

Nazwa zajęć/ <i>Course title:</i>	<b>Inżynieria procesów biotechnologicznych</b>	ECTS	6
Nazwa zajęć w j. angielskim/ <i>Course title in English:</i>	<b>Engineering of biotechnological processes</b>		
Zajęcia dla kierunku studiów/ <i>Degree program name:</i>	<b>Biotechnology</b>		

Język kursu/ <i>Course language:</i> English		Poziom studiów/ <i>Study level:</i> I	
Typ studiów/ <i>Form of studies:</i>	x intramural .. extramural	Status zajęć/ <i>Course status</i>	podstawowe/ <i>Basic</i> obowiązkowe/ <i>x mandatory</i> .. do wyboru/ <i>elective</i> x major
		Semestr/ <i>Semester:</i> 4	semestr zimowy/ <i>winter semester</i> X semestr letni/ <i>summer semester</i>
Rok akademicki/ <i>Academic year:</i>		2022/2023	Numer katalogowy/ <i>Catalogue number:</i> <b>BBT_BTa-1S-4L-27</b>

Koordinator zajęć/ <i>Course coordinator:</i>	<b>Dr hab. Ewa Jakubczyk, prof.</b>		
Prowadzący zajęcia/ <i>Teachers responsible for the course:</i>	Staff of Department of Food Engineering and Process Management		
Założenia, cele i opis zajęć/ <i>Aims, objectives and description of the course:</i>	<p>Providing knowledge about the construction and principles of operation of bioreactors and their instrumentation which enables to control and monitor of the biotechnological process; explanation of the mechanisms of separation methods and purification of products during the biotechnological process</p> <p>The lectures include the following content:</p> <ul style="list-style-type: none"> <li>• description bioreactors constructions</li> <li>• biotechnological process control tools</li> <li>• kinetics of processes</li> <li>• methods of conducting the biotechnological process, batch process, continuous process, process with biomass recirculation</li> <li>• separation and purification of biotechnological products, taking into account the principle of operation and construction of devices used to implement these processes <ul style="list-style-type: none"> <li>o Biomass separation, centrifugation and filtration.</li> <li>o Cell disruption</li> <li>o thickening processes of solutions, evaporation and cryoconcentration. Crystallization. Extraction.</li> <li>o Membrane and electrokinetic processes, gel filtration. Distillation. Convection drying, freeze-drying</li> <li>o Chromatographic methods</li> </ul> </li> </ul> <p>The exercises cover the following issues:</p> <ul style="list-style-type: none"> <li>• filtration,</li> <li>• sedimentation,</li> <li>• freezing and lyophilization,</li> <li>• process balancing</li> <li>• compaction,</li> <li>• crystallization,</li> <li>• extraction,</li> <li>• distillation,</li> <li>• drying of biological materials</li> </ul>		
Formy dydaktyczne, liczba godzin/ <i>Teaching forms, number of hours:</i>	a) Lectures; 30 hours ; b) Laboratory classes ; 30 hours;		
Metody dydaktyczne/ <i>Teaching methods:</i>	lecture, conversational lecture, experiment, discussion, possibilities of using distance learning when necessary		
Wymagania formalne i założenia wstępne/ <i>Formal requirements and prerequisites</i>	mathematics, physical chemistry the student has the skills of calculations including integration, differentiation, using a spreadsheet in the area of calculations and the graphical presentation and interpretation of results; knows the basics of physics phenomena		
Efekty uczenia się/ <i>Learning outcomes:</i>	treść efektu przypisanego do zajęć/ <i>the content of the effect assigned to the course:</i>		Odniesienie do efektu kierunkowego/ <i>/Relation to the course outcomes</i>
Wiedza (absolwent zna i rozumie) <i>/Knowledge: (the graduate knows and understands)</i>	W1	knows the conditions of specific processes of separation and purification allowing for an increase in the efficiency of processes	Siła dla ef. kier* <i>/Impact on the course outcomes *</i>
			K_W01 3 K_W02 3 K_W03 3 K_W04 3 K_W08 3 K_W13 3 K_W14 3 K_W15 3

