

Earth Science and Hydrology								Code of the course	Year / Semester
Type of subject:		Education Profile		The level of education		Form of studies			
Obligatory		General Academic				Stationary			
Type of subject							ECTS		
Lecture	Exercises	Laboratory	Project	Seminar	Practical classes	Exam			
15	15	30	-	-	-	-	7		
Subject coordinator:									
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II. COURSE CONTENT		
Course type – Lecture		Number of hours
1	Earth sciences. Geological structure of the Earth	1
2	Factors influencing the shaping of the Earth's surface	1
3	Soil forming factors and processes	1
4	Earth's atmosphere – the composition, climate and weather	1
5	The global warming and climate changes	1
6-7	The water cycle and its components. The water balance	2
8	The drainage basin hydrology. The surface water	1
9	The hydrology of streams and rivers. The stream flow velocity and discharge	1

10	The groundwater. The water table. The saturated and unsaturated zone. Aquifers aquitards and aquicludes	1
11	The confined and unconfined aquifer. The hydrogeological parameters	1
12	The groundwater flow. The filtration and fluation	1
13	The groundwater exploitation. Well design and installation	1
14	The flood forecasting. The flood prevention and control	1
15	The test	1
TOTAL:		15
Course type - Exercises		
1	The introduction to the subject	1
2-3	Calculations of the design rainfall intensity. Calculation of the infiltration rate	2
4-5	Calculation of the stream flow velocity and discharge. The Manning equation. The weirs	2
6-7	The calculation of the flow rate through the aquifer	2
8-9	The calculation of the pumping well discharge. The fully and partially penetrating wells	2
10-11	The calculation of the aquifer hydraulic conductivity on the base of pumping test data	2
12	Calculation of the hydraulic properties of the aquifer. The slug tests	1
13-14	Ditches, drains and radiator collector wells – the discharge calculations	2
15	The test	1
TOTAL:		15
Course type - Laboratory		Number of hours
	Introduction to the subject: health and safety training, discussion on the conditions and requirements of passing the laboratory, presentation of the subject and scope of the course	2
	Estimation of the gravimetric and volumetric soil water content. Calculation of the degree of saturation. The soil moisture retention curve	2

	The sieve analysis. Characterizing the hydraulic properties of soils on the base of grain-size analysis data	2
	The precipitation, temperature, dew point, relative humidity, and solar irradiation. Processing of the data collected by the weather station. The IDF curves	2
	The simulation of rainfall, runoff and infiltration. Calculation of the mean areal precipitation for a region using the Thiessen Polygon Weighting method	2
	Delineation of the drainage basin boundaries. The morphometric analysis of the catchment. Work with the map	2
	Calculation of the average flow velocity and discharge of the stream. Processing of the data collected with use of the propeller current meter	2
	Constructing the river stage-discharge rating curve. The flood hydrograph	2
	Determination of the hydraulic conductivity and the intrinsic permeability of soil using the variable-head permeameter	2
	Determination of the hydraulic conductivity and the intrinsic permeability of soil using the constant-head permeameter	2
	Hydrogeological mapping. Modelling of the groundwater flow and fate and transport of contaminants in the subsurface using the Processing Modflow software	4
	Modelling of the hydrological processes using the EPA SWMM 5 software	4
	The test	2
TOTAL:		30

DIDACTIC METHODS	
1.	blackboard
2.	multimedia presentation
3.	laboratory setup
4.	computer software
5.	the literature and instructions for laboratory classes

METHODS OF ASSESSMENTS: (F – FORMATIVE; S – SUMMATIVE)	
F01	activity in classes
F02	evaluation of work during laboratory exercises
S01	test
S02	evaluation of the laboratory reports

III. STUDENT WORKLOAD		
L.p.	Form of activity	Numer of hours for activity
		[hours]
1. Direct teaching hours:		
1.1	Hours of classes organized by universities – lectures	15
1.2	Hours of classes organized by universities – exercises	15
1.3	Hours of classes organized by universities – laboratory	30
1.4	Hours of classes organized by universities – project	
1.5	Hours of classes organized by universities – field activities	
1.6	Hours of classes organized by universities – seminar	
1.7	Exam	
Total direct hours:		60
2. Student's own work		
2.1	Preparation for exercises and for final exams	14
2.2	Preparation for laboratory test reports, preparation of individual	70
2.3	Preparing your own project	
2.4	Preparation for the final exam from the lecture	
2.5	Exam Preparation	
2.6	Reading the literature	
Total student's self-studies:		84
Overall student workload:		144
TOTAL NUMBER OF ECTS FOR THE COURSE:		7
The number of ECTS credits that a student obtains in classes requiring the direct participation of the teacher:		2,91

The number of ECTS credits that the student obtains as part of his/her own work	4,08
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IV. PRIMARY AND SUPPLEMENTARY LITERATURE	
Primary literature	
1	Nonner, J.C., Introduction to hydrogeology. Taylor & Francis Group plc, London, UK 2006.
2	Fetter, C.W., Applied Hydrogeology. 4th ed. New Jersey: Prentice Hall. 2001.
3	Sanders, L.L., A manual of field hydrogeology. Prentice-Hall, Inc. 1998.
4	Kruseman, G.P., De Ridder, N.A., Analysis and Evaluation of Pumping Test Data, International Institute for Land Reclamation and Improvement, Wageningen, 1991.
5	Ward , A.D., Trimble , S.W., Burckhard , S.R., Lyon , J.G., Environmental Hydrology, CRC Press, Taylor & Francis Group, 2016 (Electronic edition).
6	Dingman , S.L., Physical Hydrology, Waveland Press, 2015 (Electronic edition).
7	Singh , V.P., Elementary Hydrology, Prentice Hall of India, New Delhi 1994.
8	Manning , J., Applied Principles of Hydrology, Waveland Press, Inc., 2016.
9	Todd , D.K., Mays , L.W., Groundwater Hydrology, John Wiley & Sons, Inc, Printed in the United States of America 2005.
10	Krebs, R.E., The Basics of Earth Science. Greenwood Publishing Group, 2003.
11	Ackerman, S.A., Knox, J.A., Meteorology. Understanding the atmosphere. Third edition, Jones & Bartlett Learning 2012.
12	Chiang, W.H., Kinzelbach, W., Processing Modflow. A simulation system for modelling groundwater flow and pollution. User Guide for computer program Processing Modflow for Windows (PMWIN). http://www.pmwin.net/programs/prevpm/pm4/doc/pmwin41.pdf
13	Mrowiec, M., Ociepa, E., Malmur, R., Deska, I., Sustainable Water Management in Cities under Climate Changes. Problemy Ekorożwoju. 2018, 13(1), 133-138.
14	Deska, I., Łacisz, K., The possibility of the light non-aqueous phase liquids migration in the layered porous medium. Ecological Chemistry and Engineering A, 2016, 25(3), 373-382.
Supplementary literature	

VII. OTHER USEFUL INFORMATION ABOUT THE SUBJECT	
1.	Opportunity to review supporting materials and literature:

	<i>Appropriate to the type of material - in teaching classes, in the TUC Central Library.</i>
2.	Information on when and where the classes will be held
	<i>Notice board at the Faculty of Infrastructure and Environment and on the website of the Faculty of Infrastructure and Environment, MSz USOS system.</i>
3.	Information about the consultation (times + place):
	<i>the staff consultation schedule is available on the Faculty of Infrastructure and Environment website and on the staff room door.</i>