

COURSE/MODULE SYLLABUS FOR UNIVERSITY COURSES/PhD STUDIES

1.	Course/module name in Polish and English Applied hydrogeology/Hydrogeologia stosowana
2.	Discipline Earth and Environmental Science
3.	Language of instruction English
4.	Teaching unit Faculty of Earth Science and Environmental Management, Institute of Geological Sciences
5.	Course/module code USOS
6.	Type of course/module (<i>mandatory or optional</i>) optional
7.	Field of studies (major, if applicable) Geology (spec. Applied Geoscience)
8.	Level of higher education (<i>undergraduate (I cycle), Master's (II cycle), 5 year uniform Master's studies</i>) <i>(undergraduate (I cycle))</i>
9.	Year of studies (<i>if applicable</i>) II
10.	Semester (<i>winter or summer</i>) summer
11.	Form of classes and number of hours Lectures: 30 Lab classes: 6 Classes: 18 Teaching methods: mini-lecture, presentation, discussion, practical exercises, individual work, group work, preparation of reports, etc.
12.	Name, title/degree of the teacher/instructor Coordinator: prof. dr hab. Stanisław Staśko Lecturer: prof. dr hab. Stanisław Staśko Classes instructor: dr Tomasz Olichwer, dr Marek Wcisło, dr Magdalena Modelska, dr hab. Sebastian Buczyński
13.	Course/module prerequisites, in terms of knowledge, skills, social competences Knowledge of the basic laws of physicists, geological processes, and the main types of

	rocks, especially sedimentary ones. Knowledge about the water cycle in nature and general information about surface- and groundwaters.	
14.	<p>Course objectives</p> <p>The aim of the course is to familiarize students with the occurrence and circulation of groundwater in the rock environment. Acquainting with the processes determining the quantities of groundwater resources and with the processes determining the chemical composition of groundwater. Classes are carried out in three thematic blocks:</p> <p>(A) Basic hydraulic properties of rocks, porosity, permeability, specific yield. Ability to calculate the hydraulic conductivity and specific yield of rocks. Estimation of groundwater resources.</p> <p>(B) A block of issues in the field of hydro databases, mapping cartography and cross-sections. Introduction to modeling.</p> <p>(C) Basics of knowledge about the processes of formation of groundwater chemical composition and pollution migration.</p>	
15.	<p>Course content</p> <p>Lectures:</p> <p>Major geological and hydraulic parameters of rocks: porosity, permeability, fractured media, karstic phenomena and methods of evaluation.</p> <p>Unsaturated and saturated zone, aquifers and aquitards. Darcy's law and hydraulic conductivity. Groundwaters recharge method of evaluation.</p> <p>Water level fluctuation. Groundwater flow system analysis.</p> <p>Groundwater resources evaluation and pumping test results. Basic equation of groundwater flow: Dupuit, Theis and Jacob. Springs and base flow analysis. Basic groundwater modelling. Chemical composition of groundwater. Mineral and thermal water. Groundwater contamination and contaminant migration. Isotopic and tracer methods. Hydrogeological data base, mapping and survey. Groundwater protection, regulation, EU Water Framework Directive and associated and implementation.</p> <p>Classes:</p> <p>Block 1 Porosity of rocks, Permeability and hydraulic conductivity, Pumping test analysis, Groundwater recharge evaluation, Water level fluctuation.</p> <p>Block 2 Data base – Wells (Baza danych Hydro), Aquifer test analysis, Mapping. Introduction to modeling.</p> <p>Block 3 Physical properties of groundwater, Chemical composition of groundwater, Classes of water analysis. Balance of chemical analysis of water. Analysis errors. Presentation and classification of water analysis, Contamination, Introduction to mass transport modeling.</p>	
16.	<p>Intended learning outcomes</p> <p>W_1 He knows the basic terms and concepts in the field of hydrogeology</p> <p>W_2 Knows the basic laws governing the occurrence and circulation of groundwater in rock environments and processes that form groundwater resources.</p> <p>W_3 He knows the basic methodology of research on the main hydrogeological parameters of aquifer</p>	<p>Symbols of learning outcomes for particular fields of studies:</p> <p>K1_W03, K1_W04, K1_U11</p> <p>K1_W01, K1_W03 K1_W05</p> <p>K1_W05, K1_W07</p>

	<p>U_1 Performs hydrogeological measurements</p> <p>U_2 Uses a map, database, internet, for the needs of the program</p> <p>U_3 Correctly interprets measurement and observation results.</p> <p>K_1 Is aware of the importance of acquired knowledge about the soil and water environment.</p> <p>K_2 Is able to objectively evaluate scientific information from various sources.</p> <p>K_3 Is aware of the existence of threats to the aquatic environment.</p> <p>K_4 He is familiar with teamwork.</p>	<p>K1_U08</p> <p>K1_U06, K1_U09</p> <p>K1_U13, K1_U14</p> <p>K1_K06</p> <p>K1_K05, K1_K06</p> <p>K1_K06</p> <p>K1_K01</p>
17.	<p>Required and recommended reading (<i>sources, studies, manuals, etc.</i>)</p> <p>Required reading</p> <p>Freeze R.A., Cherry J.A. - Groundwater. Prentice Hall Inc. 1980.</p> <p>Gilli E., Mangan Ch., Mudry J. 2013 - Hydrogeology - Objectives, Methods, Applications, CRC Press, Taylor and Francis Group, Boca Raton:367.</p> <p>Recommended reading</p> <p>Gilli E., Mangan Ch., Mudry J. 2013 - Hydrogeology - Objectives, Methods, Applications, CRC Press, Taylor and Francis Group, Boca Raton:367.</p>	
18.	<p>Assessment methods for the intended learning outcomes:</p> <ul style="list-style-type: none"> - Lectures: written examination: K1_W01, K1_W03, K1_W04, K1_W05, K1_W07, K1_U11; - Lab classes: individual reports: K1_U08, K1_U13, K1_U14, K1_K05, K1_K06; - Classes: individual reports and final test: K1_U06, K1_U09, K1_U13, K1_U14, K1_K01, K1_K05, K1_K06. 	
19.	<p>Credit requirements for individual components of the course/module:</p> <ul style="list-style-type: none"> - Lectures: written examination (60% credits), - Lab classes: individual reports, - Classes: individual reports and final test (>50% credits), - Final rank weight factors: 50% Lecture 50% Classes. 	
20.	Total student effort	
	form of student activities	number of hours for the implementation of activities
	<p>classes (according to the plan of studies) with a teacher/instructor:</p> <ul style="list-style-type: none"> - lectures:30 - classes: 18 - lab classes: 6 - consultations: 10 - exam: 2 	66
	<p>student's own work (including group-work):</p> <ul style="list-style-type: none"> - being prepared for classes: 10 - reading the suggested literature: 5 - preparation of results: 18 - writing a class report:10 	63

	- preparing for tests and exam: 20	
	Total number of hours	129
	Number of ECTS credits	5