Groundwater - BMEEOVVMV63

I. Subject Specification

1. Basic Data

1.1 Title

Groundwater

1.2 Code

BMEEOVVMV63

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	2

1.5 Evaluation

Midterm grade

1.6 Credits

3

1.7 Coordinator

name	Dr. Csoma Rózsa
academic rank	Associate professor
email	csoma.rozsa@emk.bme.hu

1.8 Department

Department of Hydraulic and Water Resources Engineering

1.9 Website

https://epito.bme.hu/BMEEOVVMV63
https://fiek2.mywire.org/course/view.php?id=3538

1.10 Language of instruction

english

1.11 Curriculum requirements

Recommended elective in the Specialization in Water and Hydro-Environmental Engineering (MSc) programme

1.12 Prerequisites

Recommended prerequisites:

- Geology (BMEEOGMAT41)
- Soil Mechanics (BMEEOGMAT41)

1.13 Effective date

1 September 2022

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2. Objectives and learning outcomes

2.1 Objectives

The aim of the course is to introduce the groundwater flow process. The different forms of underground water: soil moisture, phreatic and confined groundwater, karstic water, thermal and mineral water, and their most important characteristics. The two and three phase movement of groundwater in porous media and in fractured rocks, water bodies with different density, transport phenomenon in groundwater. The estimation of the effects of planned interventions on the groundwater (e.g. dewatering, new lakes, etc.), and the effect of groundwater on the underground part of structures. The development of complex attitude of mind with the help of case studies.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. to be aware of the general terminology of hydrogeology
2. to be aware of the general equations describing seepage and groundwater flow
3. to be aware of the the hydraulic characteristics of aquifers and their determination
4. to be aware of the general equations describing transport processes in groundwater
5. to be aware of the basic idea of the calculation of underground water balance
6. to be aware of the determination possibilities of the perneability
7. to be aware of the methods to be applied in case of compound hydrogeological systems (e,g. karstic of thermal water)

B. Skills

1. to be able to describe groundwater flow systems with the proper hydraulic models,
2. to be able to set and analyse the water balance of groundwater bodies
3. to be able to identify simple problems of groundwater hydraulics, to find the theoretical backgrounds and to formulate the solution
4. to be able to identify and solve simple problems of the protection of recharge area,
5. based on the knowledge collected in the field of informatics to be able to solve problems of medium size computational requirements in the field of groundwater flow,
6. to be able to present his/her results in proper written form,

C. Attitudes

1. to collaborate with the teachers and his/her mates in gaining knowledge,
2. to follow the lectures, to make effort to understand the study material,
3. to strive for the proper identification of problems in connection with the underground water bodies and their proper solution,
4. to strive for accuracy in his/her calculations/solutions,

5. to realize the importance of the effects of human activities on the environment.

D. Autonomy and Responsibility

1. to be independent in problem statements and solutions in case of groundwater flow problems,
2. to be open to careful and deep going critique,
3. in some cases, as a group member to collaborate with the mates to solve technical problems,
4. to understand the complexity, comprehensiveness of the problems and recognizing the synergies.

2.3 Methods

Lectures for the theoretical backgrounds, simple examples to show its the applicability. The analysis of the main steps of the solution of the homeworks, individual and group consultation

2.4 Course outline

Hét	**Előadások és gyakorlatok témaköre**
1.	Types of Underground Water and their Description Possibilities
2.	2. Hydraulic Basis, Basic Equations
3.	3. Steady and Unsteady Horizontal
4.	4. Horizontal 2D Groundwater Flow
5.	5. Flow Near Wells and Well Fields
6.	6. Transport Processes in Groundwater
7.	7. Data Requirements in Connection with Groundwater Flow
8	8. Pumping Tests, Design and Evaluation
9.	9. Field Measurements, a Link with Geotechnics
10.	10. Water Balance. Karstic Water.
11.	11. Water Abstraction. Bank Infiltration. Protection of Wells
12.	12. Mineral and Thermal Water
13.	test
14.	consultations

The above programme is tentative and subject to changes due to calendar variations and other reasons specific to the actual semester. Consult the effective detailed course schedule of the course on the subject website.

2.5 Study materials

a) Books:

1. ***Bear, J.:*** Hydraulics of Groundwater. McGraw-Hill Inc. New-York, 1979
2. ***Bear, J. - Verruijt, A.***: Modelling Groundwater Flow and Pollution. D. Reidel Publishing Company, Dordrecht, 1987.
3. ***Verruijt, A.***: Theory of Groundwater Flow. Macmillan Civil Engineering Hydraulics Series. Macmillan and Co. Ltd. London, 1970.
4. ***Wang, H. F. - Anderson, M. P.***: Introduction to Groundwater Flow Modelling. Finite Difference and Finite Element Methods. W.H.Freeman and Company, San Francisco, 1982.

b) Online materials: materials uploaded to the web site of the subject, e.g.:

1. Lecture notes, electronic lecture notes,
2. Slides of lectures and practices,

2.6 Other information

2.7 Consultation

The instructors are available for consultation during their office hours, as advertised on the department website at the beginning of the semester.

This Subject Datasheet is valid for:

Inactive courses

II. Subject requirements

Assessment and evaluation of the learning outcomes

3.1 General rules

The assessment of the learning outcomes specified in Clause 2.2 above and the evaluation of student performance occurs via a midterm and homeworks.

3.2 Assessment methods

Teljesítményértékelés neve (típus)	Jele	Értékelt tanulási eredmények
1st homework	HW1	A.1-A.2; B.1, B.3, B.5; C.2-C.5; D.1-D.2
2nd homework	HW2	A.1, A.4; B.4, B.5; C.2-C.5; D.1-D.2
3rd homework	HW3	A.1, A.3, A.6; B.4, B.5; C.2-C.5; D.1-D.2
4th homework	HW4	A.1, A.7; B.1, B.6; C.1, C.2, C.4, C.5; D.2-D.4
test	T	A.1-A.7; B.2, B.6; D.4

The dates of deadlines of assignments/homework can be found in the detailed course schedule on the subject's website.

3.3 Evaluation system

Jele	Részarány
HW1	12,5
HW2	12,5
HW3	12,5
HW4	12,5
T	50
Összesen	**100%**

3.4 Requirements and validity of signature

No signature can be obtained

3.5 Grading system

At least 70% of the attendance of lectures and seminars are expected.
The test and the homeworks are failed, if any of them is fulfilled with the result less, than 40%.
In case of fulfilling the attendance requirements and the other assignments with the grade at least „satisfactory", the final grade is the weighted average value of the grades obtained, where the weights are according to the clause 3.3.

3.6 Retake and repeat

1. The homeworks – after the payment of the fee as described in the Regulations – can be submitted with delay until the last day of the supplementary week, until 12:00 a.m..

2. The submitted and accepted homework can be corrected without any fee until the deadline described in the point 1.
3. The midterm test can be retaken once without any fee at the time given Detailed class schedule. The grade to be considered is the more favorable for the student.
4. If a sudent cannot achieve a grade at least 'pass' with the help of the retake given in point 3), there is a second retake possibility after the payment of a fee given in then regulations. The time of this extra retake is also given in the Detailed class schedule

3.7 Estimated workload

Tevékenység	**Óra/félév**
Contact hours	1×2=28
preparation for the test	12
preparation of the homeworks	4×11=44
Home studying of the written material	6
Összesen	**90**

3.8 Effective date

1 September 2022

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Inactive courses