

**1. General information****Course:** HYDRAULIC ENGINEERING**Type:** CORE COURSE**Degree:** 345 - UNDERGRADUATE DEGREE PROGRAMME IN CIVIL ENGINEERING**Center:** 603 - E.T.S. CIVIL ENGINEERS OF CR**Year:** 2**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 38315**ECTS credits:** 6**Academic year:** 2022-23**Group(s):** 20**Duration:** C2**Second language:****English Friendly:** Y**Bilingual:** N**Lecturer:** M^a DEL CARMEN CASTILLO SANCHEZ - Group(s): 20

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Lecturer: ALVARO GALAN ALGUACIL - Group(s): 20

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2. Pre-Requisites

Not established

3. Justification in the curriculum, relation to other subjects and to the profession

First subject related to Hydraulic Engineering and Hydrology.

It focusses on Fluid Mechanics and on both Open Channel and Pipes Networks Flow.

4. Degree competences achieved in this course**Course competences**

Code	Description
CB01	Prove that they have acquired and understood knowledge in a subject area that derives from general secondary education and is appropriate to a level based on advanced course books, and includes updated and cutting-edge aspects of their field of knowledge.
CE01	Students can apply their knowledge in the practical solution of civil engineering problems, with capacity for the analysis and definition of the problem, the proposal of alternatives and their critical evaluation, choosing the optimal solution with technical arguments and with capacity of defense against third parties.
CE16	Students have knowledge of the concepts and technical aspects related to pipeline systems, both in pressurized flow and in free surface conditions.
CG01	Students achieve general knowledge of Information and Communication Technologies (ICT).

5. Objectives or Learning Outcomes**Course learning outcomes**

Description

Knowledge of the equations that govern non-permanent hydraulic problems.

Knowledge of the fundamental properties of fluids.

Ability to calculate the hydrostatic thrust on flat and curved surfaces.

Capacity of dimensioning and operation of canals and pressured pipelines under permanent regime conditions, knowing the fundamental equations of governance of the problems and the limitations of the approaches.

6. Units / Contents**Unit 1: Properties of a fluid****Unit 2: Hydrostatics****Unit 2.1** Pascal Principle**Unit 2.2** General equations**Unit 2.3** Hydrostatic forces on flat and curved surfaces**Unit 2.4** Buoyancy and stability**Unit 3: Basic concepts and laws in fluid motion****Unit 3.1** Preliminary concepts, flux

Unit 3.2 Fundamental equations

Unit 3.3 Permanent regime: integrated equations

Unit 4: Incompressible flow: general description

Unit 4.1 Perfect fluids

Unit 4.2 Real fluids: hypothesis and equations; dimensional analysis; laminar and turbulent flow

