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  Environmentally sound technologies and renewable energy sources/ Technologie w ochronie środowiska i odnawialne źródła energii | | |
|  | Discipline  Earth and Environmental Science | | |
|  | Language of instruction  English | | |
|  | Teaching unit  Faculty of Earth Science and Environmental Management, Institute of Geological Sciences, Department of Isotopic and Applied Geology, Department of Experimental Petrology | | |
|  | Course/module code  USOS | | |
|  | Type of course/module *(mandatory or optional)*  elective | | |
|  | 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*)  I | | |
|  | Semester *(winter or summer)*  summer | | |
|  | Form of classes and number of hours  Lectures: 14  Field classes:14  Teaching methods  Multimedia lecture, mini-lecture, practical exercises, preparation of reports. | | |
|  | Name, title/degree of the teacher/instructor  Coordinator:  Lecturer: Dr Adriana Trojanowska-Olichwer, Dr hab. Maciej Górka Prof. UWr,  Field classes instructor: Dr Adriana Trojanowska-Olichwer, Dr hab. Maciej Górka Prof. UWr, | | |
|  | Course/module prerequisites, in terms of knowledge, skills, social competences  Required basic range of knowledge on: geochemistry, hydrology, environmental chemistry. Suggested completed courses: basic chemistry course, basic geochemistry course, basic environmental science course | | |
|  | Course objectives  Indication the source of main environmental problems due to anthropopressure. Presentation to gain understanding of new methods of water, air and soil assessment, protection and management according to most recent polices. | | |
|  | Course content  Lectures:  1 Protection of the atmosphere: the exhaust gas purification systems - processes for the preparation of combustion of fuels, types of furnaces, fluidized bed furnaces operating principle, the phenomenon utilized in the purification of exhaust gases, the method and apparatus for purifying exhaust gas of NOx, particulate matter, sulfur oxides, other hazardous substances including, the effectiveness of the methods, advantages and disadvantages. Modern biotechnology in the cleaning of exhaust gases with CO2.  2 Protection of water: waste water treatment systems and water production the characteristics of industrial and municipal wastewater, wastewater quality indicators, mechanical, chemical and biological methods for sewage treatment and operation of these processes, sludge disposal, sewage treatment plant. Impurities present in natural waters, types of water supplies, water purification processes (aeration, coagulation, sedimentation, flotation, filtration, ion exchange, chemical precipitation, sorption on activated carbon, chemical oxidation, membrane processes, disinfection), the production of water for Wroclaw.  3 Renewable energy - what is renewable energy, renewable energy division, the practical aspects of conversion of energy of wind , water, solar, geothermal, biomass, biofuels.  4 Nuclear power - perspective – production of nuclear fuel on example of 235U (enrichment preparation reactor fuel elements), types of reactors and operation, waste disposal, risk and safety of nuclear power plants.  5 Technological solutions in waste management - what is the waste classification, characteristics and origin of industrial and municipal waste, waste production statistics, waste management, economic use of waste, disposal of waste: site preparation, security, storage system organization, management and rehabilitation land after landfills, hazardous waste disposal, Thermal waste utilization: waste incineration - technology, advantages and disadvantages, pyrolysis; biological waste treatment; composting plants: conditions, technology, advantages and disadvantages, methane fermentation – biogas plants.  6 Environmental monitoring systems in Poland and Europe.  Field class:  Visit in the Water Production Plant MPWiK „Na Grobli” in Wrocław.  Visit in the wastewater plant MPWiK in Wrocław.  Visit in the municipal waste disposal plant.  Visit in the waste sorting plant.  Visit in the hydroelectric power plant.  Visit in the conventional power plant.  Visit in the laboratory of Regional Inspectorate for Environmental Protection in Wrocław. | | |
|  | Intended learning outcomes  P\_W01 Student indicates the methods of evaluation of state of the environment and its possible degradation as a result of anthropogenic pressure.  P\_W02 Student knows the tasks and terminology related to the implementation of environmental friendly technology in an industrial plants.  P\_U01 Assesses the impact of industrial plants on the environment and is able to offer comprehensive technological systems used for environmental protection.  P\_U02 Can list environmental tasks set for the industrial units such as: sewage treatment plant (municipal and industrial), water production plant, landfill, heat and power plants, waste sorting, etc.  P\_K01 Student propagates in the local society the concept of sustainable development.  P\_K02 Student realizes the role of society in environmental protection , both local as well as at regional or national level. | Symbols of learning outcomes for particular fields of studies, *e.g. K\_W01\**, *K\_U05,K\_K03*  K2\_W01, K2\_W08  K2\_W08, K2\_W09, K2\_W10  K2\_U01, K2\_U02, K2\_U03  K2\_U01, K2\_U02  K2\_K06, K2\_K07  K2\_K01 | |
|  | Required and recommended reading *(sources, studies, manuals, etc.)*  Required reading  Sunggyu Lee, James G. Speight. Environmental technology handbook 2000. New York : Taylor & Francis, pp 333  Wang L.K., Ivanov V., Tay J-H, Hung J-T. 2010. Environmental Biotechnology  Humana Press | | |
|  | Assessment methods for the intended learning outcomes:  Lecture: 1-hour test (in English). K2\_W01, K2\_W08, K2\_W09, K2\_W10, K2\_U01, K2\_U02, K2\_U03, K2\_K01, K2\_K06, K2\_K07.  Field class: 1-hour competition test from field classes only (in English). K2\_W01, K2\_W08, K2\_W09, K2\_W10, K2\_U01, K2\_U02, K2\_U03, K2\_K01, K2\_K06, K2\_K07. | | |
|  | Credit requirements for individual components of the course/module:  Lectures:  - 1-hour exam (test in English), required 60% of correct answers to pass  Field class:  - continuous monitoring of the presence on the field classes,  - report from the field classes,  - 1-hour test from field classes (in English), required 60% of correct answers to pass | | |
|  | 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: 14  - field classes: 14 | | 28 |
| student's own work (including group-work) such as:  - consultation: 12  - being prepared for classes: 4  - reading the suggested literature: 6  - writing a class report: 10  - preparing for tests and exam: 15 | | 47 |
| Total number of hours | | 75 |
| Number of ECTS credits | | 3 |