Hydrogeology (C001705)

Valid as from the academic year 2019-2020

Course Specifications

Course size
- Credits 4.0
- Study time 105 h
- Contact hrs 35.0 h

Course offerings and teaching methods in academic year 2019-2020
- A (semester 1)
  - English
  - fieldwork 5.0 h
  - lecture 15.0 h
  - practicum 15.0 h

Lecturers in academic year 2019-2020
- Hermans, Thomas
  - WE13 lecturer-in-charge

Offered in the following programmes in 2019-2020
- Bachelor of Science in Geology
  - 4 credits
- Preparatory Course Master of Science in Geology
  - 4 credits

Teaching languages
- English

Keywords
- Groundwater - groundwater flow - groundwater quality - transport processes - drinking water - aquifer - vulnerability - pumping

Position of the course
- In this course, the students will learn the basic knowledge required for the understanding of the origin, the behaviour and the fate of groundwater. The importance of groundwater in terms of quantity and quality will be discussed, as well as the anthropogenic influence on groundwater. The students will develop the necessary tools for an integrated understanding of groundwater.

Contents
- Introduction (definitions, use of groundwater, social relevance of groundwater, distribution of groundwater, saturated and unsaturated zones, aquifers and aquitards, groundwater in the World and in Flanders)
- Occurrence of groundwater (Hydrological cycle, rock properties)
- Groundwater flow (hydrostatic, Darcy's law, hydraulic conductivity, storage coefficient, flow equations)
- Monitoring wells, pumping and slug tests
- Groundwater quality (major and minor elements, ionic balance, isotopes, diagrams)
- Transport of solute and non-aqueous phase liquid
- Introduction to groundwater models

Initial competences
- A basic knowledge of geology is necessary. This course builds on certain learning outcomes of the courses System Earth: Geology, Introduction to petrology, System Earth: Introduction to Geography, Sedimentology, Stratigraphy.
- A basic knowledge of mathematical concepts is necessary (derivates, integrals, differential equations). This course builds on certain learning outcomes of the courses Mathematics I, II and III.

Final competences
1. Recognise the occurrence of groundwater in the subsurface.
2. Name the main aquifer systems in Flanders
3. Estimate and analyze the components of the water balance
4. Discuss the hydrogeological field methods and measurements
5. Explain and estimate groundwater flow. Identify and discuss the hydraulic

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parameters involved.
6 Derive the equations of groundwater flow and pumping. Predict the effects of groundwater extraction.
7 Identify the conditions and hypotheses required to be able to make quantitative hydrogeological estimates
8 Describe and apply the concepts of groundwater quality
9 Identify and apply the principle of transport of dissolved species and contaminants in groundwater
10 Summarize the analysis of a complex hydrogeological situation and design possible solutions
11 Being aware of the societal relevance and the vulnerability of groundwater
12 Paying attention to the sustainability of groundwater resources

Conditions for credit contract
Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract
This course unit cannot be taken via an exam contract

Teaching methods
Lecture, practicum, fieldwork

Extra information on the teaching methods
During the lectures, the theoretical concepts related to the course will be taught with examples. Students are encouraged to actively participate through short assignments. During practicals, exercises related to the concepts studied during the lectures will be given. The students solve those exercises by themselves under the supervision of an assistant.
During fieldwork, the theoretical concepts are applied in real field conditions: measurement of hydraulic heads, slug tests and pumping tests. The acquired data are later processed and interpreted during the practicals.
During a seminar, a hydrogeologist from a drinking water company is invited and explain the path followed by water from the aquifer to the tap.

Learning materials and price
The slides of the theoretical lessons are available on Ufora. A Dutch syllabus (electronic format) is available on Ufora. A dictionary with the Dutch translation of hydrogeological words/concepts is provided.
Estimated costs (5 €)

References

Course content-related study coaching
Possibility to raise questions during the lectures and practicals
Possibility to contact the lecturer and the assistant by e-mail and make an appointment
Feedback session after the permanent evaluation
"Question and answers" session during the last practical session of the year.

Evaluation methods
end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period
Written examination

Examination methods in case of periodic evaluation during the second examination period
Written examination, oral examination

Examination methods in case of permanent evaluation
Assignment

Possibilities of retake in case of permanent evaluation
examination during the second examination period is not possible

Extra information on the examination methods
During the semester, 3 exercises related to the practical lessons will be given and a small report describing the solution proposed by the student is expected at the end of the period. This is part of the continuous assessment.

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The written exam will be composed of three types of questions: questions directly related to the theory, open questions related to the concepts seen in the lessons but requiring clear reasoning, exercises similar to the ones made during practicals. For the second exam session, an oral examination will follow the written examination during which the answers will be analyzed and the opportunity is given to the student to remedy any discrepancies in his/her answer.

Calculation of the examination mark

A combination of continuous assessment (assignment, i.e. 10% of the final mark) and end-of-term assessment (written exam, i.e. 90% of the final mark).