Universitat Autònoma de Barcelona

2019/2020

Surface and Groundwater Hidrology

Code: 102842
ECTS Credits: 6

Degree	Type	Year	Semester
2501915 Environmental Sciences	OB	2	2

Contact

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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

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 the future professionals of the Environmental Sciences with basic and fundamental knowledge about the natural dynamic of the hydrogeological environment: the scenario (static and dynamic).

Intentionally, the matter flees from those methods, work techniques and specific contents of the world of Hydrogeology, which are only useful for the professionals of Geology or the Engineering of Roads, Mines or Public Works. Instead, it focuses on those applied and basic aspects of utility for the future professionals of the Environmental Sciences.

Objectives of the subject:

Introduce the students to the knowledge of the basic concepts and methodology of Superficial and Underground Hydrology (HSS) applied to the resolution of environmental problems.

More specifically, it is proposed to work on two levels: on the one hand, to give basic ideas about the subject related to principles and generic formulations, on the other, to specify these formulations in examples at local and regional level.

At the same time, it is intended to initiate the students in the "real" work, by teaching a learning methodology that will allow them to orient their future work with a certain autonomy and reach a knowledge and a compression of the subjects with major or minor depth, according to your needs and interests, whether it is a review task-supervision of the work or execution of the same.

Finally, it will try to get the student to situate the knowledge of the HHS within the framework of the Environmental Sciences, without establishing fictitious cuts between these complementary knowledge areas. It is about the fact that he himself has a conception, in order to be able to apply it, according to which it is related to many other disciplines.

Our subject has a close relationship with other subjects of basic and compulsory education in the first, second and third courses. 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.

Theyallow 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 hydrosystem

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 through master classes, with support of ICT and debates in a large group. Apart from the selected bibliography, students will have a diversified material for the follow-up of classes.

Field practices and group work

Practical work is mainly aimed at acquiring a field work methodology. Purchase a set of practices through which the student must end up having the necessary skills to move safely and independently in field work in HSS.

They are organized in field exits. The dates will be communicated in a timely manner.

On the virtual campus you can consult a guide document with the organization-detailed schedule of the field days.

During the days, field explanations are carried out with an autonomous work of the students. It is intended that students develop a diversity of practical work based on the handling of the basic equipment of the data collection in HSS (grinders, infiltrometers, determination of hydrochemical parameters, topographic measurements of sections with topographic leveling equipment, piezo-probe probes, equipment for "geophysical exploration, ...) and in the acquisition of dexterity 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 a work in group. Through this work, students will have to identify and reduce the role played by hydrogeological factors in the studied territory, paying special attention to the study of their interaction with the biotic elements of the area. That is to say, the student must acquire a transversal and systemic knowledge of various hydro-environmental problems existing in these territories of Catalonia that allows him to make decisions about the use and management, planning of the water resources that it contains.

In the virtual campus of the subject you can consult a document-guide of the work to be developed. During the course the student will be encouraged about the work methodology and the problems that are raised will be solved.

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 assessment is carried out throughout the course, partly in part and in part individually.

1. Evaluation theory and classroom practices:

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

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

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

They will start from a 3 note from each partial. Each of these assessment activities of the subject represents a percentage with respect to the overall score of 45% (45% first partial and 45% second partial).

10% of the mark will come out of the presentation of individual and / or group works, either of theoretical subjects or of field trips.

2. Evaluation field trips:

The concepts explained in the field will be very present in the written tests. Both in regards to the exit to the stream of the UAB campus and the camps in the Tremp basin.

3. The non-presented ones:

It will be considered that a student will obtain the "Non-Valuable" qualification if the assessment of all the assessment activities carried out does not allow him to achieve the overall grade of 5, in the event that he had obtained the minimum mark to make an average of all of them.

4. Recovery improvement of notes:

To be able to assist in the recovery, the student must have been previously evaluated of continuous evaluation activities that are equivalent to 2/3 of the final mark.

The possibility of improving the final global note is considered, so that the notes obtained in the partial ones are invalidated.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
1st written test on basic knowledge of hydrology through theoretical questions and problem solving	45	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	45	2.5	0.1	2, 9, 3, 5, 4, 6, 7, 8, 10, 1, 13, 11, 12
individual and / or group work	10	1	0.04	9, 5, 1, 11

Bibliography

bibliography

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

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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/