	W2	knows and understands the principles of bioreactors operations	K_W01 K_W02 K_W04 K_W08 K_W13 K_W14 K_W15	3 3 3 3 3 3 3
Umiejętności (absolwent potrafi) /Skills: (the graduate is able to)	U1	able to select the proper construction of a bioreactor and a monitoring method for a specified type of process	K_U06 K_U10 K_U11 K_U12 K_U13	3 3 2 2 3
	U2	able to rationally select proper methods for extracting and purifying a biotechnological product	K_U06 K_U10 K_U11 K_U12 K_U13 K_U20	3 3 2 2 3 3
	U3	able to critically address the results of the performed experiments and the possible methodological errors.	K_U02 K_U08 K_U09 K_U14 K_U21	2 2 2 3 2
Kompetencje (absolwent jest gotów do) /Competences: (The graduate is ready to)	K1	ready to work with bioreactors	K_K05	2
	K2			
<i>Treści programowe zapewniające uzyskanie efektów uczenia się:</i>  <i>/Program contents ensuring the achievement of the learning outcomes:</i>	Construction and the operating principles of bioreactors as well as their instrumentation enabling to control and monitoring of a biotechnological process; explaining the mechanisms of separation methods and purification of products during the biotechnological process. Topics such as: discussion of the design solutions of bioreactors, tools for controlling a biotechnological process, kinetics of processes, methods for performing a biotechnological process and its balancing, a periodic process, a continuous process, a process with the recirculation of biomass, separating of biotechnological products, taking into account the operating principles and the design of devices used to carry out these processes, separation of biomass, centrifugation and filtration, fragmentation of cells, thickening processes, evaporation and cryoconcentration, crystallisation, extraction, membrane and electrokinetic processes, filtration on gels, distillation. convective drying, freeze drying, chromatographic methods.			
Sposób weryfikacji efektów uczenia się/ <i>Methods of the verification of the learning outcomes:</i>	reports, an evaluation of written papers examining the theoretical preparation for conducting experiments, exam,			
Szczegóły dotyczące sposobów weryfikacji i form dokumentacji osiągniętych efektów uczenia się <i>/Details on the verification methods and of the ways of documenting the learning outcomes:</i>	reports; personal evaluation cards of the student, the content of the examination questions with the assessment, the possibility of using distance education when necessary			
Elementy i wagi mające wpływ na ocenę końcową/ <i>Elements and weights influencing the final grade:</i>	The assessment of the learning outcomes consists of: 1. assessment of written works checking theoretical preparation for conducting experiments 2. presentation and analysis of observations and conclusions formulated in the reports 3. written exam The student obtains 3 partial grades (for each element). The condition for passing each element is obtaining 51% The final grade is computed based on the grades for each item. The weight of each of these components is as follows: 1-40%, 2-10%, 3-50% The condition for passing the course is to pass each element and obtain a minimum grade that is sufficient, taking into account all the elements.			
Miejsce realizacji zajęć/ <i>Teaching place:</i>	Laboratories and lecture halls			
Literatura/Literature:	<ol style="list-style-type: none"> <li>Introduction to food process engineering / Albert Ibarz, Gustavo V. Barbosa-Cánovas. Boca Raton [etc.] : CRC Press/Taylor &amp; Francis, cop. 2014.</li> <li>Automation for food engineering : food quality quantization and process control / Yanbo Huang, A. Dale Whittaker, Ronald E. Lacey. Boca Raton : CRC Press, 2001.</li> <li>Advances in food biotechnology / edited by Ravishankar Rai V., Chichester : Wiley Blackwell, cop. 2016.</li> </ol>			
UWAGI/ANNOTATIONS The following scale is used to calculate the final score: 100-91% points - 5.0; 90-81% points - 4.5, 80-71% points - 4.0; 70-61% points - 3.5; 60-51% points - 3.0				

\*) 3 – zaawansowany i szczegółowy, 2 – znaczący, 1 – podstawowy/ 3 – significant and detailed, 2 – considerable, 1 – basic,

Wskaźniki ilościowe charakteryzujące moduł/przedmiot/*Quantitative summary of the course:*

Szacunkowa sumaryczna liczba godzin pracy studenta (kontaktowych i pracy własnej) niezbędna dla osiągnięcia zakładanych dla zajęć efektów uczenia się - na tej podstawie należy wypełnić pole ECTS / <i>Estimated number of work hours per student (contact and self-study) essential to achieve the presumed learning outcomes - basis for the calculation of ECTS credits:</i>	140....h
Łączna liczba punktów ECTS, którą student uzyskuje na zajęciach wymagających bezpośredniego udziału nauczycieli akademickich lub innych osób prowadzących zajęcia/ <i>Total number of ECTS credits accumulated by the student during contact learning:</i>	...2.4..... ECTS