



## Subject card

Subject name and code	Water reclamation, PG_00042524						
Field of study	Environmental Engineering						
Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024				
Education level	second-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study				
Mode of study	Part-time studies	Mode of delivery	at the university				
Year of study	2	Language of instruction	Polish				
Semester of study	3	ECTS credits	3.0				
Learning profile	general academic profile	Assessment form	assessment				
Conducting unit	Department of Environmental Engineering Technology -> Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Rafał Bray					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	10.0	0.0	0.0	25
	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	25	4.0	55.0	84		
Subject objectives	introduction the unit processes used in the water reuse. Developing skills in the concept selection process and assessment of the technological solutions						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W07] has an in-depth, structured and theoretical knowledge of municipal management, including water treatment and water renewal technologies, various types of wastewater treatment technologies, including landfill leachate, sewage sludge treatment technologies; knowledge of natural methods used in water and wastewater treatment or construction, functioning, operation and closure of waste landfills	The student has in-depth, ordered, theoretically founded knowledge of water renewal, methods for removing various impurities from water, the course of unit processes and factors affecting their course.	
	[K7_U14] can technically and economically analyze and evaluate the solutions and functioning of facilities and systems in the sanitary engineering or flood protection, water intakes and water infrastructure or water and wastewater treatment plants; can assess the suitability and potential of using new achievements in materials, fixtures, devices and methodologies for designing and modeling the analyzed technical infrastructure and industrial objects, including innovative solutions	The student is able to analyze and evaluate in technical and economic terms solutions and functioning of facilities as well as water renewal and purification systems; is able to assess the usefulness and the possibility of using new achievements in the field of water regeneration devices containing innovative solutions.	
	[K7_U06] can use the known mathematical methods and models, if needed, to modify them, for: analysis and design of water systems and their components or water flows, migration of pollutants or water and wastewater treatment and sewage sludge handling	The student is able to use the known methods and mathematical models, modifying them if necessary, to analyze and design elements, systems and systems of water renewal.	
Subject contents	<p>Lecture: The concept of water renewal and its importance in the water management of the country, region and city. Aims and possibilities of water renewal. Characteristics of biologically treated wastewater. The required water quality parameters after the renewal process. Unit processes used in water recovery. Technological systems of water renewal stations. Basic processes in water renewal: coagulation with hydrolysing salts, coagulation with lime, recarbonization, ammonia removal (nitrification, stripping, ion exchange, oxidation), ion exchange, membrane processes (microfiltration, ultrafiltration, nanofiltration, reverse osmosis), disinfection in water regeneration. Equipment in water restoration. Laboratory:</p> <p>Laboratory tests on wastewater treatment (biologically treated) in the processes of coagulation with hydrolysing salts, coagulation with lime and recarbonation.</p>		
Prerequisites and co-requisites	knowledge of water and wastewater technology		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	laboratory	60.0%	40.0%
	test	60.0%	60.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. Kowal A. (red.): Odnowa wody. Podstawy teoretyczne procesów. Wrocław: Wyd. Politechniki Wrocławskiej.</li> <li>2. Kowal A., Świdzka-Bróz M.: Oczyszczanie wody. Warszawa: WN PWN.</li> <li>3. Nawrocki J., Biłozor S.: Uzdatnianie wody. Procesy chemiczne i biologiczne. Warszawa: PWN 2000.</li> </ol>	

	Supplementary literature	<ol style="list-style-type: none"> <li>1. Dojlido L.: Chemia wody. Warszawa: Arkady.</li> <li>2. Heidrich Z.: Urządzenia do uzdatniania wody. Zasady projektowania i przykłady obliczeń. Warszawa: Arkady.</li> <li>3. M. Sozański, P.M. Huck.: Badania doświadczalne w rozwoju technologii uzdatniania wody. Monografie PAN, vol.42, Lublin 2007.</li> <li>4. A. Bauer, G. Dietze, W. Muller, K. J. Soine, D. Weideling.: Poradnik eksploatatora systemów zaopatrzenia w wodę. Wyd. Seidel-Przywecki, Warszawa 2005.</li> <li>5. Z. Heidrich.: Wodociągi i Kanalizacja cz. 1. Wodociągi. Wyd. Szkolne i Pedagogiczne, Warszawa 1992.</li> </ol>
	eResources addresses	
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Select (from the list) and order the processes using lime coagulation (or hydrolysing salts). Mark with the arrow where the CaO (or coagulant) is to be dosed.</li> <li>2. What is the purpose of the carbonisation process after lime coagulation?</li> <li>3. Which ions can be removed with sodium ion exchanger?</li> <li>4. List pressure membrane processes.5. Characterize the process of microfiltration (or ultrafiltration, nanofiltration, reverse osmosis).</li> </ol>	
Work placement	Not applicable	