COURSE DESCRIPTION CARD - SYLLABUS

Course name
Biotechnology for biorefineries [N1IŚrod2>BdB]

Course

Field of study
Environmental Engineering

Year/Semester
4/8

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
10

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
10

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge in environmental engineering, chemistry, environmental and industrial biotechnology, and chemical engineering. Skills: Independent search for valuable information. Reading and comprehending articles and scientific papers. Ability to apply previously acquired knowledge in a new perspective. Basics of teamwork and report writing. Proficiency in using specialized software. Social competencies: Awareness of the need for continuous updating and complementing knowledge and skills.

Course objective

Expansion of knowledge in biorefinery processes for the conversion of biomass and waste into energy, fuels, and chemicals, as well as the applications of fermentation technology. The aim of the course is to develop knowledge in the design, simulation, and modeling of biorefineries, along with basic laboratory skills. The course will be divided into lectures providing theoretical knowledge and exercises (project) using software for bioprocess simulation.

Course-related learning outcomes

Knowledge:
The student has a well-organized and theoretically grounded knowledge of existing biorefinery systems

(lecture). The student has a well-organized and theoretically grounded knowledge of important terms related to the production of substrates for biorefineries (lecture). The student understands the role of properly planned biorefineries (lecture, project). The student understands the impact of poorly planned biorefinery systems (lecture, project). The student is familiar with the basic technologies used in biorefineries (lecture, project). The student understands the fundamentals of long-term assessment of biorefineries (project). The student understands the basics of multi-criteria assessment of biorefineries (project).

Skills:
The student can plan a biorefinery in accordance with the demand (project). The student can design and explain the main unit processes in biorefineries (lecture, project). The student can describe biorefinery technologies and explain the related physical, chemical, and biological processes (lecture, project). The student can describe pre-treatment methods for fractionating waste and biomass (lecture). The student can describe important aspects related to the utilization of resources and emissions associated with individual unit processes in biorefineries and describe their impact on the environment (lecture, project).

Social competences:
The student understands the need for teamwork in solving theoretical and practical problems (project). The student understands the need for dividing competencies in teamwork and the necessity of exchanging information and knowledge in teamwork (project). The student is aware of the necessity of sustainable development in biorefinery systems (lecture). The student sees the need for systematic deepening and expanding of their competencies (lecture, project).

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Individual assessment from lectures and the project. Passing the lectures will involve an examination testing theoretical knowledge in the field of biorefineries and the ability to solve a selected problem related to the appropriate selection of technology. Passing the project: students will be divided into small teams during classes and, based on knowledge from lectures, they will build a techno-economic model and prepare a biorefinery project. The final assessment of the project will be based on the prepared project report, project defense, and activity during classes.

Programme content

Lectures: Introduction to biorefineries. Waste for biorefineries and bioprocesses. Processing and fractionation of biomass. Selected unit processes in biorefineries. Major biotechnological technologies in biorefineries, mainly fermentation processes. Economic and environmental evaluation of biorefineries.
Project exercises: Process simulation (e.g., using SuperPro Designer software): Introduction to software and unit processes, technological design, operational parameters, economic parameters, process evaluation.

Course topics

Lecture Content:
Introduction to biorefineries, waste utilization, biomass processing, unit processes in biorefineries, biotechnological applications, and economic/environmental evaluation.
Project Preparation:
Utilizing SuperPro Designer for process simulation, covering software introduction, schematic design, parameter determination, and process evaluation.

Teaching methods

Lecture: informative and interactive, with multimedia presentation, problem-solving lecture, and engaging. Project: exercise method, problem-based, case study, teamwork, problem-solving, data interpretation, process simulation using tools like SuperPro Designer.

Bibliography

Basic:

Biorefineries - Industrial Prcoesses and Products, Patrick R. Gruber, Michael Kamm, Edited by Birgit Kamm, ISBN-13: 978-3-527-32953-3, 2011
Essentials in Fermentation Technology, Edited by Ayding Berenjian, ISBN: 978-3-030-16230-6, 2019

Additional:
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Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	20	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00