Universitat Autònoma de Barcelona

2022/2023

Surface and Groundwater Hidrology

Code: 102842
ECTS Credits: 6

Degree	Type	Year	Semester
2501915 Environmental Sciences	OB	2	2

Contact

Name: Mario Zarroca Hernandez
Email: mario.zarroca.hernandez@uab.cat

Use of Languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Teachers

Joan Bach Plaza
Mario Zarroca Hernandez

Prerequisites

Although there are no official prerequisites, it is advisable for the student to review the basic knowledge about various subjects of the first year of the Degree that will be specified at the beginning of the academic year through the virtual campus (CV).

Objectives and Contextualisation

This subject has been designed to provide future professionals in Environmental Sciences

with basic and fundamental knowledge about the natural dynamics of the hydrogeological

environment: the scenario (static and dynamic).
Intentionally, the subject escapes those methods, work techniques and s

Hydrogeology s.s., which are only useful for professionals in Geology or Engineering of Roads, Mines or

Public Works. Instead, it focuses on those applied and basic aspects of utility for future Environmental

Science professionals.

Course objectives:

Raise awareness among students in the "world of water"
Introduce the student to the knowledge of the basic concepts and metho

Ground Hydrology (HSS) applied to the resolution of environmental problems.
More specifically, it is proposed to work on two levels: on the one hand, t

subject related to generic principles and formulations, on the other hand,

to concretize these formulations in examples on a local and regional scale.
At the same time, the aim is to place students in real situations, through t

that allows them to orient their future work with a certain autonomy and reach a knowledge and a

comprehension of the topics with greater or lesser depth, according to their needs and interests,

whether it is a task of reviewing-supervising the work or executing it.
Finally, the aim is to ensure that the student places the knowledge of the

It is a question of him himself having a conception, to be able to apply it, according to which this one

is related to many other disciplines.
Our subject is closely related to other basic and compulsory subjects of f

Consequently it has been designed in accordance with its contents.

Competences

- Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
- Analyze and use information critically.
- Collect, analyze and represent data and observations, both qualitative and quantitative, using secure adequate classroom, field and laboratory techniques
- Demonstrate adequate knowledge and use the most relevant environmental tools and concepts of biology, geology, chemistry, physics and chemical engineering.
- Demonstrate concern for quality and praxis.
- Demonstrate initiative and adapt to new situations and problems.
- Learn and apply in practice the knowledge acquired and to solve problems.

- Quickly apply the knowledge and skills in the various fields involved in environmental issues, providing innovative proposals.
- Teaming developing personal values regarding social skills and teamwork.
- Work autonomously

Learning Outcomes

1. Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
2. Analyze and use information critically.
3. Assess changes in geological media by natural or anthropogenic action and their level of degradation, and proposals for prevention and mitigation.
4. Demonstrate concern for quality and praxis.
5. Demonstrate initiative and adapt to new situations and problems.
6. Geological and geomorphological develop thematic maps for the management and environmental remediation and disclosure of geological heritage.
7. Identify the geological processes in the environmental surroundings and to value properly and originally.
8. Interpret maps and geological sections developed by other authors.
9. Learn and apply in practice the knowledge acquired and to solve problems.
10. Observe, recognize, analyze, measure and properly and safely represent geological processes.
11. Teaming developing personal values regarding social skills and teamwork.
12. Use concepts and tools of geology to solve environmental problems.
13. Work autonomously

Content

The contents of the subject are structured in the following thematic blocks

Introduction. A systemic vision of the world of surface and groundwater

Water as a resource, quantity and quality. The concept of sustainability. The global distribution of water, resources and management of water at the level of Catalonia. The water cycle. The water balance and its calculation. The concept of hydrographic basin and hydrogeological basin. The definition of components of the water balance: precipitation, evapotranspiration, slip (superficial and subterranean), extractions.

Techniques and methods of study of surface waters

The origin of the runoff and its distribution. The measurement of the flow Hydrography and hydrological data. The maintenance flow. The floods Relations precipitation regulation.

Aquifers

The water in the subsoil. Aquifers Parameters that define a rock like aquifer. Hydrogeological implications of lithologic modeling and morphology.

