

I. Tantárgyleírás**1. Alapadatok***1.1 Tantárgy neve***GROUNDWATER***1.2 Azonosító (tantárgykód)***BMEEOVVMsFIN07-00***1.3 Tantárgy jellege*

Kontaktórás tanegység

1.4 Óraszámok

Típus	Óraszám / (nap)
Előadás (elmélet)	1
Gyakorlat	1

1.5 Tanulmányi teljesítményértékelés (minőségi értékelés) típusa

Félévközi érdemjegy

1.6 Kreditszám

3

1.7 Tárgyfelelős

név	Dr. Hajnal Géza
beosztás	Egyetemi docens
email	hajnal.geza@emk.bme.hu

1.8 Tantárgyat gondozó oktatási szervezeti egység

Vízépítési és Vízgazdálkodási Tanszék

1.9 A tantárgy weblapjaepito.bme.hu<https://edu.epito.bme.hu/course/view.php?id=5211>*1.10 Az oktatás nyelve*

magyar

1.11 Tantárgy típusa

Kötelezően választható az Infrastruktúra-építőmérnök (MSc) szak Víz- és vízi környezetmérnöki specializációján

*1.12 Előkövetelmények**1.13 Tantárgyleírás érvényessége*

2025. szeptember 1.

2. Céltűzések és tanulási eredmények

2.1 Céltűzések

The aim of the course is to introduce the student to 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 Tanulási eredmények

A tantárgy sikeres teljesítése után a hallgató

A. Tudás

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

B. Képesség

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

C. Attitűd

1. collaborates with the teachers and their mates in gaining knowledge, 2. follows the lectures, makes effort to understand the study material, 3. strives for the proper identification of problems in connection with the underground water bodies and their proper solution, 4. strives for accuracy in their calculations/solutions, 5. realizes the importance of the effects of human activities on the environment.

D. Önállóság és felelősség

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

2.3 Oktatási módszertan

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 Részletes tárgyprogram

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

A félév közbeni munkaszüneti napok miatt a program csak tájékoztató jellegű, a pontos időpontokat a tárgy honlapján elérhető "Részletes féléves ütemterv" tartalmazza.

2.5 Tanulástámogató anyagok

a) Books: Bear, J.: Hydraulics of Groundwater. McGraw-Hill Inc. New-York, 1979 Bear, J. - Verruijt, A.: Modelling Groundwater Flow and Pollution. D. Reidel Publishing Company, Dordrecht, 1987. Verruijt, A.:

Theory of Groundwater Flow. Macmillan Civil Engineering Hydraulics Series. Macmillan and Co. Ltd. London, 1970. 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.: Lecture notes, electronic lecture notes, Slides of lectures and practices,

2.6 Egyéb tudnivalók

None.

2.7 Konzultációs lehetőségek

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

Jelen TAD az alábbi félévre érvényes:

2025/2026 semester II

II. Tárgykövetelmények

3. A tanulmányi teljesítmény ellenőrzése és értékelése

3.1 Általános szabályok

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

3.2 Teljesítményértékelési módszerek

Assessment Name (Type)	Code	Assessed Learning Outcomes
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
midterm test	MT	A.1-A.7; B.2, B.6; D.4

A szorgalmi időszakban tartott értékelések pontos idejét, a házi feladatok ki- és beadási határidejét a "Részletes féléves ütemterv" tartalmazza, mely elérhető a tárgy honlapján.

3.3 Teljesítményértékelések részaránya a minősítésben

Code	Weight
HW1	12.5%
HW2	12.5%
HW3	12.5%
HW4	12.5%
MT	50%
Total	100%

3.4 Az aláírás megszerzésének feltétele, az aláírás érvényessége

3.5 Érdemjegy megállapítása

Grade	Score (P)
excellent (5)	$85 \leq P$
good (4)	$70 \leq P < 85\%$
satisfactory (3)	$55 \leq P < 70\%$
pass (2)	$40 \leq P < 55\%$
fail (1)	$P < 40\%$

3.6 Javítás és pótlás

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 student 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 A tantárgy elvégzéséhez szükséges tanulmányi munka

Activity	Hours/Semester
Contact hours	2x14=28
preparation for the test	12
preparation of the homeworks	4x11=44
Home studying of the written material	6

3.8 A tárgykövetelmények érvényessége

2025. szeptember 1.

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2025/2026 semester II