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  Biogeochemia i geomikrobiologia  Biogeochemistry and geomicrobiology | | |
|  | Discipline  Earth and Environmental Science | | |
|  | Language of instruction  English | | |
|  | Teaching unit  Faculty of Earth Science and Environmental Management, Institute of Geological Sciences, Department of Applied Geology, Geochemistry and Environmental Management | | |
|  | Course/module code  USOS | | |
|  | Type of course/module *(mandatory or optional)*  Mandatory within an optional module | | |
|  | Field of studies (major, if applicable)  Geologic Engineery | | |
|  | 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 | | |
|  | Semester *(winter or summer)*  winter | | |
|  | Form of classes and number of hours  Lectures: 12  Lab classes: 18  Teaching methods  Multimedia, individual work, preparation of reports. | | |
|  | Name, title/degree of the teacher/instructor  Coordinator: dr Adriana Trojanowska-Olichwer | | |
|  | Course/module prerequisites, in terms of knowledge, skills, social competences  Basics of environmental chemistry and geochemistry. | | |
|  | Course objectives  Exposure to address the complexity of the natural environment and awareness of the close relationship between the components of the abiotic and biotic. Acquainted with the possibilities of utility and / or industrial use of biogeochemistry and geomicrobiology. | | |
|  | Course content  Lectures:  Biogeochemical cycles and their changes due to anthropogenic pressure; Fundamentals of physiology of microorganisms and the role of microorganisms in the fundamental biogeochemical cycles, microorganisms of the extreme environments. Circulation of elements and processes of primary production and decomposition; overproductivity of the environment as a result of anthropo-pressure, effects, significance. Enzymes as catalysts of biochemical reactions in the environment and their application in the diagnosis of water and soil quality. Ecotoxicology. Tracking the elements pathways in the environment - application of stable isotopes - role in monitoring of selected elements. Remediation: bioremediation and phytoremediation; the use of bacteria, fungi and plants for treatment of soils and water with contaminants and rehabilitation of former. The role of microorganisms in the formation of selected minerals. Application of microorganisms in the bioleaching as an alternative to conventional metal recovery processes.  Laboratory: Simple experiments carried out in the groups: 1. changes in physical, chemical and microbiological parameters of water in conjunction with changes in the hydrological dynamics of the river on the example of the Oder in Wroclaw; 2. the impact of phosphorus and nitrogen on the rate of primary production - laboratory experiment; 3. The importance of hydrolytic enzymes in the environment on the example of phosphatase j or arylsulphatase; 4. Aerobic decomposition and anaerobic digestion of organic matter - laboratory experiments 5. Methods of assessment the size and / or microbial activity.  6. Microbiotests of ecotoxicology.  7. Analysis of carbon isotopic composition as a tool in tracking biogeochemical processes. | | |
|  | Intended learning outcomes  W\_1 understands interdisciplinary and holistic nature of the knowledge of the Earth system and has adequate knowledge in the field of biogeochemistry.  W\_2 Has knowledge on global biogeochemical cycles and the research methods used to track them down.  U\_1 student is able to acquire, synthesize and communicate current knowledge on the biogeochemical cycles in English  U\_2 He can perform a simple experiment under the supervision of a tutor.  U\_3 student is able to work constructively in the team of project or experiment  K\_1 Student updates and expands his knowledge based on the latest information from various sources and critically evaluates his credibility. | Symbols of learning outcomes for particular fields of studies  K2\_W01,  K2\_W03, InżK2\_W01,  K2\_U04  InżK2\_U02  K2\_U05  K2\_K03, K2\_K01 | |
|  | Required and recommended reading  Recommended reading  William H. Schlesinger and Emily S. Bernhardt.2013. Biogeochemistry. An analysis of global change. (Third edition).  Kurt Konhauser, 2007. Introduction to geomicrobiology. Blackwell Publishing.  Volodymyr Ivanov. 2015. Environmental Micobiology for Engineers. CRC Press | | |
|  | Assessment methods for the intended learning outcomes:  - semester paper (individual): K2\_W01, K2\_W03, InżK2\_W01, K2\_U04, InżK2\_U02, K2\_U05,  - preparation and implementation of a project (individual): K2\_W01, K2\_W03, InżK2\_W01, K2\_U04, InżK2\_U02, K2\_U05, K2\_K03, K2\_K01, | | |
|  | Credit requirements for individual components of the course/module:  lecture: test, 60% correct answers required to pass.  laboratory: reports from the laboratory experiments. | | |
|  | 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: 12  - lab classes: 18  - consultations: 8  - test: 1 | | 39 |
| student's own work (including group-work) such -- preparation before class (lecture, etc.): 8  - research outcomes: 5  - reading set literature: 5  - writing course report: 5  - preparing for exam: 15 | | 38 |
| Total number of hours | | 77 |
| Number of ECTS credits | | 3 |