



Subject card

Subject name and code	Basics of Bioprocess Engineering, PG_00054703						
Field of study	Biotechnology						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2024/2025		
Education level	first-cycle studies		Subject group		Obligatory subject group 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	4		ECTS credits		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Process Engineering and Chemical Technology -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Donata Konopacka-Łyskawa				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	30.0	0.0	60
	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	60		10.0		55.0	125
Subject objectives	To familiarize students with the basic concepts of selected dynamic operations (fluid flows, mixing, filtration, settling of particles), mechanical operation (crushing, agglomeration) and the heat exchange. Presenting students the opportunities to use mathematical equations in the description of the unit operations used in chemical and bioprocess engineering. Developing students' computing skills for the relevant unit operations.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_U08		The student is able to indicate the pros and cons of known operations and processes and propose a solution to the problem related to the operations discussed in class.		[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		
	K6_W10		Student understands and explains fundamental definitions of selected dynamic operations, heat exchange and membrane processes		[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation		
	K6_W09		The student has knowledge of separation processes used in biotechnology such as filtration, sedimentation, centrifugation and membrane processes		[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
Subject contents	Fluid properties. Flow of ideal fluids. Flow of real fluids; flow resistance. Non-newtonian fluid flow. Multiphase flow. Separation of heterogeneous systems: sedimentation, filtration, centrifugation. Fluid mixing. Crushing and agglomeration. Heat transfer: conduction, free convection, forced convection, overall heat transfer. Membrane processes						
Prerequisites and co-requisites	Gas and liquid properties. Selected problems of physical chemistry.						
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	Written tests		60.0%		20.0%		
	Lecture - written exam		60.0%		40.0%		
	Miniprojects and project		60.0%		40.0%		

Recommended reading	Basic literature	<p>M. Serwiński: Zasady inżynierii chemicznej, WNT 1982</p> <p>P. Lewicki (red.): Inżynieria procesowa i aparatura przemysłu spożywczego, WNT 2006</p> <p>Z. Orzechowki, J. Prywer, R. Zarzycki: Mechanika płynów w inżynierii środowiska, WNT 2009</p> <p>R. Zarzycki: Wymiana ciepła i ruch masy w inżynierii środowiska, WNT 2010</p> <p>R. Rautenbach: Procesy membranowe, WNT 1996</p> <p>S. Katah, J. Houruchi, F. Yoshida: Biochemical Engineering, Wiley 2015.</p>
	Supplementary literature	D. W. Green (ed.): Perry's Chemical Engineers' Handbook, The McGraw-Hill Comp. Inc. (7th ed.) 1997
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	<p>1. Draw a diagram of the injector and show how to determine the volumetric flow rate at which it will be possible to reach the maximum suction depth. The dimensions of the injector, i.e. the diameter of the water inlet pipe, nozzle diameter, overpressure in the inlet pipe, atmospheric pressure, and the temperature of the flowing water are known. Assume water is a perfect liquid.</p> <p>2. Two filtrations of the same suspension were carried out: the first one using a filter with surface A and pressure p_1, the second one using the same filter (with surface A), but under pressure $p_2 = 4 p_1$. Compare the rates of filtrations and its efficiencies after time (the same for both filtrations). Assume that the resistance of the filter cloth and the time of additional operations can be neglected and the filter cake is incompressible.</p> <p>3. Provide the principles of dimensional analysis. Using the dimensional analysis, present the procedure leading to the criterion equation for describing free settling, if it is known that the pressure exerted by the fluid on the settling particle depends on the settling velocity, the particle diameter, the density and viscosity of the fluid.</p> <p>4. What is the ratio of the agitator rotation frequencies of the stirrer in two standard mixers of diameters D_1 and $D_2 = 3D_1$, respectively, if the specific power (power delivered per unit volume of liquid in the mixer) is the same and the mixing is in the laminar range/ turbulent range?</p> <p>5. Draw the temperature distribution in the counter-current shell and tube heat exchanger when the heating medium is a liquid with a higher specific heat than the heated medium and mass flows rates of both fluids in the heat exchanger are the same. Show how to determine the minimum heating medium consumption. Discuss the change of equivalent difference of temperature when the consumption of heating medium decreases?</p>	
Work placement	Not applicable	

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