GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Basics of Bioprocess Engineering, PG_00058406		
Field of study	Biotechnology		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2022/2023
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		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Donata Konopacka-Łyskawa	
	Teachers	dr hab. inż. Donata Konopacka-Łyskawa	

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_W10] has knowledge in the field of bioprocess technology and engineering and knowledge in the field of engineering design of technical objects and processes including engineering graphics with the use of computer-aided design and databases	The student has knowledge of selected operations and unit processes used in biotechnological processes, as well as mathematical tools used to design these processes.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K7_K04] is aware of the need to solve problems and perform tasks, independently formulate questions to solve a given problem or task; is able to plan the execution of a larger task by dividing it into partial tasks and draw up an appropriate schedule	The student is able to use the knowledge and skills in the field of bioprocess engineering to solve problems that arise during the design and implementation of biotechnological processes on an enlarged scale.	[SK3] Assessment of ability to organize work [SK5] Assessment of ability to solve problems that arise in practice [SK2] Assessment of progress of work
[K7_U10] is able to use knowledge about possibilities, aims and limitations of biotechnology to develop, design and obtain products and biotechnological processes in the area of his/her specialization	The student is able to describe the dynamic processes, as well as heat and mass transfer processes, indicate the driving force and prepare the mass and heat balance of selected processes. The student is able to perform basic calculations of selected unit processes.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

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, adsorption, crystallization, drying (including lyophilization). Project: calculation of tank emptying time and pressure losses during fluid flow, heat exchanger calculations, basics of membrane process calculations and design of a selected membrane process, extraction, crystallization and drying process calculations; design of the selected mass exchange process.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="2">basic knowledge of mathematics, physics and physical chemistry</td></tr>
<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>Project</td><td>60.0%</td><td>10.0%</td></tr>
<tr><td>Written exam</td><td>60.0%</td><td>60.0%</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:
Podstawy inżynierii bioprocesowej - projekt 2022/2023 - Moodle ID: 26177
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26177
Podstawy inżynierii bioprocesowej - projekt 2022/2023 - Moodle ID: 26177
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26177</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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