

## 28734 - Extension of Underground Hydrology

### Información del Plan Docente

<b>Academic Year</b>	2016/17
<b>Academic center</b>	175 - Escuela Universitaria Politécnica de La Almunia
<b>Degree</b>	423 - Bachelor's Degree in Civil Engineering
<b>ECTS</b>	6.0
<b>Course</b>	
<b>Period</b>	Second semester
<b>Subject Type</b>	Compulsory
<b>Module</b>	---

### **1.Basic info**

#### **1.1.Recommendations to take this course**

#### **1.2.Activities and key dates for the course**

### **2.Initiation**

#### **2.1.Learning outcomes that define the subject**

#### **2.2.Introduction**

### **3.Context and competences**

#### **3.1.Goals**

#### **3.2.Context and meaning of the subject in the degree**

#### **3.3.Competences**

#### **3.4.Importance of learning outcomes**

### **4.Evaluation**

### **5.Activities and resources**

#### **5.1.General methodological presentation**

Strong interaction between the teacher/student. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. 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 teacher.

The current subject is conceived as a stand-alone combination of contents, yet organized into two fundamental and

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complementary forms, which are: the theoretical concepts of each teaching unit, and the solving of problems/resolution of questions.

### 5.2.Learning activities

Involves the active participation of the student, in a way that the results achieved in the learning process are developed, not taking away from those already set out, the activities are the following:

– **Face-to-face generic activities :**

1. **Theory Classes** : The theoretical concepts of the subject are explained and illustrative examples are developed as support to the theory when necessary.
2. **Practical Classes** : Problems and practical cases are carried out, complementary to the theoretical concepts studied.
3. **Individual Tutorials** : Those carried out giving individual, personalized attention with a teacher from the department. Said tutorials may be in person or online.

– **Generic non-class activities :**

1. ; Study and understanding of the theory taught in the lectures.
2. ; Understanding and assimilation of the problems and practical cases solved in the practical classes.
3. ; Preparation of seminars, solutions to proposed problems, etc.
4. ; Preparation of the written tests for continuous assessment and final exams.

### 5.3.Program

#### **BLOCK A.- INTRODUCTION (1 WEEK)**

1. INTRODUCTION TO HIDROGEOLOGY. RELATION BETWEEN SURFICIAL AND GROUNDWATER HYDROLOGICAL CYCLE

#### **BLOCK B.- GROUND WATER (8 WEEKS)**

2.- HIDROGEOLOGICAL PARAMETERS: POROSITY, PERMEABILITY, HYDRAULIC CONDUCTIVITY, TRANSMISIVITY, DARCY'S LAW

3.- AQUIFER TYPES

4.- RELATIONS SURFACE WATER - GROUND WATER

5.- PIEZOMETRY: HIDROGEOLOGICAL CARTOGRAPHY

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6.- GROUNDWATER HYDROCHEMISTRY

### **BLOCK C.- STUDY TECHNIQUES FOR GROUND WATER EXPLORATION (4 WEEKS)**

7.- INTRODUCTION TO MODELLING OF GROUND WATER FLOW

8.- ANALYTICAL SOLUTIONS. PUMPING TESTS: TRANSIENT AND STEADY PUMPING REGIME

9.- GRAPHICAL SOLUTIONS: FLOW NETWORKS

### **BLOCK D.- GROUND WATERS AND CIVIL WORKS (2 WEEKS)**

10.- GROUND WATER IMPACTS ON CIVIL WORKS. PUMPING WELLS.

11.- HYDROGEOTECHNICAL EFFECTS OF CIVIL WORKS.

### **5.4.Planning and scheduling**

The subject has 6 ECTS credits, which represents 150 hours of student work in the subject 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 figures are obtained from the subject file in the Accreditation Report of the degree, taking into account the level of experimentation considered for the said subject is moderate.

<b>Activity</b>	<b>Weekly school hours</b>
Lectures	4
Other Activities	6

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

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&mdash; 52 hours of lectures, with 50% theoretical demonstration and 50% solving type problems.

&mdash; 4 hours of written assessment tests, two hours per test.

&mdash; 90 hours of personal study, divided up over the 15 weeks of the 2 nd semester.

### 5.5. Bibliography and recommended resources

- Sanz Pérez, Eugenio. Hidráulica subterránea aplicada / Eugenio Sanz Pérez . [Madrid] : Colegio de Ingenieros de Caminos, Canales y Puertos, [2013
- Martínez Alfaro, Pedro Emilio. Fundamentos de hidrogeología / Pedro E. Martínez Alfaro, Pedro Martínez Santos, Silvino Castaño Castaño Madrid : Mundi-Prensa, 2006
- Ingeniería geológica / Luis I. González de Vallejo...[et al.] Madrid [etc.] : Prentice Hall, 2006
- Hidrología subterránea / Emilio Custodio, Manuel Ramón Llamas, directores de edición . - 2a ed. corr., [reimp.] Barcelona : Omega, cop. 1996
- Hidrogeología : conceptos básicos de hidrología subterránea / Comisión Docente Curso Internacional de Hidrología Subterránea formada por, Roser Escuder ... [et al.] Barcelona : FCIHS, 2009