Course guide
2500216 - GEA0216 - Hydraulics

Last modified: 20/06/2024

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: BACHELOR'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2020). (Compulsory subject).
BACHELOR'S DEGREE IN ENVIRONMENTAL ENGINEERING / BACHELOR'S DEGREE IN MINERAL RESOURCE ENGINEERING AND MINERAL RECYCLING (Syllabus 2024). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: MARTI SANCHEZ JUNY

Others: MARTI SANCHEZ JUNY

REQUIREMENTS

MATHEMATICS FOUNDATIONS - Prerequisite
MATHEMATICS I - Prerequisite
FLUID MECHANICS - Corequisite

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14445. Recognize the biological bases and foundations of the plant and animal field in engineering: notions of genetics, biochemistry and metabolism, physiology, organisms and environment, population dynamics, flows of matter and energy and changes in ecosystems, biodiversity, principles of the kinetics of microbial growth and reactor theory.
14447. Obtain basic knowledge about the use and programming of computers, operating systems, databases and basic numerical calculation and applied to engineering.
14451. Apply the fundamental concepts of statistics and randomness of physical, social and economic phenomena, as well as uncertainty and decision-making techniques.
14452. Enhance the capacity of spatial vision and identify the techniques of graphic representation, topography, photogrammetry, cartography, remote sensing and Geographic Information systems.
14453. Describe and apply the techniques of analysis of physical, chemical and biological parameters; Integrate the experimental evidence found in field and / or laboratory data with the theoretical knowledge and interpret its results.
14454. Formulate the principles of fluid mechanics and the fundamentals of continuous medium mechanics.
14455. Identify the concepts and technical aspects linked to the conduit systems, both in pressure and in free sheet and apply them to the water supply transport networks; pumping systems; unit networks; separative networks; Avenues prevention systems in urban areas and analysis of tools for the recovery of altered river and coastal spaces.
14456. Describe the processes linked to the water cycle: atmospheric circulation and rain formation; rain transformation into runoff; and apply them to surface and underground hydrology associated with avenues risk, surface water pollution, aquifer management and groundwater pollution.

Generical:
14440. Identify, formulate and solve problems related to environmental engineering.
14441. Apply the functions of consulting, analysis, design, calculation, project, construction, maintenance, conservation and exploitation of any action in the territory in the field of environmental engineering.
14442. To use in any action in the territory proven methods and accredited technologies, in order to achieve the greatest efficiency respect for the environment and the protection of the safety and health of workers and users.

TEACHING METHODOLOGY

The course consists of 2 hours per week of face-to-face classes in a classroom (large group) and 2 hours per week with half of the students (medium-sized group).

Two hours are devoted to theory classes in a large group, in which the lecturers explain the basic concepts and materials of the subject, present examples and carry out exercises.

2 hours (medium group) are devoted to problem solving with more interaction with the students. Practical exercises are carried out in order to consolidate the general and specific learning objectives.

The remaining weekly hours are devoted to laboratory practice.

Support material is used in the form of a detailed teaching plan via the ATENEA virtual campus: contents, schedule of assessment and directed learning activities and bibliography.

Although most of the sessions will be taught in the language indicated in the guide, sessions with the support of other invited experts may be held in another language.

LEARNING OBJECTIVES OF THE SUBJECT

This course will provide knowledge of hydraulics and its application to pressure conduction and open channel systems and the ability to apply it to the solving of engineering problems. The applications of the fluid equations of motion to engineering cases related to pressure and open channel conduits will be shown. It will show how to solve pressure flow problems (pipes) including auxiliary elements such as pumps, elbows and valves and the flow of open channel water will be analyzed, in natural (rivers) and artificial channels.

1. Understand and know how to apply the laws of hydrostatics and the equations of fluid motion to engineering cases.
2. Solve problems of piping systems including pumping and auxiliary elements such as elbows and valves.
3. Analyze the free sheet water flow in geometries or basic conditions.

Hydraulics. Students will be introduced to hydrostatics and then the main equations that govern water transport will be analyzed. Will apply these to pressure and free sheet conduction systems to solve problems in the field of environmental engineering.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	15,0	10.00
Hours large group	30,0	20.00
Hours medium group	15,0	10.00

Total learning time: 150 h

CONTENTS

Mechanical characteristics of fluids

Description:
Mechanical characteristics of fluids

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

Hydrostatics

Description:
Basic principles. Push on flat surfaces
Thrust on curved surfaces. Uplift
Exercises

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

Fundamental equations in the motion of fluids

Description:
Mass conservation. Momentum equation
Bernoulli equation. Reynolds experiment
Exercises

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

Pressure flow

Description:
Steady flow in pipelines
Exercises
Pumping systems
Exercises
Transients in pipelines. Water hammer
Exercises

Full-or-part-time: 33h 36m
Theory classes: 6h
Practical classes: 6h
Laboratory classes: 2h
Self study : 19h 36m

Open channel fliow

Description:
Uniform regime
Gradually varied flow
Exercises
Rapidly varied flow
Exercises
HECRAS in steady flow
Introduction to the variable regime in open channel flow
Introduction to HECRAS in variable regime
Evaluation

Full-or-part-time: 76h 48m
Theory classes: 16h
Practical classes: 8h
Laboratory classes: 8h
Self study : 44h 48m

GRADING SYSTEM

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

The assessment tests consist of questions on 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 by applying the following expression:

NF = 0.62 - NA + 0.38 - NC

Where

-NA: arithmetic mean of the ordinary assessment tests -NC: arithmetic mean of the activities proposed by the lecturers throughout the course.

The student may waive the continuous assessment process either by notifying the lecturer responsible in writing at the beginning of the course or by not attending 20% of the NC activities. In this case, the NF of the subject will be calculated as follows:

NF = NA

Grading criteria and admission to re-evaluation: Students failed in the ordinary assessment who have regularly sat the assessment tests for the failed subject will have the option to sit a re-evaluation test in the period set in the academic calendar. Students who have already passed the re-evaluation test of a subject and students who have been graded as failed may not sit the re-evaluation test of a subject. The maximum grade in the case of sitting the re-evaluation exam shall be five (5.0). The non-attendance of a student summoned to the re-evaluation test, held in the fixed period, may not give rise to the taking of another test at a later date. Extraordinary evaluations will be carried out for those students who, due to accredited force majeure, have not been able to take any of the continuous assessment tests. These tests must be authorised by the corresponding Head of Studies, at the request of the teacher responsible for the subject, and will be held within the corresponding academic period.

EXAMINATION RULES.

If any of the laboratory or continuous assessment activities are not performed in the scheduled period, it will be considered as 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.
- Sotelo, G. Hidráulica general: vol. 1: fundamentos. México: Limusa, 1974. ISBN 968-18-0503-8.
- Streeter, V.; Wylie, E. B.; Bedford, K. Mecánica de fluidos. 9a ed. Publicació México [etc.]: McGrawHill, 2000. ISBN 9586009874.
- 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.