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  Environmental pollution/Zanieczyszczenia środowiska | | |
|  | Discipline  Earth and Environmental Sciences | | |
|  | Language of instruction  English | | |
|  | Teaching unit  Faculty of Earth Sciences and Environmental Management, Institute of Geological Sciences, Department of Experimental Petrology, Department of General Hydrogeology | | |
|  | Course/module code  USOS | | |
|  | Type of course/module *(mandatory or optional)*  mandatory | | |
|  | Field of studies (major, if applicable)  Geology (spec. Applied Geoscience) | | |
|  | 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*)  II | | |
|  | Semester *(winter or summer)*  winter | | |
|  | Form of classes and number of hours  Lectures: 24  Classes: 12  Field classes: 12  Teaching methods  Multimedia lecture, field classes, practical exercises, individual work, group work, preparation of reports. | | |
|  | Name, title/degree of the teacher/instructor  Coordinator: Dr hab. Jakub Kierczak, Prof. UWr  Lecturer: Dr hab. Jakub Kierczak, Prof. UWr, Dr hab. Maciej Górka, Prof. UWr., Dr Magdalena Modelska  Classes instructor: Dr hab. Jakub Kierczak, Prof. UWr, Dr hab. Maciej Górka, Prof. UWr., Dr Magdalena Modelska | | |
|  | Course/module prerequisites, in terms of knowledge, skills, social competences  Basic knowledge and skills in the field of environmental protection, geology, chemistry and geochemistry. | | |
|  | Course objectives  The aim of the course is to prepare students to independently carry out studies to assess the degree of air, soils, sediments pollution, taking into account the existing legal acts and methods described in the scientific literature. To acquaint students with the methods of tracking sources of pollution using isotopic analyses. Presentation of methods for developing a balance of pollutants in the environment. Preparing students for independent assessment of the hydrogeochemical background and assessment of the rate and range of migration of pollutants in groundwater. | | |
|  | Course content  Lecture:  Characteristics of pollutants of the individual components of the environment. Pollution - the types and sources of pollution.  1. Examples techniques of monitoring air pollution and prevention of pollution - sulphur dioxide (SO2) case  2. Examples of techniques for monitoring air pollution and prevention of pollution - nitrogen oxides (NOx) case  3. Examples of techniques for monitoring air pollution and prevention of pollution - dust pollution case  4. Catalysts of automobiles as examples the removal of exhaust gaseous and particulate pollutants from transport  5. Dynamic olfactometry and methods of deodorization.  6. Presentation of issues related to the pollution of solid environmental samples (soils, sediments). Discussion of soil degradation processes and methods for reclamation of degraded areas.  7. Discuss the methods for determination of the mobility and bioavailability of elements in soils and estimation of the geochemical balance of elements in soil with a particular focus on heavy metals.  8. Industrial activity as the main source of inorganic pollution for soil environment. Discussion of the possible use of isotopic analyzes to trace the sources of pollution in soils and sediments.  9. Hydrogeochemical background as a method of identification of pollutants in groundwater. The theoretical basis of evaluation of hydrogeochemical background. Method of calculation and presentation of hydrogeochemical background  10. Migration of pollutants in groundwater. Basic mechanisms of the processes its influence on manner and pace of migration. Theoretical basis and methods of assessment.  Field classes:  1. A visit to the atmospheric pollution monitoring site belonging to the Regional Inspectorate of Environment Protection (RIEP) in Wroclaw  2. Visit the Laboratory of Olfactometry Research (Wroclaw University of Technology)  Laboratory:  1. Air sampling and analysis of concentrations and isotopic composition of atmospheric CO2 and CH4  2. Preparation of projects aimed at assessing the quality of soils and sediments polluted with heavy metals. Drawing up the geochemical balance of the elements in soils. The application of methods for determining the mobility of elements in soils and attempt to identify the sources of pollution. Preparation of reports describing the results.  3. Evaluation of hydrogeochemical background for selected indicators of chemical and research areas  4. Calculations of migration of selected chemical indicators from the selected source of pollution | | |