Unit 4.3 Boundary layer

Unit 5: Steady State Pipes Networks Flow

Unit 5.1 Fluids in ducts

Unit 5.2 Head loss

Unit 5.3 Local losses in pipe systems

Unit 5.4 Multiple pipe systems

Unit 5.5 Hydraulic pumps

Unit 6: Steady State Open Chanel Flow

Unit 6.1 Uniform flow

Unit 6.2 Specific energy

Unit 6.3 Gradually varied flow and

Unit 6.4 Aforo de caudal

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	CB01 CE01 CE16	1.24	31	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CB01 CE01 CE16	0.88	22	Y	N	This part cannot be retaken
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	CB01 CE01 CE16	0.12	3	Y	Y	Lab sessions are compulsory and cannot be retaken
Computer room practice [ON-SITE]	Practical or hands-on activities	CB01 CE01 CE16	0.16	4	Y	Y	Numerical tests reports can be retaken.
Practicum and practical activities report writing or preparation [OFF-SITE]	Group Work	CB01 CE01 CE16	0.36	9	Y	Y	Reports for laboratory tests are compulsory and must be due on date regardless of any decision about taking (or not) the progress test exam. If the mark is less than 45, it can be retaken once on an oral exam with a maximum grade of 4 over 10 unless plagiarism has been detected.
Study and Exam Preparation [OFF-SITE]	Self-study	CB01 CE01 CE16	3.04	76	N	-	
Other off-site activity [OFF-SITE]	Combination of methods	CB01 CE01 CE16 CG01	0.2	5	Y	N	Problem solving and/or presentation and/or online activities
Mid-term test [ON-SITE]	Assessment tests	CB01 CE01 CE16	0	0	Y	Y	Partial and final exams will take place outside of class hours
Total:			6	150			
Total credits of in-class work: 2.4			Total class time hours: 60				
Total credits of out of class work: 3.6			Total hours of out of class work: 90				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Mid-term tests	30.00%	0.00%	Written exam (Unit 1/Tema 1) (P1). It can be re-evaluated in the final exam. It can be retaken with another exam
Mid-term tests	30.00%	0.00%	Written exam (Unit 2/Tema 2) (P2). It can be re-evaluated in the final exam. It can be retaken with another exam
Practicum and practical activities reports assessment	10.00%	10.00%	Laboratory tests and reports (L1, L2, L3). They cannot be retaken
Assessment of activities done in the computer labs	10.00%	10.00%	Numerical assignments and reports (N1, N2). They can be retaken with another report
Assessment of active participation	10.00%	0.00%	During class hours (C1, C2). It cannot be retaken
Other methods of assessment	10.00%	0.00%	Problem solving and/or presentation and/or online activities (O1, O2). It can be retaken with another report if there is a final deadline at the end of the semester. Continuous evaluation with quizzes cannot be retaken.
Final test	0.00%	60.00%	Written exam (All units) (NC1). It can be retaken with another exam
Oral presentations assessment	0.00%	20.00%	Oral presentation of a scientific paper related with the subject (NC2). It cannot be retaken
Total:	100.00%	100.00%	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

All numerical and laboratory tests (sessions and reports) are compulsory.

Reports for laboratory tests must be due on date regardless of any decision about taking (or not) the mid-term tests. Each day of delay in delivery is a penalty of 2 points out of 10.

Every unit includes a mid-term test (P1, P2), laboratory tests (L1, L2, L3) and numerical assignments (N1, N2).

Any details on content, extension and requirements of written exercises will be indicated on virtual campus at the beginning of the semester.

In order to pass the subject, the following requirements must be satisfied: (at any time: mid-term tests, final exam or retake exam dates)

- a) $L1, L2, L3, N1, N2 \geq 4$;
- b) $P1, P2 \geq 3$;
- c) $(30 \cdot P1 + 3.33 \cdot L1 + 3.33 \cdot L2) / 36.66 \geq 4$;
- d) $(30 \cdot P2 + 3.33 \cdot L3 + 5 \cdot N1 + 5 \cdot N2) / 43.33 \geq 4$;
- e) Global mark: $[30 \cdot (P1 + P2) + 3.33 \cdot (L1 + L2 + L3) + 5 \cdot (N1 + N2 + C1 + C2 + O1 + O2)] / 99.99 \geq 5$;

All minimum marks on this guide refer to (a maximum of) 10 points.

Non-continuous evaluation:

Unless stated otherwise, continuous evaluation criteria will be applied to all students.

Anyone choosing non-continuous assessment must notify it to the lecturer within the class period of the subject. The option is only available if the student's participation in evaluation activities (from the continuous assessment) has not reached 50% of the total evaluation for the subject.

For the retake exam, the assessment type used for the final exam will remain valid.

All numerical and laboratory tests (sessions and reports) are compulsory.

Reports for laboratory tests must be due on date regardless of any decision about taking (or not) the progress test exam. Each day of delay in delivery is a penalty of 2 points out of 10.

In order to pass the subject, the following requirements must be satisfied: (at any time: final exam or retake exam dates)

- a) $L1, L2, L3, N1, N2 \geq 4$;
- b) $NC1 \geq 3$;
- c) Global mark $[60 \cdot (NC1) + 3.33 \cdot (L1 + L2 + L3) + 5 \cdot (N1 + N2) + 20 \cdot (NC2)] / 99.99 \geq 5$

Specifications for the resit/retake exam:

All numerical and laboratory tests (sessions and reports) are compulsory.

