MODULE DESCRIPTION (SYLLABUS)

1.	Module: **Bioprocess Engineering**
2.	Language of instruction: **English**
3.	Faculty: **Faculty of Biotechnology**
4.	Course/module code: **29-BT-S1-E6-EnBE** (Lect.) **29-BT-S1-E6-EnBEb** (Lab.)
5.	Course/module type (*mandatory* or *elective*): **mandatory**
6.	Programme: **Biotechnology**
7.	Study cycle (*1st/2nd*): **1st cycle**
8.	Year: **3rd**
9.	Semester *(autumn* or *spring):* **spring**
10.	Form of tuition and number of hours: Lecture: **30 h** Laboratory: **15 h**
11.	Coordinator(s): **Katarzyna Cieślik-Boczula, PhD**
12.	Initial requirements *(knowledge, skills, social competences)*: **Knowledge of basic biochemical processes, completed a basic course in mathematics, biochemistry and microbiology.**
13.	Objectives: **Acquisition of the skills of using various experimental techniques required for employment in the bioprocess engineering.**
14.	Content: Lecture: **Microorganisms of industrial importance; the isolation, preservation and improvement of industrially important microorganisms; the development of inocula for industrial**

	fermentations; media for industrial bioprocesses; sterilization; classification of microbial growth techniques and kinetics, the recovery and purification of fermentation products; fermenters - structure, functions, division; examples of industrial production of biomass and secondary and primary metabolism products; economics of bioprocess engineering; mass and energy balance of the microbial growth in industrial processes. Laboratory: **Unit processes of bioprocess engineering associated with the separation and purification: extraction, sublimation, filtration, crystallization of small organic compounds and protein molecules. The control and selection of appropriate conditions for an increase in the efficiency of unit processes.** **Balance and kinetic aspects of industrial bioprocesses: the element composition of microbial with industrial use, concept of C-mole, mass and energy balance of the microbial growth in industrial processes, kinetics of thermal sterilization.** **Principles of the working of bioreactors and criteria for selection of a type of bioreactors.**	
1.	Learning outcomes: Student: • **can make a qualitative and quantitative description of the basic biological phenomena and processes using in bioprocess engineering;** • **is able to link theoretical knowledge of biochemistry, biotechnology, molecular biology and microbiology with its practical application in industrial realization of biotechnology;** • **can analyze data and draw conclusions in the field of bioprocess engineering with the use of qualitative and quantitative analysis methods and a thorough knowledge of the biochemistry, biotechnology, molecular biology and microbiology. Can identify the methods and technologies used in bioprocess engineering;** • **can describe selected topics in the area of bioprocess engineering using specialist language;** • **is able to think and act in an entrepreneurial manner.**	Outcome symbols: K1_W01, K1_W09, K1_U08, K1_U09, K1_K06
2.	Obligatory and recommended literature: • **Stanbury P. F., Whitaker A., Hall S. J. Principles of fermentation technology, Elsevier Science Ltd. Oxford, 2003** • **Lydersen B.K., D'ella N.A., Nelson K.I.: Bioprocess engineering, John Wiley & Sons, New York, 1994.** • **ed. H. Brauer: Biotechnology. Fundamentals of biochemical engineering, VCH, Weinheim, 1985** • **Schuegerl K., Bellgardt K.H.: Bioreaction Engineering. Modeling and Control, Springer Verlag, Berlin, 2000.**	

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- **Van't Riet K., Tramper J.: <u>Basic bioreactor design</u>, Marcel Dekker Inc, New York, 1991.**

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<tr><td>3.</td><td colspan="2">Methods of verification of the assumed learning outcomes:
Lect.: written exam
Lab.: colloquium, protocol, and assessment of laboratory work</td></tr>
<tr><td>4.</td><td colspan="2">Conditions of earning credits:
laboratory:
Lect.: positive exam result
Lab.:
• active participation in laboratory classes;
• positive colloquium and report results.</td></tr>
<tr><td rowspan="5">5.</td><td colspan="2">Student's workload:</td></tr>
<tr><td>Activity</td><td>Number of hours for the activity</td></tr>
<tr><td>Hours of instruction (as stipulated in study programme):
• Lect.: 30 h
• Lab.: 15 h</td><td>45 h</td></tr>
<tr><td>Student's own work:
• reading the literature;
• preparation for the exam;
• preparation of reports;
• preparation for the test.</td><td>45 h</td></tr>
<tr><td>Total number of hours:</td><td>90 h</td></tr>
<tr><td>Number of ECTS:
• Lect.: 2 ECTS
• Lab.: 1 ECTS</td><td>3 ECTS</td></tr>
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