COURSE SYLLABUS

Course code	1070-ICGTE-MSA-107
Course name	Bioconversion of Waste Raw Materials
Course version	2026L
Level of education	second cycle programme
Form and mode of study	full-time study
Study profile	general academic profile
Field of study	Chemical and Process Engineering
Specialisation	Green Technologies in Chemical Engineering
Organizational unit	The Faculty of Chemical and Process Engineering
Implementing unit	The Faculty of Chemical and Process Engineering
Course unit	n/a
Course groups	-
Course status	Obligatory
Language of the course	English
Study stage code	ICZTC-S1-MSA-1070
Number of ECTS credits	2

Part I

01. Learning outcomes and the method of conducting classes	
Learning outcomes	see table "Learning outcomes"
Forms of classes and the number of hours in the semester	
lectures	30.00 h

02. ECTS balance		
Number of ECTS credits	2	
Course workload	**Hours**	**ECTS**
Total number of hours and ECTS credits for the course:		
Hours and ECTS credits for courses involving direct participation of academic teachers	32	1.28
Hours and ECTS credits involving student's independent work	28	1.12
Total	60	2.40 (2.00)
Number of hours involving direct participation of academic teachers:		
Hours connected with class participation	30	
Other synchronous hours	2	
Total	32	
Number of hours involving student's independent work:		
Hours for student's independent work	28	

03. Course content	
lectures	Lectures (30h in total): Introduction. Equilibrium of Earth. Bioprocesses help sustainability. Characteristics of waste materials subjected to bioconversion. Single-cell biomass for feeding. Bioproducts as energy carriers and substitutes for fossil fuels. Production of bioethanol from wastes from the food industry. Bioethanol from lignocellulosic raw materials. Biotechnological production of organic acids. Microbial production of polysaccharides Biotechnological production of amino acids. Enzymes in a sustainable industry. Applicability of biological methods in wastewater treatment. Worldwide variety in clean technologies.

Table: Learning outcomes	
Knowledge	
Outcomes code	P_W05

Part I

Description	The student has theoretically based and well-established knowledge necessary to design processes and apparatuses in the processing industry.
Related field-of-study learning outcomes	K2_W05
Outcomes code	P_W09
Description	The student has knowledge of the directions of development of industrial technologies and the latest achievements in chemical and process engineering.
Related field-of-study learning outcomes	K2_W09
Outcomes code	P_W11
Description	The student has extensive knowledge necessary to understand the social, economic, legal, and non-technical conditions of engineering activities and to consider them in professional practice.
Related field-of-study learning outcomes	K2_W11
Skills	
Outcomes code	P_U01
Description	The student can obtain information from literature, databases and sources, also in a foreign language, in the field of chemical and process engineering, integrate the obtained data, interpret and critically evaluate it, and draw conclusions and formulate and justify opinions.
Related field-of-study learning outcomes	K2_U01
Outcomes code	P_U06
Description	The student can design and implement devices, facilities, systems and processes typical for the processing industry.
Related field-of-study learning outcomes	K2_U06
Social competence	
Outcomes code	P_K04
Description	The student is aware of the social role of a technical university graduate and understands the need to formulate and provide the public with information and opinions on the achievements of technology and engineering and scientific activities in a generally understandable way.
Related field-of-study learning outcomes	K2_K04
Outcomes code	P_K05
Description	The student knows the importance of non-technical aspects and the effects of engineering activities, including their impact on the environment and the related responsibility for decisions made.
Related field-of-study learning outcomes	K2_K05

Part II

04. Year and semester of studies	
Year	2026L
Semester	1

05. Course leader and course teachers	
lectures	Maciej Pilarek
lectures	Maciej Pilarek

06. Course objective

Part II

Course objective	The aim of the lecture is to familiarize students with the specifics of the industrial production of bioproducts as a result of the bioconversion of waste materials using microbial cells (bacteria, yeast, filamentous fungi, microalgae) or by enzymatic catalysis. The biotechnological utilization of waste materials discussed during the lectures is presented as efficient and economically motivated waste management methods generated in various branches of the industry. In sustainable economies, bioconversion processes are implemented as renewable industrial production methods of valuable and economically significant products, including biofuels and other energy carriers, food products, functional feed supplements, and biologically active compounds for the pharmaceutical industry.

07. Teaching methods and techniques	
lectures	Lecture with a multimedia presentation. Written test.

08. Methods of verifying learning outcomes	
Knowledge	
Outcomes code	P_W05
Description	The student has theoretically based and well-established knowledge necessary to design processes and apparatuses in the processing industry.
Verification methods	lectures: written test
Outcomes code	P_W09
Description	The student has knowledge of the directions of development of industrial technologies and the latest achievements in chemical and process engineering.
Verification methods	lectures: written test
Outcomes code	P_W11
Description	The student has extensive knowledge necessary to understand the social, economic, legal, and non-technical conditions of engineering activities and to consider them in professional practice.
Verification methods	lectures: written test
Skills	
Outcomes code	P_U01
Description	The student can obtain information from literature, databases and sources, also in a foreign language, in the field of chemical and process engineering, integrate the obtained data, interpret and critically evaluate it, and draw conclusions and formulate and justify opinions.
Verification methods	lectures: written test
Outcomes code	P_U06
Description	The student can design and implement devices, facilities, systems and processes typical for the processing industry.
Verification methods	lectures: written test
Social competence	
Outcomes code	P_K04
Description	The student is aware of the social role of a technical university graduate and understands the need to formulate and provide the public with information and opinions on the achievements of technology and engineering and scientific activities in a generally understandable way.
Verification methods	lectures: written test
Outcomes code	P_K05

Part II

Description	The student knows the importance of non-technical aspects and the effects of engineering activities, including their impact on the environment and the related responsibility for decisions made.
Verification methods	lectures: written test

09. Required and recommended reading list

Required reading	Andrzej B. Kołtuniewicz Sustainable Process Engineering - Prospects and Opportunities. De Gruyter, Berlin/Boston 2014 (ISBN 978-3-11-030875-5, eISBN 978-3-11-030876-1).
Recommended reading	1. Materials facilitating the preparation of lecture notes provided by the lecturer. 2. Source articles recommended by the lecturer.

10. Other information

Other information	As long as it does not cause changes in the scope of linking a given subject with the learning outcomes specified for the program of study, changes in education content may be introduced continuously, considering the latest scientific achievements.