Course Specifications
Valid as from the academic year 2019-2020

Geophysical Well Logging (C002654)

Course

Credits 6.0
Study time 150 h
Contact hrs 50.0 h

Course offerings and teaching methods in academic year 2019-2020

A (semester 1) English lecture 20.0 h
integration seminar 30.0 h

Lecturers in academic year 2019-2020

Hermans, Thomas WE13 lecturer-in-charge
Walraevens, Kristine WE13 co-lecturer

Offered in the following programmes in 2019-2020

Master of Science in Teaching in Science and Technology (main subject Geology) 6 A
Master of Science in Geology 6 A
Master of Science in Geology 6 A
Exchange programme in Geology (master's level) 6 A

Teaching languages

English

Keywords

Geophysical measurements in boreholes, resistivity measurements, natural gamma, porosity sensitive methods, hydrogeological description

Position of the course

In this course, the students will learn how to improve the hydrogeological description of subsurface reservoirs through geophysical well logging methods. Classical hydrogeological investigation methods such as pumping tests have a large volume of investigation, preventing the determination of the small-scale properties of aquifers. The acquisition of high-resolution geophysical parameters along boreholes allows to collect crucial information about the layering of groundwater reservoirs and to estimate some physical characteristics of rocks surrounding the borehole like temperature, clay content, density, porosity, hydraulic conductivity, or total salt content of pore water. Some methods also allow the determination of the discharge rate of different layers in natural or pumping conditions, the technical control of boreholes and well constructions or the presence of fractures in the reservoir.

Contents

1 Electrical resistivity (direct current and electromagnetic induction) and related properties (temperature, electrical fluid resistivity)
2 Natural gamma ray
3 Nuclear magnetic resonance
4 Ground Penetrating Radar (GPR)
5 Vertical flow measurements in wells and boreholes
6 Spontaneous potential log
7 Porosity sensitive methods
8 Other geophysical borehole measurements (temperature, strike and dip, CCL, ...)

Initial competences

Knowledge of hydrogeological, physical and geophysical concepts is required. This course builds on certain learning outcomes of the courses Hydrogeology, Physics 3 and Exploration Geophysics.

Final competences

(Approved)
1 Be acquainted with the methods of geophysical well logging, their application in geological studies, groundwater prospection and investigation of pollution. Identify the advantages and limitations of the methods.

2 Understand the influence of measuring parameters on the quality and robustness of geophysical well logging data.

3 Independently evaluate geophysical well logs and critically interpret them in terms of hydrogeological properties. Integrate and correlate several well logs collected on the same site.

4 Compare geophysical well logging methods and choose the most appropriate one(s) in a specific hydrogeological context.

5 Independently collect and deal with geophysical well logs in a professional context.

6 Give evidence of environmental consciousness and societal engagement, related to soil pollution and human actions with impact on groundwater and subsoil.

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, integration seminar, practicum

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 the 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 integration seminars, geophysical well logging data are integrated with geological and hydrogeological data (measurement of hydraulic heads, pumping tests, borehole description). This includes field data acquisition.

Learning materials and price
The slides of the theoretical lessons are available on Ufora. Course notes available Cost: 7 EUR

References

Course content-related study coaching
The lectures, practicals and seminars include an intensive interaction with the tutor, in which ample opportunity is provided for questioning and discussion on the subject.

Evaluation methods
end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period
Written examination with open questions, oral examination

Examination methods in case of periodic evaluation during the second examination period
Written examination with open questions, 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, an exercise related to the practical lectures/integration seminar 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. 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 lectures but requiring clear reasoning, exercises similar to the ones made during practicals. An oral examination will follow the written examination during which the lecturers will go through the answers and give the student the opportunity 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).

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