Techniques and methods of study and exploitation of groundwater

Principles of fluid mechanics. The energy of water in aquifers. The hydraulic gradient. The movement of water on the ground: Darcy's law. Hydraulic parameters: permeability, transmissivity and coefficient of storage. Representation of the underground flow. Piezometers. Piezometric level and phreatic level. The representation of the underground flow. Calculation of the flow vector. General equation of the underground flow. Derivation of the general equation of the subterranean flow. Hydrogeochemistry. General concepts Analyzes and graphs used in hydrogeology. Evolution according to lithologies. Isotopes. Pickup hydraulics. Types of gatherings and probes. Geometry of collections. Formulas that express the shape of the cone of descent. Pumping test. The screens Delay of catchment areas. Geophysical methods

Field work at HHS

It integrates knowledge of previous blocks and applies them to real field conditions.

They allow the student:

- Know how to distribute water resources in Catalonia and in different areas around the world

- To know qualitatively and quantitatively the different elements that intervene in the water balance of a hydrographic basin as the main element of water and land resources management.

- Evaluation of the hydrological dynamics of rivers and surface water in general with special emphasis on the factors involved in ecological quality and management of avenues

- Relate and integrate the geology and dynamics of fluids as the main conditioners of underground hydrology.

- Management and use of the main tools and methodologies of field and cabinet that allow to know and quantify the dynamics of groundwater and surface water.

- Climate change in relation to water

Programming

Block 1. Introduction. A systemic vision of the world of surface and groundwater

1.1. Hydrogeology? by environmentalists

1.2. The water cycle. The water balance and its calculation. The concept of hydrographic basin and hydrogeological basin. The definition of components of the water balance: precipitation, evapotranspiration, slip (superficial and subterranean), extractions.

Block 2. Techniques and methods of study of surface water

2.1. Fluvial hydro system

2.2. The origin of the runoff and its distribution. The measurement of the flow

2.3. Hydrography and hydrological data. The maintenance flow. The floods

2.4. Relations precipitation regulation

Block 3. Aquifers

3.1. The water in the subsoil. Aquifers Hydraulic parameters that define a rock like aquifer.

3.2. Interaction of surface and groundwater in different landscapes.

Block 4. Techniques and methods of study and exploitation of groundwater

4.1. Foundations. Principles of fluid mechanics. The energy of water in aquifers. The hydraulic gradient. The movement of water on the ground: Darcy's law.

4.2. Representation of the underground flow. Piezometers. Piezometric level and phreatic level. The representation of the underground flow. Calculation of the flow vector. General equation of the underground flow.

4.3. Pickup hydraulics. Types of gatherings and probes. Geometry of collections. Formulas that express the shape of the cone of descent. Pumping test.

Methodology

The learning process that has been designed for this subject is based on the following approaches:

- The student should acquire the theoretical and practical knowledge necessary to identify and interpret the main hydrological processes and their importance at the environmental level.
- The student should come up with the necessary skill to obtain and measure field data, conduct studies of flow rates, prepare piezometries and know the different aspects related to hydrology at a qualitative level.
- The student must know the main factors that intervene and / or condition the quality of the water for its use and management.
- It is desirable that the student familiarize himself with a basic bibliography on hydrology and hydrogeology, including texts in English, and that exercise the communication of knowledge, hypotheses and interpretations both orally and in written form.
- The student must have direct contact in the field where he can observe examples in situ of the different subjects treated in the subject.
- It is desirable that the student develop part of the training program autonomously, being able to resort on time to the advice of the professor.

In accordance with the objectives previously defined, the theoretical and practical aspects of the subject are distributed as follows:

Master classes

Theoretical knowledge will be transmitted mainly in the classroom (whenever possible) through lectures, with the support of ICT and large group discussions. Apart from the selected bibliography / webography, students will have a complementary material for the follow-up of the classes.

In the event that it is necessary to take distance classes, the master classes will be recorded in audio and later reinforcement tutorials will be given.

Field practices and group work

The practical work mainly aims to acquire a fieldwork methodology. They include a set of internships through which the student must end up with the skills needed to move safely and independently in fieldwork in HSS.

