

Academic Year/course: 2022/23

## 28717 - Extension of Hydraulic Engineering and Hydrology

### Syllabus Information

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**Academic Year:** 2022/23

**Subject:** 28717 - Extension of Hydraulic Engineering and Hydrology

**Faculty / School:** 175 - Escuela Universitaria Politécnica de La Almunia

**Degree:** 423 - Bachelor's Degree in Civil Engineering

**ECTS:** 6.0

**Year:** 2

**Semester:** Second semester

**Subject Type:** Compulsory

**Module:**

## 1. General information

### 1.1. Aims of the course

The main objective of the course is to get students to acquire knowledge of the concepts and technical aspects related to open channel hydraulics, applied surface and underground hydrology.

This approach and this objective are aligned with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement:

- Goal 6: Clean water and sanitation (Targets 6.3 and 6.6)
- Goal 9: Industry, innovation and infrastructures (Target 9.1)
- Goal 11: Sustainable cities and communities (Targets 11.4 and 11.5)
- Goal 13: Climate action (Targets 13.1 and 13.3)

### 1.2. Context and importance of this course in the degree

The course *Extension of Hydraulic Engineering and Hydrology*, with 6 ECTS credits, is a subject of the EUPLA Degree in Civil Engineering. It is a semestral and mandatory subject of the second year of the degree.

The main objective of this subject, jointly to the other subject *Hydraulic Engineering: the Basics*, is to provide a solid knowledge about open channel flow and hydrology to be used in more practical courses (subjective-specific courses or elective subjects).

### 1.3. Recommendations to take this course

The subject of *Extension of Hydraulic Engineering and Hydrology* has not mandatory prerequisites although it is advisable to students who take it to have previously passed the subjects of Mathematics applied to Engineering I and II, General Physics and Hydraulic Engineering: the Basics of the Civil Engineering Degree.

## 2. Learning goals

### 2.1. Competences

As stated in the compulsory Common Competence C07 of the EUPLA Academic Memory of the Degree in Civil Engineering, the main competence of this subject will be to acquire knowledge of the concepts and technical aspects related to open channel flow. Furthermore, this subject includes the Common Competence C08 competence related to the knowledge of the basic concepts of surface and underground hydrology.

Finally, as generic competences, the student will acquire:

G01. Organizational and planning skills

G02. Capacity to solve problems

G03. Ability to make decisions

G04. Aptitude for oral and written communication of the native language

- G05. Capacity for analysis and synthesis
- G06. Ability to manage information
- G07. Capacity for teamwork
- G08. Capacity for critical reasoning
- G09. Ability to work in an interdisciplinary team
- G10. Ability to work in an international context
- G11. Adaptation capacity to face new situations
- G12. Leadership aptitude
- G13. Positive social attitude towards social and technological innovations
- G14. Ability to reason, discuss and present your own ideas
- G15. Ability to communicate through words and images
- G16. Ability to search, analyze and select information
- G17. Capacity for independent learning
- G18. Acquire and understand knowledge in an area of study that starts from the general secondary education base and is usually supported by advanced textbooks, but includes some aspects that involve cutting-edge knowledge in this field
- G19. Apply their knowledge to their work or vocation in a professional way and acquire the competencies that are usually demonstrated through the elaboration and defense of arguments and problem solving within their area of study
- G20. Ability to collect and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature
- G21. Transmit information, ideas, problems and solutions to a specialized and non-specialized audience
- G22. Develop those learning skills necessary to undertake further studies with a high degree of autonomy
- G23. Know and understand respect for fundamental rights, equal opportunities between women and men, universal accessibility for people with disabilities, and respect for the values of the culture of peace and democratic values.
- G24. Promote entrepreneurship
- G25. Knowledge in information and communication technologies.

## 2.2. Learning goals

The student, to pass this subject, should demonstrate to have acquired the following learning outcomes:

- Deep knowledge about the behaviour of open channel flow
- General knowledge of surface hydrology
- General knowledge of underground hydrology.

## 2.3. Importance of learning goals

The subject of *Extension of Hydraulic Engineering and Hydrology* has a marked engineering character with direct and immediate application in the professional field of the civil engineering.

In particular, upon completing and passing this course, the student will acquire:

- Deep knowledge about the hydraulic behaviour of open channel flow
- Deep knowledge to achieve and understand a flow profile according to the different flow regime
- Knowledge for the detailed calculation of the vertical layout of the free surface of a channel, or flow profile
- Basic knowledge of the hydrological cycle, the concepts of precipitation, hydrological losses and estimation of the maximum flow through the rational method
- Basic knowledge about underground hydrology.

# 3. Assessment (1st and 2nd call)

## 3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

Assessment tasks are the basic elements in the entire teaching-learning process since it is the only mechanism that allows, at any time during an educational period, to evaluate the degree of achievement of the proposed learning results and, if appropriate, apply the necessary corrections.

At the beginning of the course the student will choose one of the following two assessment methodologies:

- **Continuous assessment system:** it is an assessment system characterized by the obligation to participate in face-to-face activities of the subject and to take and pass the practical tests, partial exams and academic work proposed in the subject, within the established deadlines. In the case the student passes all the continuous assessment tests, he will be exempt from the global exam.
- **Global final evaluation exam:** it is a final and global exam on all the theoretical and practical content of the

subject.

