GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Basics of Bioprocess Engineering, PG_00054703		
Field of study	Biotechnology		
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
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	dr hab. inż. Donata Konopacka-Łyskawa dr inż. Izabela Wysocka dr inż. Patrycja Makoś-Chełstowska	

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_W09	The student has knowledge of separation processes used in biotechnology such as filtration, sedimentation, centrifugation and membrane processes	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
K6_W10	Student understands and explains fundamental definitions of selected dynamic operations, heat exchange and membrane processes	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
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.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task

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
Miniprojects and project	60.0%	40.0%
Lecture - written exam	60.0%	40.0%
Written tests	60.0%	20.0%

Recommended reading	Basic literature	M. Serwiński: Zasady inżynierii chemicznej, WNT 1982 P. Lewicki (red.): Inżynieria procesowa i aparatura przemysłu spożywczego, WNT 2006 Z. Orzechowki, J. Prywer, R. Zarzycki: Mechanika płynów w inżynierii środowiska, WNT 2009 R. Zarzycki: Wymiana ciepła i ruch masy w inżynierii środowiska, WNT 2010 R. Rautenbach: Procesy membranowe, WNT 1996 S. Katah, J. Houriuchi, F. Yoshida: Biochemical Engineering, Wiley 2015.
	Supplementary literature	D. W. Green (ed.): Perry's Chemical Engineers'Handbook, The McGrow-Hill Comp. Inc. (7th ed.) 1997
	eResources addresses	Adresy na platformie eNauczanie: Podstawy inżynierii bioprocesowej - projekt sem 4 2023/24 - Moodle ID: 34205 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=34205 Podstawy inżynierii bioprocesowej - projekt sem 4 2023/24 - Moodle ID: 34205 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=34205
Example issues/ example questions/ tasks being completed	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. 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. 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. 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? 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. Discusse the change of equivalent difference of temperature when the consumption of heating medium decreases?	
Work placement	Not applicable	