

COURSE DESCRIPTION CARD

Białystok University of Technology Faculty of Civil Engineering and Environmental Sciences									
Field of study	Environmental engineering							Degree level and programme type	Master's degree
Specialization/ diploma path	International School of Engineering							Study profile	The general academic
Course name	Water renewal							Course code	19284257H
								Course type	Obligatory
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	3
	16		32	16				No. of ECTS credits	4
Entry requirements	Water technology, Wastewater technology, Facilities for water treatment								
Course objectives	To familiarise students with basic concepts, phenomena occurring during water renewal processes and methods used in water renewal. To teach the selection of processes, design of technological systems and determination of technological and technical parameters of the applied methods. To develop skills of operating measuring devices and technological systems. To familiarise students with selected diagrams and solutions of water renewal applied in practice. To teach how to apply technical solutions in water renewal stations. To teach how to select processes and equipment used to recover water from waste and wastewater generated at water restoration stations, and to prepare for conducting and implementing scientific research.								
Course content	<p>The lecture: Basic concepts of water renewal. Costs of water renewal. Process diagrams and plant layouts. Micropollutants and emerging contaminants. Lime coagulation. Rerocarbonisation. Ammonium nitrogen removal (stripping, clinoptilolite, strong oxidisers and activated carbon). Membrane processes (microfiltration, nanofiltration, ultrafiltration, reverse osmosis, electrodialysis). Integrated and hybrid membrane processes. Grey and rainwater renewal. Utilisation of water renewal by-products.</p> <p>Laboratory classes: Removal of dissolved contaminants from water by the sorption process. Ion exchange as the reversible exchange of one ion for another at the same time, without undergoing significant structural modification. Reverse osmosis (RO) and ultrafiltration (UF) for the production of water from municipal wastewater. Removal of ammoniacal nitrogen by stripping. Coagulation with lime.</p> <p>Project: Performing a water renewal project using membrane techniques for given parameters. Analysis and justification of the choice of the best technological solution. Preparation of a diagram of the technological concept, technological calculations and statement of results. Proposing a complete model of a water renewal station including management of water renewal by-products. Calculation</p>								

	and selection of equipment. Production of flow graphic models of the open and closed circuits of the water renewal plant. Drawings of the water renewal plant to scale.	
Teaching methods	Lectures, projects, laboratory analysis, analysis of actual facilities, case studies	
Assessment method	Lecture - written exam; laboratory - evaluation of written reports tests; project - realization of the project, evaluation of the project	
Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
L01	knows the processes, facilities and latest developments related to water renewal	EN_IS2_W01 EN_IS2_W06
L02	knows the principles of operation and use of facilities and equipment found in water renewal and the directions of technology found in water renewal, and is able to correctly select data to design renewal technology	EN_IS2_W02 EN_IS2_U08
L03	is familiar with the latest methods for the management of water renewal by-products and is able to select data correctly in order to design a technology for the management of water renewal by-products	EN_IS2_W04 EN_IS2_U08
L04	is able to properly plan and carry out experiments in the field of water renewal, interpret the results and on this basis draw correct conclusions and relate them to the latest developments	EN_IS2_U01 EN_IS2_U02 EN_IS2_U03
L05	is able to carry out physico-chemical tests using specialised scientific instruments, interpret the results obtained, draw conclusions and relate them to the latest developments	EN_IS2_U03 EN_IS2_U05
L06	is able to use scientific, popular science and professional literature, subject standards, legal acts, Internet databases, is able to use his/her knowledge in a creative interpretation and presentation of water renewal issues	EN_IS2_U02 EN_IS2_U09
Symbol of learning effect	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
L01	written exam	L
L02	written exam, project paperwork, defence of the project	L, P
L03	written exam, project paperwork, defence of the project	L, P
L04	test, written reports	LC
L05	test, written reports	LC
L06	written exam, project paperwork, defence of the project, test, written reports	L, P, LC
Student workload (in hours)		No. of hours
Participation in lectures		16

Calculation	Participation in the project	16	
	Participation in laboratory classes	32	
	Preparation for the project, preparation for laboratory exercises, preparation for tests	16	
	Completion of laboratory exercise reports, completion of the project and its presentation	10	
	Exam preparation and attendance (8h+2h written exam of lectures)	10	
	Participation in consultations	5	
	TOTAL:	105	
Quantitative indicators		HOURS	ECTS
Student workload – activities that require direct teacher participation		72	3
Student workload – practical activities		77	3
Basic references	<ol style="list-style-type: none"> 1) John C. Crittenden, R. Rhodes Trussell, David W. Hand (2022) Stantec's Water Treatment: Principles and Design, III-rd edition, WILEY. 2) Hermann H. Hahn, Erhard Hoffmann, Hallvard Ødegaard (2004) Chemical Water and Wastewater Treatment VIII, IWA Publishing. 3) Frank R. Spellman (2008) Handbook of Water and Wastewater Treatment Plant Operations, CRC Press, Taylor & Francis Group. 		
Supplementary references	1) Edward E. Baruth, American Society of Civil Engineers, American Water Works Association (2005) Water Treatment Plant Design, Mcgraw-hill.		
Organisational unit conducting the course	Department of Technology in Environmental Engineering	Date of issuing the programme	
Author of the programme	Joanna Struk-Sokołowska, Ph.D Ewa Szatyłowicz, Ph.D Elżbieta H. Grygorczuk-Petersons, Ph.D	30.06.2023	