		

T- Theoretical ; TP – Theory and practice ; PL – Laboratory ; S – Seminar ; OT –Tutorial ; TT – Total of contact hours

Entry into Force	Semester: **Winter**	Academic Year: **2016/2017**

Objectives of the curricular unit and competences (max. 1000 characters)

Objectives of the curricula unit:

Position the Fluid Mechanics and its applicability in the context of Mechanical Engineering.

Introduction of fluid mechanics fundamentals, employing a theoretical approach involving basic knowledge of general physics (static, cinematic and dynamics) essential to physical modelling, as well as basic knowledge of mathematics (differential and integral calculus and vector analysis) indispensable for the mathematical modelling.

Complementary applied approach, comprising the execution of laboratory experiments and solution of examples of application illustrative of the practical problems.

Competencies to assimilate:

Create a knowledge basis of fundamental concepts of fluid mechanics to enable the development of this subject in other disciplines of the same scientific area.

Syllabus (max. 1000 characters)

1. Introduction to the study of fluid mechanics

1.1. Preliminary remarks; 1.2. The concept of a fluid; 1.3. The fluid as a Continuum; 1.4. Physical dimensions and units; 1.5. Properties of the velocity field; 1.6. Thermodynamic properties of a fluid; 1.7. Viscosity and other secondary properties; 1.8. Basic flow analysis techniques; 1.9. Flow patterns: streamlines, streaklines and pathlines.

2. Pressure distribution in a fluid

2.1. Pressure and pressure gradient; 2.2. Equilibrium of a fluid element; 2.3. Hydrostatic pressure distributions; 2.4. Application to manometry; 2.5. Hydrostatic forces on plane surfaces; 2.6.

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Hydrostatic forces on curved surfaces; 2.7. Hydrostatic forces in layered fluids; 2.8. Buoyancy.
3. Integral relations for a control volume
3.1. Basic physical laws of fluid mechanics; 3.2. The Reynolds Transport theorem; 3.3. Conservation of mass; 3.4. The linear momentum equation; 3.5. The angular momentum theorem; 3.6. The energy equation; 3.7. Frictionless flow: the Bernoulli equation.

Syllabus of laboratory experiments:
Experimental characterization of Bernoulli equation (Venturi tube).
Resolution of several examples of application illustrative of the practical problems related to the theoretical basis explained in each one of the chapters and sub chapters comprising the syllabus contents.

Demonstration of the syllabus coherence with curricular unit's objectives (max. 1000 characters)

The syllabus encompasses the curricular unit objectives. A good balance is achieved between the depth with which the different subjects are treated and the contact time with the students

Teaching methodologies (including evaluation) (max. 1000 characters)

Teaching methodology:

Introduction of fluid mechanics fundamentals, employing a theoretical approach involving basic knowledge of general physics (static, cinematic and dynamics) essential to physical modelling, as well as basic knowledge of mathematics (differential and integral calculus and vector analysis) indispensable for the mathematical modelling.

Complementary applied approach, comprising the execution of laboratory experiments and solution of examples of application illustrative of the practical problems.

Assessment:

Continuous assessment with 2 tests and/or final examination, complemented by the execution of 1 laboratory experiment:

NT – Theoretical grade:
2 tests: grade >= 8 for each one; NT = the arithmetic mean of the tests grades.
Exam: NT = the exam grade;
NT>=9,5
NL – Laboratory grade; NL>=9,5
NF – Final grade: NF = 0.85NT+0.15NL.

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Demonstration of the teaching methodologies coherence with the curricular unit's objectives (max. 3000 characters)
The objective of providing students with a solid theoretical and practical knowledge on fluid mechanics builds on a dual approach encompassing a theoretical component delivered in class and laboratory activities. The elaboration of laboratory experiments allow students a better integration of acquired concepts.

Main Bibliography (max. 1000 characters)
Title: FLUID MECHANICS [Fourth Edition, McGraw Hill, Inc., 1999, ISBN 0 07 116848 6] [original text (in English language)] MECÂNICA DOS FLUIDOS [Fourth Edition, McGraw Hill, Interamericana do Brasil, Lda., 2002, ISBN 85 86804 24 X] [Translation (for Portuguese «Brazilian» language) of: Amorim, José Carlos Cesar / Filho, Nelson Manzanares / Oliveira, Waldir] Author(s): White, Frank M.