



## Subject card

Subject name and code	Process apparatus in environmental protection, PG_00059380						
Field of study	Mechanical Engineering						
Date of commencement of studies	February 2023	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	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 Energy and Industrial Apparatus -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Bartosz Dawidowicz					
	Teachers	dr inż. Bartosz Dawidowicz dr inż. Blanka Jakubowska					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	9.0	0.0	0.0	9.0	0.0	18
	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	18	4.0		28.0		50
Subject objectives	Teaching the basics of construction and calculation of typical devices from process apparatus used in environmental protection. Indication of the specificity of devices in this application. Providing the methodology for calculating the dimensions of selected elements of the installation.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W03] possesses a profound knowledge on thermodynamic processes and their simulation, knows simulation methods and programs aiding the design and operation of power generating machines and process equipment, including renewable energy sources, air conditioning and cooling  renewable energy sources, air conditioning and cooling		The student is able to make a project and make calculations of basic process apparatus.		[SW3] Assessment of knowledge contained in written work and projects		
	[K7_U07] is able to perform a preliminary economic analysis of the undertaken engineering actions within the range of design, production and operation of machines and technical devices		Can assess the value and operating costs of devices		[SU1] Assessment of task fulfilment		
	[K7_W05] possesses profound knowledge on the operation of complex systems and mechanical devices, including process equipment		The student knows technical solutions that can be used in technical calculations and projects.		[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		

Subject contents	Lecture. Concepts of process apparatus and environmental protection engineering. Overview of the elements and equipment of the apparatus. Construction materials used in the construction of process apparatus. Selected issues of process equipment, including REACTORS. General concepts, classification, their place in environmental protection. Technological operations carried out in reactors: mixing, air injection, circulation of the reactor contents. Periodic and flow reactors. Ideal and real reactors. Dynamic characteristics. Cascade. Types of flows in reactors. Aeration systems. Construction of diffusers. Mixing power, examples of mixers used in reactors. TANKS FOR WASTEWATER. Construction. Basics of calculations. Apparatus used for secondary and subsequent treatment of sewage. SEALS. Stabilization. Thickening. Drainage. Basics of device construction. Other examples of process equipment in environmental protection. DESIGN. Selected issues in the design of apparatus, eg: the basics and methods of dimensioning the treatment plant. Selected processes in environmental protection		
Prerequisites and co-requisites	basics of physics, chemistry, fluid mechanics and wastewater treatment		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Exam from the lecture	56.0%	50.0%
	Grade of the project	56.0%	50.0%
Recommended reading	Basic literature	1. Warych J.: Aparatura chemiczna i procesowa, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1996  2. Vesilind A., Peirce J.J., Weiner R.: Environmental engineering. Butterworth Publishers, Stoneham, 1988.  3. Łomotowski J., Szpindor A.: Nowoczesne systemy oczyszczania ścieków. Arkady, W-wa, 1999.  4. Grandison A.S., Lewis M.J.: Separation processes in the food and biotechnology Industries. Woodhead Publishing Ltd., Cambridge, 1996.  5. Ciborowski J.: Inżynieria procesowa. WNT, W-wa, 1965.	
	Supplementary literature	1. Pikoń J.: Aparatura chemiczna. PWN, W-wa, 1978.  2. Wodociągi - Kanalizacja. Abrys sp. z o.o., monthly	
	eResources addresses	Adresy na platformie eNauczanie: Aparatura procesowa w ochronie środowiska W/P, MiBM, niestac., II st., sem. 7, zima 23/24 (PG_00059380) - Moodle ID: 34023 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=34023">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=34023</a>	
Example issues/ example questions/ tasks being completed	1. Real reactor. 2. Discuss the structure and operation of a reactor with a biological bed. 3. Purpose and methods of reactor aeration.		
Work placement	Not applicable		