

## 。 GDAŃSK UNIVERSITY OF TECHNOLOGY

## Subject card

Subject name and code	, PG_00059979								
Field of study	Environmental Engineering								
Date of commencement of studies	February 2025		Academic year of realisation of subject			2025/2026			
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			Polish			
Semester of study	2		ECTS credits			2.0			
Learning profile	general academic profile		Assessment form			assessment			
Conducting unit	Department of Enviro	nmental Engin	eering Technol	ogy -> Faculty	of Civil	and En	vironmental Er	ngineering	
Name and surname	Subject supervisor dr hab. inż. Rafał Bray								
of lecturer (lecturers)	Teachers								
Lesson types and methods	Lesson type	Lecture	Tutorial	Laboratory	Projec	ect Seminar		SUM	
of instruction	Number of study hours	15.0	15.0 0.0 0.0		0.0		0.0	30	
	E-learning hours included: 0.0								
Learning activity and number of study hours	Learning activity	Participation in classes include plan	n didactic led in study	lidactic Participation in I in study consultation hours		Self-study SUM			
	Number of study hours	30	5.0			20.0		55	
Subject objectives	Familiarization with individual processes used in water renewal. Developing the ability to select technological concepts and evaluate the technological solutions used. To familiarize students with issues related to water resources on Earth and the availability and use of resources in Poland. To familiarize students with methods of calculating groundwater resources and determining protection zones.								
Learning outcomes	Course outcome		Subject outcome		Method of verification				
	K7_W07		The student has in-depth, structured, theoretically based knowledge of water resources, water renewal, methods of removing various pollutants from water, individual processes and factors influencing their course.			[SW1] Assessment of factual knowledge			
	[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		The student has the knowledge to analyze, evaluate and optimize processes, facilities and systems used in water renewal and knows the principles of rational resource management.			[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task [SW1] Assessment of factual knowledge			

Subject contents	Water resources: Water resources in the world, in Europe and in Poland, the degree of resource use and the impact of climate change on their depletion. Groundwater resources in Poland: main aquifers and associated resources of ordinary groundwater. Geothermal water resources in Poland. Classification of resources: static and dynamic resources, available and prospective resources, and operational resources. Methods for determining water resources, hydrogeological models as a basis for determining groundwater resources. Isotope research in the assessment of water resources. Water threats and protection. Main Ground Water Reservoirs (GZWP) and their protection. Classifications of bottled water: mineral and medicinal.Exercises:: Student presentation on bottled water: mineral, spring, table and medicinal water water renewal. Lecture: The concept of water renewal and its importance in the water management of a country, region and city. Goals and possibilities of water renewal. Characteristics of biologically treated sewage. Required water quality parameters after the renewal process. Unit processes used in water renewal. Technological systems of water renewal stations. Basic processes in water renewal: coagulation with hydrolyzing salts, coagulation with lime, recarbonization, ammonia removal (nitrification, stripping, ion exchange, oxidation), ion exchange, membrane processes (microfiltration, ultrafiltration, nanofiltration, reverse osmosis), disinfection in water renewal. Devices in water renewal.Exercises: Design task - calculation of an ion exchanger						
Prerequisites and co-requisites	Knowledge of geology, environmental protection, environmental chemistry, environmental microbiology and ecology, and water and wastewater technology.						
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade				
and criteria	Design task related to water renewal	60.0%	10.0%				
	Presentation on water resources	60.0%	10.0%				
	Final colloquium on water resources	60.0%	40.0%				
	Final colloquium on water renewal	60.0%	40.0%				
Recommended reading	Supplementary literature	<ol> <li>Kowal A. (red.): Water renewal. Theoretical foundations of processes. Wrocław: Ed. Wrocław University of Science and Technology.</li> <li>Kowal A., Świderska-Bróż M.: Water purification. Warsaw: WN PWN.</li> <li>Nawrocki J., Biłozor S.: Water purification. Chemical and biological processes. Warsaw: PWN 2000.</li> <li>UN-Water and UNESCO, The United Nations World Water Development Report 2022 - Making the Invisible Visible</li> <li>Jokiel 2004, Water resources of central Poland on the threshold of the 21st century. Ed. UŁ</li> <li>Pergoł, Regulska 2021, Balance of exploitable groundwater resources in Poland, Warsaw, PIG PIB</li> <li>E. Poeter, et al 2020 Groundwater in Our Water Cycle.The Groundwater project.</li> <li>Zuber red., 2007, Tracer methods in hydrogeological research: methodological guide, Polit. Wr.</li> <li>Dojlido J.: Water chemistry. Warsaw: Arkady.</li> <li>Heidrich Z.: Water treatment devices. Design principles and calculation examples. Warsaw: Arkady.</li> <li>M. Sozański, P.M. Huck.: Experimental research in the development of water treatment technologies. Monographs PAN, vol.42, Lublin 2007.</li> <li>A. Bauer, G. Dietze, W. Muller, K. J. Soine, D. Weideling.: Water supply system operator's guide. Ed.Seidel- Przywecki, Warsaw 2005.</li> <li>Z. Heidrich.: Waterworks and sewerage part 1. Waterworks. Ed. School and Pedagogical, Warsaw 1992.</li> <li>Healy R.W, 2010, Estimating groundwater recharge. Cambridge University Press.</li> <li>Pergol, Regulska 2021, Balance of exploitable groundwater resources in Poland, Warsaw, PIG PIB</li> <li>Macioszczyk A., Dobrzyński D., 2007 Hydrogeochemistry, PWN</li> <li>Diamond R.E., 2022, Stable Isotope Hydrology. The Groundwater preixed</li> </ol>					
Example issues/ example questions/ tasks being completed	<ol> <li>Select (from the list) and arrange in order the processes using coagulation with lime (or hydrolyzing salts). Mark with an arrow the place where CaO (or coagulant) is dosed.</li> <li>What is the purpose of the recarbonization process after coagulation with lime?</li> <li>Which ions can be removed with sodium cation exchanger?</li> <li>Name pressure membrane processes.</li> <li>Characterize the microfiltration process (or ultrafiltration, nanofiltration, reverse osmosis).</li> </ol>						
Work placement	Not applicable						

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