

COURSE/MODULE SYLLABUS FOR UNIVERSITY COURSES/PhD STUDIES

1.	Course/module name in Polish and English Environmentally sound technologies/ Technologie prośrodowiskowe
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
8.	Level of higher education (<i>undergraduate (I cycle), Master's (II cycle), 5 year uniform Master's studies</i>) Master's (II cycle)
9.	Year of studies (<i>if applicable</i>) I/II
10.	Semester (<i>winter or summer</i>) Winter/summer
11.	Form of classes and number of hours Lectures: 20 Field classes: 28 Teaching methods: Multimedia lecture, mini-lecture, presentation, discussion, preparation of reports.
12.	Name, title/degree of the teacher/instructor Coordinator: dr Adriana Trojanowska-Olichwer Lecturer: dr Adriana Trojanowska-Olichwer, dr hab. prof. UW. Maciej Górka, dr Wojciech Drzewicki, Field classes instructor: dr Adriana Trojanowska-Olichwer, dr hab. prof. UW. Maciej Górka
13.	Course/module prerequisites, in terms of knowledge, skills, social competences Basic knowledge on environmental chemistry and geochemiasty.
14.	Course objectives

	Transfer of knowledge about the most popular and most modern techniques used in air protection, water, soil remediation, safe waste management, energy production from renewable sources. And presenting new technological trends.
15.	Course content Lectures: 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 NO_x, 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. 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 Wrocław. Renewable energy - what is renewable energy, renewable energy division, the practical aspects of conversion of energy of wind, water, solar, geothermal, biomass, biofuels. 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. 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. Environmental monitoring systems in Poland and Europe. Field classes: 1. Field trip - a visit to the Wrocław Heat and Power Plant (or other): a technological line for the production of heat and electricity, the preparation of combustion fuels, a fluidized bed furnace, exhaust gas cleaning systems; production of heating and boiler water, waste management. 2. Field trip - visit to the LPWiK Water Production Plant in Legnica: technological system of water production, efficiency, precautions. 3. Field trip - visit to the municipal wastewater treatment plant LPWiK in Legnica: technological system of sewage treatment plant, sludge management and biogas production. 4. Field trip - a visit to the Wrocław I (or other) hydro power plant - technological system, advantages and limitations. 5. Field trip - visit to the waste composting plant Ekosystem Sp. z o.o. Wrocław - technological line, conditions for composting and maturing of compost, efficiency. 6. Field trip - visit to the ALBA Wrocław sorting plant - technological line, devices used for preparation, separation, sorting and compacting of waste. Secondary market. 7. Field trip - visit to the WIOŚ laboratory in Wrocław - VIEP tasks, work of an accredited WIOŚ laboratory, analytical equipment in air, water and soil monitoring, biological monitoring of waters. 8. Field trip - municipal visit to the Waste Management Plant CHEMEKO System in Rudna, Poland, technological process, organization of landfill, groundwater protection, monitoring system, alternative fuel production line.

16.	Intended learning outcomes W_1 Student lists the ways of assessing the value of environmental elements and its possible degradation as a result of anthropogenic activity. W_2 Knows the tasks and terminology related to the implementation of environmentally safe technologies in industrial plants. U_1 Is able to assess the impact of an industrial plant on the environment and propose comprehensive technological systems for its protection. U_2 Knows the environmental tasks faced by such industrial institutions as: sewage treatment plant (municipal and industrial), water production plant, landfill, heat and power plant, waste sorting, etc. K_1 Promotes the concept of sustainable development in local society. K_2 Realizes the role of society in environmental protection both at the local and regional or national level.	Symbols of learning outcomes for particular fields of studies: K2_W01, K2_W08 K2_W03, K2_W09 K2_U01, K2_U02 K2_U01, K2_U02 K2_K06, K2_K07 K2_K01
17.	Required and recommended reading (<i>sources, studies, manuals, etc.</i>) Required reading Cheremishinoff Nicolas (ed.), 2005. Environmental Technologies handbook. The Roman and Littlefield Publishing Group Wang L.K., Ivanov V., Tay J-H, Hung J-T. 2010. Environmental Biotechnology Humana	
18.	Assessment methods for the intended learning outcomes: -Lecture: test (in English): K2_W01, K2_W03, K2_W08, K2_W09. -Field class: reports from field classes and written test in English: K2_U01, K2_U02, K2_K01, K2_K06, K2_K07.	
19.	Credit requirements for individual components of the course/module: -Lecture: 1-hour test (in English): required 60% of correct answers to pass -Field class: -Reports from the field classes -1-hour test from field classes (in English): required 60% of correct answers to pass -Monitoring attendance on the course, Elements and weights affecting the final grade: 50% exam, 50% field exercise.	
20.	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: 20 - field classes: 28 - other: consultation: 8	56
	student's own work (including group-work) such as:	

	- being prepared for classes: 10 - reading the suggested literature: 10 - preparing papers/presentations/projects: 10 - writing a class report: 13 - preparing for tests and exam: 15	48
	Total number of hours	104
	Number of ECTS credits	4