



## Subject card

Subject name and code	Chemical Apparatus, PG_00052340						
Field of study	Chemical Technology						
Date of commencement of studies	October 2022		Academic year of realisation of subject		2023/2024		
Education level	first-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	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Energy Conversion and Storage -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Monika Wilamowska-Zawłocka				
	Teachers		dr hab. inż. Monika Wilamowska-Zawłocka				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	15.0	0.0	45
	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	45		5.0		50.0	100
Subject objectives	Student will learn the classification of industrial processes (mechanical, thermal and diffusion) and the construction and operation of apparatuses for their implementation. During classes the equations describing fluid dynamics (including Bernoulli's equation and counting the flow resistance) will be discussed and the construction and function of machines and apparatuses t.i.e. pumps, pipelines, tanks, conveyors, grinding, separation and mixing equipment, heat exchangers, drying, distillation, rectification and mass exchange equipment will be presented.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_U04		A student knows technological processes and industrial installations. Based on calculations and assumptions, he can select the right device and construction material for various chemical substances.		[SU1] Assessment of task fulfilment		
	K6_W04		A student knows technological processes and industrial installations. Based on calculations and assumptions, he can select the right device and construction material for various chemical substances.		[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		
Subject contents	<ul style="list-style-type: none"><li>- Fluid dynamics - equations describing fluid dynamics, flow resistance in pipelines.</li><li>- Pipelines and pipeline armature for chemical processes</li><li>- Pumps - standard and special pumps, their construction and application, pump sealing</li><li>- Compressors and fans</li><li>- Transport of materials - conveyors</li><li>- Storage tanks - materials and components of containers depending on the type of substance stored</li><li>- Mixing processes in the chemical industry, construction of mixers, types of mixers, mixing efficiency and methods of vortex elimination</li><li>- Shredding processes - construction of equipment and energy consumption of operations depending on the required degree of fragmentation</li><li>- Separation of heterogeneous systems</li><li>- Heat exchange - heat transfer coefficients, heat exchangers, evaporators, crystallizers, dryers.</li><li>- Mass exchange - adsorption and absorption columns</li><li>- Distillation and rectification processes</li></ul>						

Prerequisites and co-requisites	Knowledge of the basics of Mathematics, Physics, Chemistry, Technical Drawing, Mechanical Engineering, Computer Usage		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project - calculation colloquium + project	60.0%	40.0%
	Lecture - exam	60.0%	60.0%
Recommended reading	Basic literature	1. Błasiński H., Młodziński B., - Aparatura przemysłu chemicznego, WNT 1983, 2. Pikoń J., - Aparatura chemiczna, PWN 1978, 3. J. Warych, Aparatura Chemiczna i Procesowa, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1996 4. Bieszk H., Urządzenia do realizacji procesów mechanicznych w technologii chemicznej, Wyd. PG. 2001, 5. Bieszk H., Urządzenia do realizacji procesów cieplnych w technologii chemicznej, Wyd. PG. 2010, 6. Pawłow K.F., Romankow P.G., Noskow A.A. - Przykłady i zadania z zakresu aparatury i inżynierii chemicznej, WNT 1981.	
	Supplementary literature	1. Goździcki M., Świątkiewicz H., Przenośniki. WNT, Warszawa 1979, 2. Koch R., Noworyta A.: Procesy mechaniczne w inżynierii chemicznej. WNT, Warszawa 1992, 3. Leszczyński S.: Filtracja w przemyśle chemicznym. WNT, Warszawa 1972, 4. Stępniewski M.: Pompy. WNT, Warszawa 1985	
	eResources addresses	Adresy na platformie eNauczanie: Aparatura Chemiczna - 2023 - Moodle ID: 26457 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26457">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26457</a>	
Example issues/ example questions/ tasks being completed	Sample questions: List and describe the differences between displacement and centrifugal pumps. Why are the pumps connected in series / parallel? How can the capacity of a centrifugal / piston pump be adjusted? Give examples of special purpose valves/armature in pipelines. List a pipeline cleaning methods. Give examples of conveyors. Specify the device (s) best suited for separating a three-phase liquid-liquid-solid system. Why are heat exchangers connected in series / parallel? Why are evaporators often combined in series?		
Work placement	Not applicable		

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