UNIVERSITY OF MISKOLC

FACULTY OF
EARTH AND ENVIRONMENTAL
SCIENCE AND ENGINEERING

APPLIED AND ENGINEERING HYDROLOGY

Hydrogeology Engineer MSc

2023/24 Semester II.

COURSE COMMUNICATION FOLDER

University of Miskolc
Faculty of Earth and Environmental Science and Engineering
Institute of Water Resources and Environmental Management

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1. Course introduction, teacher, number of lessons, credits

Course Title: Applied and engineering hydrology **Instructor:** Dr. Márton Tóth, assistant professor	**Code:** MFKHT720022 **Responsible department/institute:** Institute of Water Resources and Environmental Management
	Type of course: Compulsory
Position in curriculum (which semester): 2	**Pre-requisites (if any):**
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other):** practice mark
Credits: 2	**Course:** full time

Course Description:
To introduce the measurement methods and principles of hydraulic characteristics of surface and subsurface waters; to familiarize the students with its newest tools and the modern processing methods of the measurement data. Tools, methods, and organizations of prevention of water damage. To prepare students on how to solve basic hydraulic measurement problems.

The short curriculum of the subject:
Overview of hydrometeorology basics. Importance of precipitation in the hydrological cycle. Determination of precipitation data characteristics, and precipitation forecast systems. Flowing and stagnant waters. The place of surface and subsurface flowing waters in the hydrological cycle. Measurement of water level, water depth, and water velocity in flowing waters, calculation methods of water yield. Sediment measurements and calculating methods on flowing and stagnant waters. Effects of ice phenomena on water levels and on objects on shore. Place of evaporation in the hydrological cycle. Evaporation determination methods. Hydrology of storage. Surface drainage, river training, flood control, excess surface waters. Procession of hydrological data, and hydrological calculations. Publication of processed data.

Compatencies to evolve:
Knowledge:
T1 - It includes knowledge of hydrogeology, water resource management, water quality protection, water treatment, production and waterworks operat
T2 - Extensive knowledge of hydrogeological assessment and monitoring techniques related to watershed approach and considers ecological water demands.
T3 - Thorough understanding of the concepts and principles of engineering geology and civil engineering and their processes.
T5 - Knows and understands hydrogeological modelling techniques.
T7 - Have knowledge of a wide range of problem-solving techniques for research or academic work.
Ability:
K1 - Ability to understand the laws and relationships related to the location, movement and quality of groundwater, to apply and put into practice the knowledge acquired, and to use problem-solving techniques.
K2 - Ability to process information from the knowledge frontiers of professional experience of the discipline, ability of problemsolving, and interpreting hydrogeological issues.
K3 - Ability to independently plan and execute tasks related to groundwater exploration, exploitation and well hydraulics at a high professional level.
K6 - Prepared to tackle complex water resource management, water conservation and aquifer protection challenges.
K9 - Ability to model hydrodynamics and transport of groundwater flow systems
K10 - Prepared to effectively apply relevant national and European professional, environmental and conservation legislation
K11 - Ability to implement an ecological approach in line with the EU Water Framework Directive
K12 - Ability to work in compliance with EU legislation, to cooperate with foreign partners to solve the tasks required by the EU Water Framework Directive
K13 - The ability to independently participate in and manage research, development and expertise in the field of hydrogeology
K14 - Ability to lead and participate in complex design work and project management in water management and water supply
K15 - Ability to solve complex problems in a flexible way through creative problem solving, to work in a team, to think and cooperate effectively with representatives of other disciplines (e.g. environment, quality, consumer protection, human health, construction, etc.)
Attitude:
A1 - Open-minded and receptive, active in learning about professional and technological methodological developments in the fields of geosciences and environmental engineering, and in solving geological problems from an engineering perspective
A3 - Have the motivation to work in a changing work, geographical and cultural contexts
A4 - Deep commitment and professional solidarity
Autonomy and responsibility:

F1 - Act independently and proactively to solve professional problems.
F5 - Committed to sustainable natural resource management practices.
F6 - He/she is responsible claims in expert oppinions, professional judgements and for the work carried out under his/her supervision.

