COURSE DESCRIPTION CARD - SYLLABUS

Course name
Environmental biotechnology [N2IŚrod2-ZwWOWiG>BŚ]

Course

Field of study
Environmental Engineering

Year/Semester
1/1

Area of study (specialization)
Water Supply, Water and Soil Protection

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
10

Laboratory classes
18

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge: General understanding of environmental biology and ecology topics at the undergraduate level. Skills: Ability to use literature and self-educate, make observations, and draw conclusions. Social Competences: Awareness of the need for learning, ability to work in a group.

Course objective

Introducing students to the issues of using microorganisms and biotechnological processes in environmental protection and biorefineries. Familiarizing students with the problems of organism metabolism and their role in the cycles of matter and energy.

Course-related learning outcomes

Knowledge:
1. The student has extended and in-depth knowledge of environmental biology and biochemistry useful for formulating and solving complex tasks in environmental engineering. 2. The student has systematic, theoretically grounded general knowledge encompassing elements of biotechnology, environmental biology, and technical microbiology. 3. The student has systematic and theoretically grounded knowledge of existing biorefinery systems (lecture). 4. The student has systematic and theoretically

grounded knowledge of important terms related to the production of substrates for biorefineries (lecture).

Skills:
The student is able to plan and conduct experiments, including measurements in the areas of research systems and process control, including biochemical and microbiological processes at various stages of wastewater treatment and biorefineries. The student can use analytical and experimental methods to formulate and solve engineering tasks and simple research problems in environmental engineering. The student has theoretically grounded detailed knowledge related to: biological wastewater treatment processes, microbiological methods of environmental control. The student can design and explain unit processes in biorefineries (lecture, laboratories). The student can describe biorefinery technologies and explain the related physical, chemical, and biological processes (lecture).

Social competences:
The student is aware of the non-technical aspects and impacts of engineering activities, including their effects on the environment. The student is aware of the responsibility for the decisions made.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

During the exam period, a written test is conducted covering topics discussed in the lectures and laboratory exercises. Throughout the semester, there are consultations with students (1.5 hours/week). The assessment of lecture material and retake exams are in written form. Points for passing the lectures are earned through approximately 20-25 questions, with a maximum of around 20-25 points. Each answer can earn from 0 to 1 point. To pass, students must obtain more than 50% of the maximum points. Detailed criteria for scoring and grading scales are provided before the assessment.

Programme content

The role of biotechnology and biochemistry in environmental engineering. Microorganism metabolism - nutrition and respiration. The role of selected groups of microorganisms in the cycles of matter and energy (nitrification, iron bacteria, manganese bacteria, sulfur bacteria, hydrogen bacteria). Biocatalysts: structure and function of enzymes, mechanism of enzyme action, classification of enzymes. Biotechnologies in environmental protection: bioremediation, biological wastewater treatment, biorefinery concept, bioproduction of energy and fuels, biosensors. Waste for biorefineries and bioprocesses. Selected unit processes in biorefineries. Main biotechnological technologies in biorefineries: enzymatic, fermentation, and thermochemical processes. Laboratory Exercise Topics: 1. Respiration of activated sludge and microscopic analysis of activated sludge. 2. Photosynthesis in algae. 3. Transformation of nitrogen and phosphorus compounds in water and soil. 4. Characterization and preparation of biorefinery substrates. 5. Fermentation processes. 6. Analytical methods and fermentation monitoring.

Course topics

Lecture Content: Biotechnology in Environmental Engineering. Fundamentals of Microorganism Metabolism. Element Cycling Involving Microorganisms. Enzymes and Their Applications. Biorefinery Processes and Production of Biochemicals, Biofuels. Selected Biotechnological Processes in Biorefineries. Laboratory Sessions: Wastewater Treatment Processes Using Activated Sludge. Photosynthesis. Nitrogen and Phosphorus Removal by Bacteria. Fermentation of Selected Organic Waste.

Teaching methods

Teaching Methods: informational lecture, lecture with multimedia presentation, problem-based lecture. Laboratory Sessions: practice-based method, problem-based method, case study, measurement, observation, experiment.

Bibliography

Basic:
1. Michałkiewicz M., Fiszer M. Biologia sanitarna - ćwiczenia laboratoryjne. Skrypt Politechniki Poznańskiej

Biorefineries - Industrial Processes and Products, Patrick R. Gruber, Michael Kamm, Edited by Birgit Kamm, ISBN-13: 978-3-527-32953-3, 2011

Additional:
Essentials in Fermentation Technology, Edited by Ayding Berenjian, ISBN: 978-3-030-16230-6, 2019

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	28	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	47	2,00