

Course guide 2500015 - GECHIDRACO - Hydraulics

Unit in charge: Teaching unit:	Last modified: 01/10/2023 Barcelona School of Civil Engineering 751 - DECA - Department of Civil and Environmental Engineering.		
Degree:	BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2020). (Compulsory subject).		
Academic year: 2023	ECTS Credits: 6.0	Languages: Catalan, Spanish, English	
LECTURER			
Coordinating lecturer:	ERNEST BLADE CASTELLET		

Others:ERNEST BLADE CASTELLET, MARIA SOLEDAD ESTRELLA TORAL, EDUARDO MARTÍNEZGOMARIZ, BENIAMINO RUSSO, MARTI SANCHEZ JUNY, JACKSON DAVID TELLEZ ALVAREZ

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

14404. Knowledge of the concepts and technical aspects linked to the conduction systems, both in pressure and in free foil. (Common module to the Civil branch)

14418. Knowledge and ability to project and size hydraulic works and installations, energy systems, hydroelectric uses and planning and management of surface and underground hydraulic resources. (Specific technology module: Hydrology)

14419. Knowledge and understanding of the functioning of ecosystems and environmental factors. (Specific technology module: Hydrology)

Generical:

14380. Scientific-technical training for the exercise of the profession of Technical Engineer of Public Works and knowledge of the functions of advice, analysis, design, calculation, project, construction, maintenance, conservation and exploitation.

14384. Capacity for the maintenance and conservation of hydraulic and energy resources, in its field.

14389. Knowledge of the history of civil engineering and training to analyze and assess public works in particular and construction in general.

TEACHING METHODOLOGY

The course consists of 2 hours per week of classroom activity (large size group) and 2 hours weekly with half the students (medium size group).

The 2 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 2 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.



LEARNING OBJECTIVES OF THE SUBJECT

Knowledge of fluid characteristics: compressibility, viscosity, phase transition and surface tension. Fluid statics. Knowledge of the equations of fluid motion and their application to ducted flow. Continuity, momentum, Bernoulli's trinomial. Turbulent motion and Reynolds number. Permanent and variable flow in pipes, including the conservation of energy and pressure-drop analysis, as well as pumping systems. Knowledge of the permanent and variable flow and its application to the functioning of channels.

1 Ability to apply the equations of the fluid motion to engineering cases related to pressurised or open channel flow systems

2 Ability to solve problems related to pipe networks, including support elements such as fittings and valves.

3 Ability to analyze the open-channel water flow in basic geometries or conditions.

Knowledge of the concepts and technical aspects related to both pressure and free surface conduction systems. Ability to solve basic hydraulic problems in engineering. Understand the characteristics of fluids: compressibility, viscosity, phase transition and surface tension. Fluid statics.

Knowledge of fluid equations of motion and their application to ducted flow. Continuity, momentum, and Bernouilli's trinomial.

Turbulent movement and Reynolds number. Knowledge of permanent and variable flow in pipes, including energy conservation and the pressure-drop analysis, as well as pumping systems. Knowledge of permanent and variable flow in open channel flow systems and its application to the operation of channels.

STUDY LOAD

Туре	Hours	Percentage
Hours medium group	30,0	20.00
Hours large group	30,0	20.00
Guided activities	6,0	4.00
Self study	84,0	56.00

Total learning time: 150 h

CONTENTS

Topic 1. Mechanical characteristics of fluids

Description: Mechanical properties of fluids

Full-or-part-time: 4h 48m Theory classes: 2h Self study : 2h 48m

Topic 2. Hydrostatics

Description: Equations and basic principles Exercises

Full-or-part-time: 12h Theory classes: 3h Practical classes: 2h Self study : 7h



Topic 3. Fundamental equations in the motion of fluids

Description:

Fundamental equations: Conservation of mass, momentum Theorem and Energy balance Exercises

Full-or-part-time: 16h 48m Theory classes: 4h Practical classes: 3h Self study : 9h 48m

Topic 4. Flow under Pressurized conditions

Description:

Steady flow in pipelines Exercises Pumping systems Exercises Transients in pipes. Wtaer-hammer Exercises

Full-or-part-time: 31h 12m Theory classes: 6h Practical classes: 5h Laboratory classes: 2h Self study : 18h 12m

Topic 5. Open channel flow

Description:

Uniform regime Gradually varied flow Exercises Rapidly varied flow Exercises HECRAS model in steady flow Introduction to the variable regime in open channel flow Introduction to the HECRAS model in non-steady flow

Full-or-part-time: 79h 12m Theory classes: 15h Practical classes: 10h Laboratory classes: 8h Self study : 46h 12m



GRADING SYSTEM

The grade of the subject is obtained from the grades of continuous assessment. The continuous assessment consists of doing different activities, both individual and group, of an additive and formative nature, carried out during the course (inside the classroom and outside it).

Assessment tests consist of questions about concepts associated with the learning objectives of the subject in terms of knowledge or understanding, and a set of application exercises.

The final grade (NF) is obtained from the application of the following expression:

 $NF = 0.62 \cdot NA + 0.38 \cdot NC$

Where

-NE: arithmetic mean of ordinary assessment tests

-NC: arithmetic mean of the activities proposed by the teachers throughout the course.

The student can give up the process of continuous assessment or by communicating it in writing to the teacher responsible at the beginning of the course or for non-attendance at 20% of NC activities. In such case the NF of the subject will be obtained doing:

NF = NE

Criteria of qualification and of admission to the re-evaluation: The students suspended to the ordinary evaluation that have presented regularly in the proofs of evaluation of the suspended subject will have the option to take a re-assessment test in the period set in the academic calendar. Students who have already passed it or students qualified as not presented will not be able to take the re-assessment test for a subject. The maximum grade in the case of taking the re-assessment exam will be five (5.0). The non-attendance of a student summoned to the test of re-evaluation, celebrated in the fixed period will not be able to give rise to the realization of another test with later date. Extraordinary assessment swill be carried out for those students who, due to force majeure, have not been able to take any of the continuous assessment tests. These tests must be authorized by the corresponding head of studies, at the request of the teacher responsible for the subject, and will be carried out within the corresponding teaching period.

EXAMINATION RULES.

If any of the laboratory or continuous assessment activities are not performed in the scheduled period, it will be considered a zero score.

BIBLIOGRAPHY

Basic:

- Sanchez, M.; Bladé, E.; Puertas, G. Hidráulica [on line]. Barcelona: Edicions UPC, 2005 [Consultation: 04/03/2021]. Available on: http://hdl.handle.net/2099.3/36802. ISBN 8483018217.

- Puertas, Jerónimo ... [et al]. Apuntes de ingeniería hidráulica. A Coruña: Fundación Ingeniería Civil de Galicia, 2016. ISBN 9788461746644.

- Chadwick A. J.; Morfett, J.C. Hydraulics in civil engineering. London: Allen and Unwin, 1986. ISBN 0046270035.

- Chanson, H. The Hydraulics of open channel flow : an introduction : basic principles, sediment motion, hydraulic modelling, design of hydraulic structures. 2nd ed. Oxford [etc.]: Butterworth Heinemann, 2004. ISBN 9780750659789.

- Streeter, V.; Wylie, E. B.; Bedford, K. Mecánica de fluidos. 9a ed. Publicació México [etc.]: McGrawHill, 2000. ISBN 9586009874.

- Sotelo, G. Hidráulica general: vol. 1: fundamentos. México: Limusa, 1974. ISBN 968-18-0503-8.