



Subject card

Subject name and code	Environmental Remediation Technologies, PG_00036294						
Field of study	Green Technologies						
Date of commencement of studies	October 2020	Academic year of realisation of subject				2022/2023	
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery				at the university	
Year of study	3	Language of instruction				Polish	
Semester of study	6	ECTS credits				3.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Department of Process Engineering and Chemical Technology -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Anna Zielińska-Jurek				
	Teachers		dr hab. inż. Anna Zielińska-Jurek				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours		Self-study		SUM
	Number of study hours	45	2.0		28.0		75
Subject objectives	To gain knowledge in the field of soil and water remediation technologies						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W04] is aware of the importance of environmental protection and has a basic knowledge of chemical and biological threats to the environment, with particular emphasis on anthropogenic factors, has a basic knowledge of knowledge of the principles of sustainable development as well as national and European environmental management conditions.	knowledge of the ways of soil remediation using methods physicochemical, biological, thermal and chemical.			[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		
	[K6_U02] is able to operate equipment and perform typical analyzes of studies of environmental pollution, is able to carry out an analysis of typical environmental pollution and simple devices according to specification	knowledge of physicochemical properties soil contamination (heavy metals, petroleum substances, pesticides, pharmaceuticals) knowledge in the field of soil and land remediation technology.			[SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		
	[K6_W03] has a basic knowledge of soil, air and water pollutants, design and supervision of environmentally friendly technologies and technologies which do not produce waste, knows technology of cleaning and neutralization of industrial waste and wastewater management, has a basic understanding of the theoretical basis of methods and types of apparatus used in chemical analysis of environmental pollutants	the student is able to select the proper method of soil remediation to type pollution and assess costs related to the application remediation methods.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		

Subject contents	<p><i>Lecture:</i> Pollutants: source and classifications. Pollutants characteristics: pesticides, petroleum hydrocarbons, heavy metals, radioactive elements. Soil characteristics. Types of soil sorption. Migration of pollutants in the environment. Ground water characteristics. Fate of pollutants in soil, surface and groundwater (chemical, biochemical and photochemical processes). The effect of pollutants on the physical and mechanical properties of soil. Land reclamation basic terms and the aim of the process. Classification of remediation technologies. Physicochemical soil remediation. Biological soil remediation. Thermal soil remediation. Solidification and stabilization. Groundwater treatment: in-situ and ex-situ technologies. Method of waste dump isolation and its isolation layers. <i>Laboratory:</i> Bioremediation of polluted soil. Remediation of soil polluted with heavy metals Chemical methods of dump effluents treatment: ozonation, Fenton reaction and photochemical oxidation. Remediation of oil polluted soil. Cation mobility in soil.</p>		
Prerequisites and co-requisites	<p>Basic knowledge of inorganic chemistry, organic chemistry and analytical chemistry.</p>		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	laboratory	60.0%	40.0%
	lecture	60.0%	60.0%
Recommended reading	Basic literature	<p>Zaleska A., Zielińska-Jurek A., Technologie remediacji gruntów. Wydawnictwo Politechniki Gdańskiej, Gdańsk 2013</p>	
	Supplementary literature	<ol style="list-style-type: none"> 1. Kowalik P., Ochrona środowiska glebowego, PWN, Warszawa, 2001. 2. Zadroga B., Olańczuk-Neyman K., Ochrona i rekultywacja podłoża gruntowego, Wydawnictwo Politechniki Gdańskiej, 2001. 3. Greinert H., Ochrona gleb, Wydawnictwo Politechniki Zielonogórskiej, Zielona Góra, 1998. 4. Olszanowski A. (red.), Remediacja i bioremediacja zanieczyszczonych wód i gruntów oraz wykorzystanie modelowania i technik informatycznych w inżynierii, Wydawnictwo Politechniki Poznańskiej, 2001. 5. Gworek B (red), Technologie rekultywacji gleb, Wydawnictwo Naukowe Gabriel Borowski, Warszawa 2004 	
	eResources addresses		

Example issues/ example questions/ tasks being completed	Classification of contaminants Remediation of soil contaminated with heavy metals Remediation of soil contaminated with oil Remediation of soil contaminated with pesticides Schematic procedure of soil remediation
Work placement	Not applicable