Annex No. 5

to Ordinance No. 21/2019

COURSE/MODULE SYLLABUS FOR UNIVERSITY COURSES/PhD STUDIES

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|  | Course/module name in Polish and English  Applied hydrogeology - selected issues/ Hydrogeologia stosowana - wybrane zagadnienia | | |
|  | Discipline  Earth and Environmental Science | | |
|  | Language of instruction  English | | |
|  | Teaching unit  Faculty of Earth Science and Environmental Management, Institute of Geological Sciences | | |
|  | Course/module code  USOS | | |
|  | Type of course/module *(mandatory or optional)*  optional | | |
|  | Field of studies (major, if applicable)  Geology | | |
|  | Level of higher education *(undergraduate (I cycle), Master’s (II cycle), 5 year uniform Master’s studies)*  Master’s (II cycle) | | |
|  | Year of studies *(if applicable*)  I or II | | |
|  | Semester *(winter or summer)*  winter or summer | | |
|  | Form of classes and number of hours  Lectures: 24  Classes: 24  Teaching methods:  mini-lecture, presentation, discussion, practical exercises, individual work, group work, preparation of reports | | |
|  | 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 | | |
|  | 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. | | |
|  | Course objectives  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:  (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.  (B) A block of issues in the field of hydro databases, mapping cartography and cross-sections. Introduction to modeling.  (C) Basics of knowledge about the processes of formation of groundwater chemical composition and pollution migration. | | |
|  | Course content  Lectures:  Major geological and hydraulic parameters of rocks: porosity, permeability, fractured media, karstic phenomena and methods of evaluation. Unsaturated and saturated zone, aquifers and aquitards. Darcy’s law and hydraulic conductivity. Groundwaters recharge method of evaluation. Water level fluctuation. Groundwater flow system analysis. 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.  Classes:  Block 1 Porosity of rocks, Permeability and hydraulic conductivity, Pumping test analysis, Groundwater recharge evaluation, Water level fluctuation  Block 2 Data base – Wells (Baza danych Hydro), Aquifer test analysis, Mapping. Introduction to modeling  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 | | |
|  | Intended learning outcomes  W\_1 Knows the basic terms and concepts in the field of hydrogeology.  W\_2 Knows the basic laws governing the occurrence and circulation of groundwater in rock environments and processes that shape groundwater resources. He knows the basic methodology of research on the main hydrogeological parameters of aquifers.  U\_1 Performs hydrogeological measurements.  U\_2 Uses a map, database, internet, for the needs of the program. Correctly interprets the results of measurements and observations.  K\_1 Is able to objectively evaluate scientific information from various sources.  K\_2 Is aware of the existence of threats to the aquatic environment from various sources. | Symbols of learning outcomes for particular fields of studies:  K2\_W04, K2\_W05  K2\_W05  K2\_U01, K2\_U05  K2\_U05  K2\_K01, K2\_02  K2\_K02 | |
|  | Required and recommended reading *(sources, studies, manuals, etc.)*  Required reading  Freeze R.A., Cherry J.A. 1980 - Groundwater. Prentice Hall Inc.  Gilli E., Mangan Ch., Mudry J. 2013 - Hydrogeology - Objectives, Methods, Applications, CRC Press, Taylor and Francis Group, Boca Raton:367  Recommended reading  Journal of Hydrogeology, Water Resources. | | |
|  | Assessment methods for the intended learning outcomes:  - Lectures: written examination: K1\_W01, K1\_W03, K1\_W04, K1\_W05, K1\_W07, K1\_W11.  - Lab classes: individual reports: K1\_U08, K1\_U13, K1\_U14, K1\_K05, K1\_K06.  - Classes: individual reports and final test: K1\_U08, K1\_U13, K1\_U14, K1\_K05, K1\_K06. | | |
|  | Credit requirements for individual components of the course/module:  - Lectures: written examination (60% credits)  - Lab classes: individual reports  - Classes: individual reports and final test (>50% cedits) | | |
|  | Total student effort | | |
| form of student activities | | number of hours for the implementation of activities |
| classes (according to the plan of studies) with a teacher/instructor:  - lectures: 24  - classes: 24  - consultation: 2 | | 50 |
| student's own work (including group-work) such as:  - being prepared for classes :5  - reading the suggested literature: 10  - preparation of results:15  - writing a class report: 10  - preparing for tests and exam: 10 | | 50 |
| Total number of hours | | 100 |
| Number of ECTS credits | | 4 |