Reports for laboratory tests must be due on date regardless of any decision about taking (or not) the progress test exam. Each day of delay in delivery is a penalty of 2 points out of 10.

Every unit includes a progress test (P1, P2), laboratory tests (L1, L2, L3) and numerical assignments (N1, N2).

In order to pass the subject, the following requirements must be satisfied:

- a) $L1, L2, L3, N1, N2 \geq 4$;
- b) $P1, P2 \geq 3$;
- c) $(30 \cdot P1 + 3.33 \cdot L1 + 3.33 \cdot L2 + 5 \cdot N1) / 41.66 \geq 4$;
- d) $(30 \cdot P2 + 3.33 \cdot L3 + 5 \cdot N2) / 38.33 \geq 4$;
- e) Global mark: $[30 \cdot (P1 + P2) + 3.33 \cdot (L1 + L2 + L3) + 5 \cdot (N1 + N2 + C1 + C2 + O1 + O2)] / 99.99 \geq 5$;

L1, L2, L3, C1, C2 cannot be retaken.

Specifications for the second resit / retake exam:

Just a final progress test. $L1, L2, L3, N1, N2 \geq 4$

- a) $L1, L2, L3, N1, N2 \geq 4$;
- b) $PF \geq 3$;
- c) Nota global: $[60 \cdot PF + 3.33 \cdot (L1 + L2 + L3) + 5 \cdot (N1 + N2 + C1 + C2 + O1 + O2)] / 99.99 \geq 5$;

for continuous assessment or

- a) $L1, L2, L3, N1, N2 \geq 4$;
- b) $PF \geq 3$;
- c) Nota global $[60 \cdot (PF) + 3.33 \cdot (L1 + L2 + L3) + 5 \cdot (N1 + N2) + 20 \cdot (NC2)] / 99.99 \geq 5$

for non-continuous evaluation

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Unit 1 (de 6): Properties of a fluid	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	16
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	12
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	1
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	3

Study and Exam Preparation [AUTÓNOMA][Self-study]	38
Other off-site activity [AUTÓNOMA][Combination of methods]	2.5
Unit 2 (de 6): Hydrostatics	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	10
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	6
Study and Exam Preparation [AUTÓNOMA][Self-study]	38
Other off-site activity [AUTÓNOMA][Combination of methods]	2.5
Global activity	
Activities	hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	3
Computer room practice [PRESENCIAL][Practical or hands-on activities]	4
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	9
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	22
Class Attendance (theory) [PRESENCIAL][Lectures]	31
Study and Exam Preparation [AUTÓNOMA][Self-study]	76
Other off-site activity [AUTÓNOMA][Combination of methods]	5
Total horas: 150	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
BERTIN, John J.	Mecánica de fluidos para ingenieros	Prentice-Hall-Hispanoamericana		968-880-071-6	1986	
Batchelor, G. K.	An introduction to fluid dynamics	Cambridge University Press		978-0-521-66396-0	2009	
Chow, Ven Te	Hidráulica de canales abiertos / Ven Te Chow	Diana		968-13-1327-5	1993	
Crespo, AntonioCrespo Martínez	Mecánica de fluidos	Thomson		978-84-9732-292-8	2006	
Daugherty, Robert L.	Fluid mechanics : (with engineering applications)	McGraw-Hill		0-07-015427-9	1977	
Giles, Ranald V.	Mecánica de los fluidos e hidráulica	McGraw-Hill		978-84-481-1898-3	2003	
Kundu, Pijush K.1941-1994	Fluid mechanics	Academic Press		978-0-12-373735-9	2008	
Mays, L. W.	Water resources engineering	John Wiley and Sons			2001	
Streeter, Victor L.	Mecánica de los fluidos	McGraw-Hill		958-600-987-4	2001	
White, Frank M.	Fluid Mechanics	McGraw-Hill Higher Education		0-07-128645-4	2008	
Wurbs, R. A. y James, W. P.	Water resources engineering	Prentice Hall			2002	