Assessment and grading:
Students will be assessed with using the following elements.

Final exam	100%
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
80 – 89%	4 (good)
70 - 79%	3 (satisfactory)
60 - 69%	2 (pass)
0 - 59%	1 (failed)

Compulsory or recommended literature resources:

- Brooks, K. N. – Ffolliott, P. F. – Gregersen, H. M. – Thames, J. L. (1996): Hydrogeology and the management of watersheds. Iowa State University Press/AMES
- Chow, V., Maidment, D., Mays, L.:Applied hydrology, 1988
- Eslamian, S.: Handbook of engineering hydrology1: Fundamentals and applications, Taylor and Francis, 2014
- Ojha, C. S. P., Brendtsson, R., Bhunya P.: Engineering hydrology, Oxford University Press, 20.

Course syllabus

Water chemistry
Syllabus
Spring semester
Hydrogeological Engineer MSc, Semester II., Compulsory course

02.14	Mean precipitation height determination
02.21	Precipitable water amount calculation, atmosphere condition parameters calculation
02.28	Evaporation
03.06	Infiltration
03.13	Surface runoff - Unit hydrographs
03.20	S-hydrograph, watershed characteristic
03.27	Water storm design
04.03	Holiday
04.10	Pipe system design
04.17	Modeling watersheds
04.24	Field trip (Kisköre)
05.01	Holiday
05.08	Test
05.15	Test repetition

2. Example Test

Applied and engineering hydrology
TEST 1.
2022.05.13

Each exercise what you can find below should be solved in MS Excel. Solve the 4 exercises on 4 different worksheet and save the Excel file with the name of your Neptun ID.

1. The air pressure on the surface is 101.1 kPa, the air temperature is 25 °C, the lapse rate is 6.5 °C/km. Determine the amount of precipitable water in the first 5 km above 1 m^2 of ground surface with 1000 m increments! (Ra = 287 J/kg·°K)
2. Determine the evaporation (in cm) of a lake in the given period (Table 1.), if the pan constant is 0.8!

Table 1 Measurement data in an evaporation pan

Day	1	2	3	4	5	6
Precipitation (cm)	0	0	1,5	0	0	0
Filled water (cm)	1,5	1,7	0,5	1,2	0,7	1,3

3. Determine the infiltration capacity curve of a 6h long precipitation and plot that, if I_{max}=1.41 cm/hr and I_{min}=0.05 cm/hr, the α=0.6!
4. There is a measured flood wave (see data below). Determine the unit hydrograph of the watershed! Please give the unit of unit hydrograph also!

Time [0.5 h]	P [mm]	Q [m^3/s]
1	13.5	12.1
2	24.5	54.5
3	23.0	150.0
4		258.6
5		300.9
6		221.8
7		111.0
8		52.3
9		39.7
10		23.5
11		8.9

5. Convert a 0.5h-unit hydrograph (see data below) into 1.5h-unit hydrograph!

Time [hr]	0.5-h unit hydrograph [$m^3/s/mm$]
0.5	11.4
1	30.6
1.5	66.3
2	71.0
2.5	41.3
3	12.8
3.5	10.8
4	7.8
4.5	4.9
5	0

Time [hr]	0.5-h unit hydrograph [$m^3/s/mm$]
5.5	0
6	0

6. Determine the indication curve (2S/dt+Q) of a buffer lake if its base is 45 m x 45 m (area at the bottom of the lake) and the slope inclination is 2. There is a vent and a weir integrated in the lake to ensure the outflow from lake. The diameter of vent is 1.5 m and the C_v is 0.8. The length of the weir is 4.5 m and the C_w is 0.72. The vent is installed at the bottom of the lake so it works from start of filling but the weir head is 3 m. Determine the indication curve between h = 0 - 4 m with resolution of 0.2 m. The dt is 15 min (take care about the conversion into m3/s)!