|  | Intended learning outcomes  P\_W01 Student has knowledge of current legislation and the scientific literature concerning the contamination of soils and sediments.  P\_W02 Student knows the main sources of inorganic pollutants and the principles of planning for studies aiming at the evaluation of soil quality.  P\_W03 Student has knowledge about methods for the determination of the mobility of inorganic pollutants and tracing of sources of these pollutants in soils.  P\_W04 Student has knowledge about the importance of evaluation and calculation and of hydrogeochemical background.  P\_W05 Student has knowledge about the migration of pollutants in groundwater.  P\_U01 On the basis of available data, student can perform a study on the assessment of the quality of soils and sediments, where he is able to identify the mobility of individual elements and identify sources of pollution.  P\_U02 Student can make calculations of hydrogeochemical background using analytical and graphical methods and make its presentation and interpretation.  P\_U03 Student can, based on the data, evaluate the pollution flow zone and the impact of pollution from the sources of pollution to groundwater.  P\_K01 Student is aware of the risks associated with the emission of pollutants into the environment.  P\_K02 Student can plan his task accordingly and respects the time limits for their implementation. | Symbols of learning outcomes for particular fields of studies, e.g. K\_W01\*, K\_U05,K\_K03  K2\_W03, K2\_W10  K2\_W01, K2\_W06, K2\_W08  K2\_W04, K2\_W06  K2\_W03, K2\_W04, K2\_W05, K2\_W08  K2\_W03, K2\_W04, K2\_W08  K2\_U03, K2\_U04, K2\_U05  K2\_U01, K2\_U04, K2\_U05  K2\_U01, K2\_U04, K2\_U05  K2\_K04, K2\_K05  K2\_K02, K2\_K03 | |
|  | Required and recommended reading *(sources, studies, manuals, etc.)*  Required reading  Selected Polish and international legal acts and standards relevant to the assessment of the degree of soil, water and air pollution with heavy metals.  Jacobson M.Z., Atmospheric pollution – history, science and regulation, Cambridge University Press, 2002  Hem, John D. Study and Interpretation of the Chemical Characteristics of Natural Water, 3rd ed. Alexandria, VA: Department of the Interior, U.S. Geological Survey, Water-Supply Paper 2254, 1985.  Recommended reading  De Vivo B., Belkin H.E., Lima A., Eds. Environmental Geochemistry. Site Characterization, Data Analysis and Case Histories. Elsevier. Amsterdam, 2008.  Holgate S.T., Samet J.M., Koren H.S. and Maynard R.L., Air Pollution and Health, Academic Press. London, 1999  Zhang C., Fundamentals of Environmental Sampling and Analysis, John Wiley & Sons, 2007 | | |
|  | Assessment methods for the intended learning outcomes:  Lecture: written examination (teste). K2\_W01, K2\_W03, K2\_W04, K2\_W05, K2\_W06, K2\_U03, K2\_U04, K2\_U05, K2\_K02, K2\_K03, K2\_U04, K2\_U05.  Classes: writing a class report, (individual or group). K2\_W01, K2\_W03, K2\_W04, K2\_W05, K2\_W06, K2\_U01, K2\_U03, K2\_U04, K2\_U05, K2\_K02, K2\_K03, K2\_U04, K2\_U05. | | |
|  | Credit requirements for individual components of the course/module:  Lectures:  - exam (written) a positive result after 60% of the points.  Lab classes:  - monitoring attendance (two possible absences) during classes,  - writing a set of class reports describing tasks given on classes, (students should elaborate all reports on the tasks carried out during classes), the opportunity to do classes during individual consultations with lecturers.  Field classes:  - monitoring attendance (no possible absence) during classes,  - writing a class report.  The final grade is the result of the exam grade (50%) and the laboratory and field classes grades (50%). | | |
|  | 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: 12  - field classes: 12  - consultation: 17 | | 65 |
| student's own work (including group-work):  - being prepared for classes: 10  - description of results: 10  - reading the suggested literature: 5  - writing a class report: 15  - preparing for tests and exam: 20 | | 60 |
| Total number of hours | | 125 |
| Number of ECTS credits | | 5 |