



## Subject card

Subject name and code	Groundwater and Soil Protection, PG_00059995						
Field of study	Environmental Engineering						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2023/2024		
Education level	second-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	1	Language of instruction			English		
Semester of study	1	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Adam Szymkiewicz					
	Teachers	prof. dr hab. inż. Adam Szymkiewicz dr inż. Jolanta Lewandowska dr inż. Anna Gumuła-Kawęcka					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
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	60	5.0		62.0		127
Subject objectives	To familiarize students with the main sources of contaminants in soil-groundwater environment, mechanisms of contaminant transport, methods of soil and groundwater protection and clean-up						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W11] has knowledge to analyze, evaluate and optimize processes, objects and systems of environmental engineering and knows the principles of rational energy management and resources	student knows the principles of rational and sustainable management of groundwater resources			[SW2] Assessment of knowledge contained in presentation		
	[K7_U08] is able to assess risks in the implementation of engineering projects and implement appropriate safety rules	student is able to identify the threats to quality and quantity of groundwater resources, related to engineering activity			[SU2] Assessment of ability to analyse information		
	K7_U10	student is able to design elements of soil and groundwater remediation systems			[SU4] Assessment of ability to use methods and tools		
	K7_U12	student is able to evaluate usefulness of selected systems for protection and remediation of soil and groundwater			[SU4] Assessment of ability to use methods and tools		
K7_W09	student has in-depth knowledge about groundwater hydrology as well as protection and management of groundwater resources			[SW2] Assessment of knowledge contained in presentation			
Subject contents	Flow in unsaturated and saturated zone, types of contaminants and their sources, mechanisms of contaminant transport, methods of groundwater protection, methods of soil and groundwater remediation						
Prerequisites and co-requisites	Basic knowledge of hydrology, geology and chemistry						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	exercises: individual or group assignments	50.0%	100.0%
	lecture: attendance	80.0%	0.0%
Recommended reading	Basic literature	<p>Bhandari, Alok Surampalli, Rao Y. Champagne, Pascale Ong, Say Kee Tyagi, R. D. Lo, Irene M. C.. (2007). Remediation Technologies for Soils and Groundwater. American Society of Civil Engineers (ASCE). Retrieved from <a href="https://app.knovel.com/hotlink/toc/id:kpRTSG0007/remediation-technologies/remediation-technologies">https://app.knovel.com/hotlink/toc/id:kpRTSG0007/remediation-technologies/remediation-technologies</a></p> <p>Domenico, Patrick A. Schwartz, Franklin W.. (1998). Physical and Chemical Hydrogeology (2nd Edition). John Wiley &amp; Sons. Retrieved from <a href="https://app.knovel.com/hotlink/toc/id:kpPCHE0002/physical-chemical-hydrogeology/physical-chemical-hydrogeology">https://app.knovel.com/hotlink/toc/id:kpPCHE0002/physical-chemical-hydrogeology/physical-chemical-hydrogeology</a></p>	
	Supplementary literature	<a href="https://www.itrcweb.org/Guidance">https://www.itrcweb.org/Guidance</a>	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	distribution of organic contaminants between solid, liquid and gas phases, determination of well capture zone, solution of 1D advection-diffusion equation		
Work placement	Not applicable		