

Course title:		component code 71C2300
<b>Earth Science and Hydrology</b> Nauki o ziemi i hydrologia		
Field of study: <b>Environmental Engineering</b>		
Type of study: <b>full-time studies</b>	The level of education: <b>first-cycle studies</b>	Education profile: <b>general academic</b>
Type of subject:	Semester:	Course language: <b>English</b>
Course type: <b>lecture, tutorials, laboratory</b>	Number of hours: <b>15L, 15T, 30Lab</b>	ECTS Credit points: <b>7</b>

## SYLLABUS

### COURSE OBJECTIVES

- C.1. Transferring the knowledge of the links of hydrology with other branches of the Earth sciences, and the knowledge of the general characteristics of the hydrological processes
- C.2. Transferring the skills for use of the calculations, laboratory experiments, and computer software for the determination of the basic hydrological and hydrogeological parameters and modelling of the hydrological processes

### PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge on the mathematics, physics and chemistry
2. Ability to carry out the engineering calculations
3. Ability to use the literature sources individually
4. Ability to use the computer software

### SUBJECT EDUCATIONAL EFFECTS

- EU 1 - Student knows the links of hydrology with other branches of the Earth sciences
- EU 2 - Student knows the basic phenomena and hydrological processes occurring in geoecosystems
- EU 3 - Student is able to make the calculations of basic hydrological and hydrogeological parameters
- EU 4 - Student is able to characterize the elements of the hydrological system and to estimate the basic hydrological and hydrogeological parameters on the base of laboratory experiments
- EU 5 - Student is able to use the computer software for modelling of hydrological and hydrogeological processes
- EU 6 - Student is aware of the importance of the acquired knowledge in the aspects of engineering activity and critical approach towards practical and theoretical problem-solving

### COURSE CONTENT

<b>Form of classes - lectures</b>	<b>Hours</b>
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
<b>Form of classes - tutorials</b>	<b>Hours</b>
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
<b>Form of classes - laboratory</b>	<b>Hours</b>
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
Delineation of the drainage basin boundaries. The morphometric analysis of the catchment. Work with the map	2
The simulation of rainfall, runoff and infiltration using the Hydrology and Rainfall Apparatus	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)

<b>F1.</b> - activity in classes
<b>F2.</b> - evaluation of work during laboratory exercises
<b>S1.</b> - test
<b>S2.</b> - 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
<b>DIRECT TEACHING, hours/ ECTS</b>	<b>74 h / 3.6 ECTS</b>
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	-
<b>SELF-STUDY, hours/ ECTS</b>	<b>70 h / 3.4 ECTS</b>
<b>TOTAL (hours)</b>	<b>Σ 144</b>
<b>TOTAL ECTS</b>	<b>7 ECTS</b>

### PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Nonner, J.C., Introduction to hydrogeology. Taylor & Francis Group plc, London, UK 2006 name of author (authors), initials, title, publisher, place and year of publication – <i>for books</i>
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). <a href="http://www.pmwin.net/programs/prevpm/pm4/doc/pmwin41.pdf">http://www.pmwin.net/programs/prevpm/pm4/doc/pmwin41.pdf</a>
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

### SUBJECT COORDINATOR (NAME, SURNAME, E-MAIL ADDRESS)

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### NAME OF LECTURER (s) (NAME, SURNAME, E-MAIL ADDRESS)

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<b>Learning outcome</b>	<b>In relation to the learning outcomes specified for the field of study</b>	<b>Course objectives</b>	<b>Course content</b>	<b>Course study methods</b>	<b>Methods of assessment</b>
<b>EU 1</b>	<b>K_W04, K_U05, K_K01</b>	<b>C.1.</b>	lecture	<b>1., 2., 5.</b>	<b>S1.</b>
<b>EU 2</b>	<b>K_W04, K_W06, K_U05</b>	<b>C.1.</b>	lecture, tutorials	<b>1., 2., 5.</b>	<b>S1.</b>
<b>EU 3</b>	<b>K_U05, K_U06, K_U07</b>	<b>C.1., C.2.</b>	lecture, tutorials	<b>1., 2., 5.</b>	<b>F1., S1.</b>
<b>EU 4</b>	<b>K_W04, K_W06, K_U05, K_U06, K_U07</b>	<b>C.1., C.2.</b>	lecture, laboratory	<b>1., 2., 3., 5.</b>	<b>F1., F2., S1., S2.</b>
<b>EU 5</b>	<b>K_W04, K_W06, K_U05, K_U06, K_U07, K_K01</b>	<b>C.2.</b>	laboratory	<b>1., 2., 4., 5.</b>	<b>F1., F2., S1., S2.</b>
<b>EU 6</b>	<b>K_W04, K_U05, K_K01</b>	<b>C.1., C.2.</b>	lecture, laboratory	<b>1., 4., 5.</b>	<b>F1., S1.</b>

#### **OTHER USEFUL INFORMATION**

1. All the information on the class schedule is posted on the student information board and online at: <https://is.pcz.pl/>.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at <https://is.pcz.pl/>.
3. The information on course completion and grade is provided to students on the first class meeting.