### Continuous evaluation system

Following the spirit of the reform of the European Higher Education Area (EHEA), the evaluation of the subject contemplates a continuous evaluation system as the most consistent to be in line with the guidelines set by this new framework. In the continuous assessment model, the professor will assess the student's participation in face-to-face activities and their ability to solve problems and laboratory practices. Finally, the student should take and pass two partial exams ("continuous assessment exams") throughout the course.

The following table summarizes the weights of the activities cited in the evaluation process. All students who do not attend a minimum of 80% of the face-to-face activities (classes, seminars, technical visits, laboratory practices, etc.) or who do not obtain the minimum thresholds required for the partial tests, practices, exams or academic work proposed in the course, should pass to the global assessment model.

Assessment task	Weight
Participation in face-to-face activities	5%
Laboratory activity	5%
I Continuous evaluation exam	70%
II Continuous evaluation exam	20%

### Global final evaluation exam

The students must choose this modality when, due to their personal situation, they cannot adapt to the rhythm of work required in the continuous evaluation modality. In this case, the evaluation consists of a single exam on theory, problems and practices related to the content of the subject.

In the global final evaluation exam, the score regarding participation in classroom activities and laboratory practices may also be considered in the final and global score. The final score will be given by:

Score:  $MAX (90\% \times \text{Exam Score} + 5\% \times \text{Laboratory activity score} + 5\% \times \text{Face-to-face task score}; \text{Final Exam score})$

## 4. Methodology, learning tasks, syllabus and resources

### 4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions, laboratory sessions, tutorials, and autonomous work and study.

- The learning process designed for this course is based on a strong interaction between the professor and the student. This interaction is brought into being through a division of work and responsibilities between the students and the professor. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the professor.
- This course is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary forms, which are: the theoretical concepts of each teaching unit, problem-solving or resolution of questions and laboratory work, and at the same time supported by other activities.

The approach, methodology and assessment of this guide are intended to be the same for any teaching scenarios. They will be adapted to the social-health situation at any particular time, as well as to the instructions given by the authorities concerned.

### 4.2. Learning tasks

This course is organized as follows:

- **Lectures:** Theoretical activities carried out mainly through exposition by the professor, where the theoretical supports of the course are displayed, highlighting the fundamentals, structuring them in topics and or sections, interrelating them.
- **Practice sessions:** The professor resolves practical problems or cases for demonstrative purposes. This type of teaching complements the theory shown in the lectures with practical aspects.
- **Laboratory sessions:** The lecture group is divided up into various groups, according to the number of registered

students, but never with more than 5 students, in order to make up smaller sized groups.

- **Tutorials:** Carried out giving individual, personalized attention with a professor from the department, these tutorials may be on-site or online.
- **Autonomous work and study**
  - Study and understanding of the theory taught in the lectures.
  - Understanding and assimilation of the problems and practical cases solved in the practical classes.
  - Preparation of seminars, solutions to proposed problems, etc.
  - Preparation of laboratory workshops, preparation of summaries and reports.
  - Preparation of the written tests for continuous assessment and final exams.

The course has 6 ECTS credits, which represents 150 hours of student work in the course during the trimester, in other words, 10 hours per week for 15 weeks of class.

A summary of a weekly timetable guide can be seen in the following table. These data are obtained from the course file in the Accreditation Report of the degree, taking into account the level of experimentation considered for this course is moderate.

<b>Activity</b>	<b>Weekly school hours</b>
Lectures	3
Laboratory sessions	1
Other Activities	6

Nevertheless, the previous table can be shown in greater detail, taking into account the following overall distribution:

- 54 hours of lectures, with 50% theoretical demonstrations and 50% solving different type of problems
- 2 hours of laboratory activity
- 4 hours of written assessment tests (two hours per test)
- 90 hours of personal work, divided up over the 15 weeks of the 2<sup>nd</sup> semester.

### 4.3. Syllabus

This course will address the following topics:

#### Theory

- Topic 1: Open channel hydraulics
- Topic 2: Hydraulic structures and flow measurements
- Topic 3: Physical model and Buckingham theorem
- Topic 4: Introduction to the hydrological cycle, precipitation, hydrological losses, rational method
- Topic 5: Introduction to groundwater hydrology.

#### Contents of exercises and laboratory experience

- Problems Topic 1: Problems about open channel flow, uniform flow, gradually varied flow, hydraulic jump
- Problems Topic 2: Problems on weirs, gates and orifices
- Problems Topic 3: Problems on dimensional analysis and Buckingham theorem
- Problems Topic 4: Problems on the calculation of rainfall and peak flows.

#### Laboratory experience

Analysis of GVF profiles and weir hydraulics

### 4.4. Course planning and calendar

The dates of the two final exams will be those officially published on the EUPLA website.

For students who opt for the continuous assessment system, the I continuous assessment exam will be held during the month of April and its date will be communicated on the first day of class. The second exam will be held on the last day of class.

The laboratory activity will be scheduled throughout the semester. The following date will be the deadline for the delivery of the report related to this activity:

- Delivery of the report about laboratory activity: date of the exam of the first call.

The I continuous evaluation exam will consist of a written exam on theoretical topics (approximately 20%) and problems (approximately 80%) related to topics 1 and 2.

The II continuous evaluation exam will be held on the same date of the global exam (non-continuous evaluation) and will consist of a written exam on theoretical arguments (approximately 20%) and problems (approximately 80%) related to topics 3, 4, 5.

The global evaluation exam will take place at the end of the semester (1st call) and in September (2nd call) and will consist of a global written test on theoretical arguments (approximately 20%) and problems (approximately 80%) related to all the topics covered in class.

#### **4.5. Bibliography and recommended resources**

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28717>