GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	BASIC OF BIOPROCESS ENGINEERING, PG_00063454		
Field of study	Biotechnology		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	second-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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department Of Process Engineering And Chemical Technology -> Faculty Of Chemistry -> Wydziały Politechniki Gdańskiej		
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	8.0	32.0	100

Subject objectives

To familiarize students with the basic concepts of selected dynamic operations (fluid flows, mixing, filtration, settling of particles), the heat exchange, and the mass transfer. Presenting students the opportunities to use mathematical equations in the description of the unit operations used in bioprocess engineering. Developing students' computing skills for the selected unit operations.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K01] understands the need to constantly update knowledge based on the state of the art in accordance with the latest scientific literature, improve professional skills and the importance of teamwork	understands the need to carry out tasks and projects in a team	[SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness [SK1] Assessment of group work skills
[K7_U03] designs technological solutions for obtaining useful goods using biomolecules and living organisms based on the state of the art in accordance with the latest scientific literature	uses energy, heat and mass balances as well as physicochemical balances to design and implement biotechnological processes, indicates their driving force	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
[K7_W05] identifies crucial developments in research, apparatus and technology in biotechnology and related fields	identifies selected operations and unit processes used in biotechnological processes, is able to classify them and adjusts appropriate mathematical tools used to design biotechnological processes	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge

Subject contents

Lecture: Properties of fluids. The flow of real fluids, the flow of non-Newtonian fluids. Transport of liquid and gaseous mixtures. Heat exchange. Mixing. Filtration, centrifugation, sedimentation. Separation of mixtures using membrane methods. Selected mass exchange processes: extraction, absorption, crystallization, drying (including lyophilization). Project: pressure drop during fluid flow through the granular bed, heat conduction, heat convaction, extraction drying, crystallization.

Prerequisites and co-requisites

basic knowledge of mathematics, physics and physical chemistry

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written test</td><td>60.0%</td><td>60.0%</td></tr>
<tr><td>Project</td><td>100.0%</td><td>10.0%</td></tr>
<tr><td>Mini-projects</td><td>60.0%</td><td>30.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>P. M. Doran: Bioprocess engineering principles, 2nd Ed., Elsevier, 2013
S. Katah, J. Houriuchi, F. Yoshida, Biochemical Engineering, Wiley 2015
McCabe W.L., Smith J.C., Harriot P., Unit operations of chemical engineering, 7th Edition, McGraw-Hill Education 2005.
Perry's Chemical Engineers' Handbook, Wyd. 7 lub 8 lub 9, Green D. W. (Red.), The McGrow-Hill Comp. Inc. 1997/2008/2021
Seader J. D., Henley E. J., Roper D. K.: Separation Process Principles, 3rd ed., John Wiley & Sons, Inc. 2010.</td></tr>
<tr><td>Supplementary literature</td><td>Z. Orzechowski, J. Prywer, R. Zarzycki: Mechanika płynów w inżynierii i ochronie środowiska, WNT 2009
T. Hobler: Ruch ciepła i wymienniki, WNT 1979
F. Stręk: Mieszanie i mieszalniki, WNT 1981
J. Kamieński: Mieszanie układów wielofazowych, WNT 2004
R. Ruatenbach: Procesy membranowe, WNT, 1996</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. Explain the calculation method of the time needed to the liquid flows from the tank. What parameters affect the time of liquid outflow from the tank? How to speed up the time needed to empty the tank?
2. List the parameters characterizing the granular bed. Describe one of the methods for determining the porosity of the bed.
3. Explain how you can increase the heat transfer coefficient in forced convection.
4. Draw any installation consisting of two membrane modules. Describe the streams. Write the mass balance of the component retained in a single module and the entire plant.
5. Draw the scheme of multistage co-current extraction. Explain how the number of extraction stages can be determined when the composition and weight of feed, the composition and weight of a single batch of secondary solvent, and the degree of extraction are known.
6. Explain how the particle size distribution changes during crystallization.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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