ISEL
INSTITUTO SUPERIOR DE ENGENHARIA DE LISBOA

DEC
ÁREA DEPARTAMENTAL DE ENGENHARIA CIVIL

## Course file

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| **Study cycle** | MASTER IN CIVIL ENGINEERING | | |
| **Course** | Hydraulics I | Mandatory | ☒ |
| | | Optional | ☐ |
| **Course scientific area** | CIVIL ENGINEERING | Category | C |

Course category: B - Basic; C - Core Engineering; E - Specialization; P - Complementary.

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|---|---|---|---|---|---|
| Year: 2nd | Semester: 3rd | | ECTS: 5,5 | | Total: 148 |
| Contact time | T: 22,5 | TP: 45 | PL: | S: | OT: |

T - Lectures; TP - Theory and practice; PL - Lab Work; S - Seminar; OT - Tutorial Guidance.

| **Course Director** | **Title** | **Position** |
|---|---|---|
| João Alfredo Ferreira dos Santos | Doutor | Professor Coordenador |

| **Learning objectives (knowledge, skills and competences to be developed by students)**<br>(max. 1000 characters) |
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| To acquire knowledge on the Fluid Mechanics domain and in the evaluation of pressure hydraulic circuits needed for civil engineering applications, namely:<br>O1-to identify the major properties of fluids;<br>O2-to compute the resultant of hydrostatic pressure distributions in plane and in curved surfaces;<br>O3-to classify the flows according to the space and time variation of their properties;<br>O4-to establish, interpret and apply similitude laws between prototype and scale models;<br>O5-to compute major head losses in uniform flows in pipes and the flow induced forces at the flow boundaries;<br>O7-to analyse both qualitatively and quantitatively hydraulic transients in pipes. |

| **Syllabus**<br>(max. 1000 characters) |
|---|
| C1-Fluid properties<br>C2-Hydrostatics<br>C3-Flow kinematics<br>C4-Flow dynamics<br>C5-Dimensional analysis. Similitude laws<br>C6-Major losses in uniform flows<br>C7-Steady and transient flows |

| **Demonstration of the consistency between the syllabus and the course objectives**<br>(max. 1000 characters) |
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| In the scheme below, Ci -> Oj means that the syllabus component i (Ci) contributes to the learning objective j (Oj)<br>C1 -> O1<br>C2 -> O2<br>C3 -> O3<br>C4 -> O6<br>C5 -> O4<br>C6 -> O5; C6 -> O6<br>C7 -> O6; C7 -> O7 |

| **Teaching methodology (evaluation included)**<br>(max. 1000 characters) |
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| Expositive classes with the syllabus topics and exercise classes on the same topics; two sets of laboratory experiments on part of presented topics.<br>Although the students' knowledge can be assessed and capabilities can be assessed during the exam term, they are encouraged to keep in pace with the matters presented in the lectures by making two mid-term tests and by presenting before each test a report on a set of laboratory experiments. In this type of assessment, the minimum grade in each of the assessment components is 8/20<br>In the out-of-class assessment, the student makes an exam covering the whole syllabus, the grades in the laboratory experiments reports being irrelevant then.<br>Tests and exams always contain three types of questions: direct application of the transmitted concepts and principles; practical application requiring the synthesis of the acquired knowledge; interpretation of basic hydraulic phenomena. |

| **Demonstration of the consistency between teaching methodology and the course learning objectives**<br>(max. 3000 characters) |
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| The basic concepts and principles needed to attain the established learning objectives are explained during the lectures where the syllabus contents are presented. The practical work carried out during the classes as well as the question presented to and by the students during this sort of activity do contribute to the consolidation of those concepts and principles and to attain all the course learning objectives.<br>In addition to that, the students have to carry out, in groups with three elements at most, laboratory experiments on:<br>Hydrostatic force on plane surfaces;<br>Bernoulli's equation demonstration;<br>Jet impact;<br>Major head losses in turbulent flow;<br>Minor head losses at a pipe enlargement;<br>Emptying a container. |

This way, most of the syllabus contents are reviewed and the students awareness to the flow analysis, as well as to the use of the methodologies presented in the theoretical lessons and developed in the exercises lessons, is arisen. The reports on these experiments are written by each group following the established norm for this sort of document. These reports are used in the course assessment. With this assessment component, and the same happens with the two mid-term tests that together with the reports make the assessment during the lectures period, one seeks to confirm that the learning objectives were attained.
The structure of the mid-term tests is similar to exam one, which is the course's alternative assessment procedure. Whereas the mid-term tests are offered during the lectures period splitting approximately in half the syllabus, the exam is offered out of the lectures period and cover the whole syllabus.

**Main Bibliography**

(max. 1000 characters)

QUINTELA, A. – Hidráulica - 9ª edição, F.C.Gulbenkian, 2005
PEREIRA, J. – Hidráulica I (protocolo de experiências laboratoriais) – AEISEL, 2005
MARTINS, S. - Escoamentos Variáveis sob Pressão - AEISEL, 2004
LENCASTRE, A. – Hydraulique Générale - Ed. Eyrolle, 2002.