They are organized on field trips. Dates will be communicated in due course.

In the event that it cannot be carried out, the outings would be replaced by assignments and taught by the teachers responsible for them.

A guide document with the detailed organization-programming of the field days can be consulted on the virtual campus.

During the conference, field explanations are interspersed with independent student work.

It is intended that students develop a variety of practical work based on the management of basic equipment for data capture in HSS (windmills, infiltrometers, determination of hydro chemical parameters, topographic measurements of sections with topographic leveling equipment, piezometric probes, equipment for geophysical exploration, etc.) and in the acquisition of skill in hydrogeological observations.

The set of practical knowledge acquired by the students will be evaluated by means of written tests (same controls programmed by the theoretical contents) and with the realization of works in group.

Through this work, students will have to identify and delineate the role that hydrogeological factors play in the studied territory, paying special attention to the study of their interaction with the biotic elements of the area. In other words, the student must acquire a transversal and systemic knowledge of various hydro-environmental problems existing in this territory of Catalonia that will allow him to make decisions on the use and management, planning of the water resources it contains.

A guide document of the work to be developed can be consulted on the virtual campus of the subject.

During the course the student will be guided on the work methodology and the problems that will be solved.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Field practices	30	1.2	2, 3, 5, 4, 7, 8, 10, 13, 11, 12
Master classes	30	1.2	3, 7
Type: Autonomous			
Autonomous work	84	3.36	3, 7

Assessment

The evaluation is carried out throughout the course, partly in groups and partly individually.

1. Evaluation theory and classroom practices:

In this part, the scientific-technical knowledge of the subject achieved by the student is evaluated individually, as well as their capacity for analysis and synthesis, and critical reasoning.

The evaluation of the theoretical contents and part of the practical part of the subject is carried out by means of 2 written tests that are carried out throughout the course, one in the middle of the semester, and another at the end of the course.

The contents will be eliminatory (the second test does not include the contents of the first).

They will average from a 2.5 mark of each partial. Each of these evaluation activities of the subject represent a percentage with respect to the global grade of 70% (35% first part and 35% second part).

30% of the grade will come from the presentation of individual and / or group work, either from theoretical subjects and / or from field trips.

2. Evaluation field trips:

The concepts explained in the field will be very present in the written tests. Both regarding the exit

in the stream of the UAB campus and the camps in the Tremp basin.

3. Recovery notes improvement:

To be able to attend the recovery, the student has had to have previously been evaluated from

continuous evaluation activities that are equivalent to 2/3 of the final grade.

The possibility of improving the final global grade is considered, therefore the grades obtained

in the partial grades are invalidated.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
1st written test on basic knowledge of hydrology through theoretical questions and problem solving	35	2.5	0.1	2, 9, 3, 5, 4, 6, 7, 8, 10, 1, 13, 11, 12
2nd written test on basic knowledge of hydrology through theoretical questions and problem solving	35	2.5	0.1	2, 9, 3, 5, 4, 6, 7, 8, 10, 1, 13, 11, 12
group work	30	1	0.04	9, 5, 1, 11

Bibliography

It will usually work with resources on the network. (Webgraphy)

bibliography

Chow, V. T., Maidment, D. R., Mays, L. W. (1988). *Applied Hydrology*, McGraw-Hill International editions

Custodio, E. i Llamas, M. (1976). Hidrología Subterránea

Domenico, P.A. i F.W. Schwartz (1990). *Physical and chemical hydrogeology*. Wiley.

Freeze, R.A i J.A. Cherry (1979), *Groundwater*. Prentice Hall.

Martínez Alfaro, Pedro E., Martínez Santos, Pedro, Castaño Castaño, Silvino (2006). Fundamentos de hidrogeología. . Madrid : Mundi-Prensa.

Poncev. M. (1989). Engineering hydrology. Principles and practices. New Jersey. Ed. Prentice Hall. http://ponce.sdsu.edu/330textbook_hydrology_chapters.html

Younger, P. L, (2007). Groundwater in the Environment. Blackwell Publishing.

Web links:

The consultation of:

http://aca-web.gencat.cat/aca/appmanager/aca/aca/

Software

No specific software required