Course title: **Earth Science and Hydrology** Nauki o ziemi i hydrologia		
Field of study: **Environmental Engineering**		
Type of study: **full-time studies**	The level of education: **first-cycle studies**	Education profile: **general academic**
Type of subject: Wybierz element.	Semester: Wybierz element.	Course language: **English**
Course type: **lecture, tutorials, laboratory**	Number of hours: **15L, 15T, 30Lab**	ECTS Credit points: **7**

SYLLABUS

COURSE CONTENT

Form of classes - lectures	**Hours**
Earth sciences. Geological structure of the Earth	1
Factors influencing the shaping of the Earth's surface	1
Soil forming factors and processes	1
Earth's atmosphere – the composition, climate and weather	1
The global warming and climate changes	1
The water cycle and its components. The water balance	2
The drainage basin hydrology. The surface water	1
The hydrology of streams and rivers. The stream flow velocity and discharge	1
The groundwater. The water table. The saturated and unsaturated zone. Aquifers aquitards and aquicludes	1
The confined and unconfined aquifer. The hydrogeological parameters	1
The groundwater flow. The filtration and fluation	1
The groundwater exploitation. Well design and installation	1
The flood forecasting. The flood prevention and control	1
The test	1
Form of classes - tutorials	**Hours**
The introduction to the subject	1
Calculations of the design rainfall intensity. Calculation of the infiltration rate	2
Calculation of the stream flow velocity and discharge. The Manning equation. The weirs	2
The calculation of the flow rate through the aquifer	2
The calculation of the pumping well discharge. The fully and partially penetrating wells	2
The calculation of the aquifer hydraulic conductivity on the base of pumping test data	2
Calculation of the hydraulic properties of the aquifer. The slug tests	1
Ditches, drains and radiator collector wells – the discharge calculations	2
The test	1

Form of classes - laboratory	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

COURSE STUDY METHODS

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

METHODS OF ASSESMENT (F - formative; S - summative)

F1. - activity in classes
F2. - evaluation of work during laboratory exercises
S1. - test
S2. - evaluation of the laboratory reports

STUDENT WORKLOAD

Form of activity	Workload (hours)

Participation in lectures	14 h
Participation in classes	14 h
Laboratory	28 h
Participation in project classes	-
Participation in seminar	-
Preparation course on e-learning	-
Test	4 h
Entrance test for laboratory classes	2 h
Project's defence	-
Exam	-
Consultation hours	12 h
DIRECT TEACHING, hours/ ECTS	**74 h / 3.6 ECTS**
Preparation for tutorials	20 h
Preparation for laboratories	20 h
Preparation for projects	-
Preparation for seminars	-
Preparation for e-learning classes	-
Participation in e-learning classes	-
Working on project	-
Preparation for tests	30 h
Preparation for exam	-
SELF-STUDY, hours/ ECTS	**70 h / 3.4 ECTS**
TOTAL (hours)	**∑ 144**
TOTAL ECTS	**7 ECTS**

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Nonner, J.C., Introduction to hydrogeology. Taylor & Francis Group plc, London, UK 2006.
Fetter, C.W., Applied Hydrogeology. 4th ed. New Jersey: Prentice Hall. 2001.
Sanders, L.L., A manual of field hydrogeology. Prentice-Hall, Inc. 1998.
Kruseman, G.P., De Ridder, N.A., Analysis and Evaluation of Pumping Test Data, International Institute for Land Reclamation and Improvement, Wageningen, 1991.
Ward, A.D., Trimble, S.W., Burckhard, S.R., Lyon, J.G., Environmental Hydrology, CRC Press, Taylor & Francis Group, 2016 (Electronic edition).
Dingman, S.L., Physical Hydrology, Waveland Press, 2015 (Electronic edition).
Singh, V.P., Elementary Hydrology, Prentice Hall of India, New Delhi 1994.
Manning, J., Applied Principles of Hydrology, Waveland Press, Inc., 2016.
Todd, D.K., Mays, L.W., Groundwater Hydrology, John Wiley & Sons, Inc, Printed in the United States of America 2005.
Krebs, R.E., The Basics of Earth Science. Greenwood Publishing Group, 2003.
Ackerman, S.A., Knox, J.A., Meteorology. Understanding the atmosphere. Third edition, Jones & Bartlett Learning 2012.
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

Mrowiec, M., Ociepa, E., Malmur, R., Deska, I., Sustainable Water Management in Cities under Climate Changes. Problemy Ekorozwoju. 2018, 13(1), 133-138.
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.

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