COURSE DESCRIPTION CARD - SYLLABUS

Course name
Environmental biotechnology [S2IŚrod2-ZwWOWiG>BS]

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
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr inż. Mateusz Łężyk
mateusz.lezyk@put.poznan.pl

Lecturers

Prerequisites

1;Knowledge: Basic knowledge of the biology. 2.Skills: The ability to use literature and self-education, making observations, drawing conclusions, working in a group. 3.Social competencies: Is aware of the need to learn, able to work in a group.

Course objective

To familiarize students with the use of microorganisms and application of selected biotechnologies for environmental protection. To acquaint students with the metabolism of organisms and their role in the circulation of matter and energy

Course-related learning outcomes

Knowledge:
1. The student has expanded and in-depth knowledge of environmental biology and biochemistry useful for formulating and solving complex tasks in the field of environmental engineering.
2. The student has ordered, theoretically founded general knowledge covering environmental biology, technical microbiology and elements of biotechnology.
3. The student has theoretically grounded detailed knowledge related to: - biological wastewater

treatment processes, - microbiological methods of environmental control.

Skills:
1. The student is able to plan and carry out experiments, including measurements in the field of: systems for research and control processes, including biochemical and microbiological at various stages of wastewater treatment and water production.
2. The student is able to use analytical and experimental methods to formulate and solve engineering tasks and simple research problems in the field of environmental engineering.

Social competences:
1. The student is aware of the non-technical aspects and effects of engineering activities, including its impact on the environment.
2. The student is aware of the responsibility for making decisions.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

During the examination session, a written test is conducted, covering topics discussed in lectures and laboratory exercises.
Throughout the semester, student consultations are available (1.5 hours per week).
The assessment of lecture material and the retake are in written form.
Each answer can earn between 0 and 1 point. To pass, a student must obtain at least 50% of the maximum possible points. Detailed scoring criteria and grading scale are provided before the test.
Attendance at all laboratory classes is mandatory. The classes begin with entry quizzes, and the points earned from these quizzes account for 55% of the final grade.
A report must be prepared for each topic. The reports are assessed, but no points are assigned.
During the last class, a final test will be conducted, accounting for 45% of the final grade.

Programme content

The Role of Biology, Biochemistry, and Biotechnology in Environmental Engineering
Characteristics of Organism Metabolism: Assimilation and dissimilation processes; fundamentals of organism nutrition; autotrophs and heterotrophs.
Nutrition – Energy Sources: Phototrophs and chemotrophs; photosynthesis in bacteria; chemosynthesis and its role in environmental engineering (nitrification, iron bacteria, manganese bacteria, sulfur bacteria, hydrogen-oxidizing bacteria).
Respiration as an Energy Process: The role of ATP as an energy carrier. Types of respiration: aerobic respiration, anaerobic respiration, fermentation – stages and functions. Denitrification, ammonification, sulfate and carbonate reduction. Types of fermentation: alcoholic, butyric, lactic, and propionic.
Matter and Energy Cycles: The circulation of matter in the environment; the carbon cycle in nature; nitrogen, phosphorus, sulfur, and water cycles; the role of microorganisms in element cycling.
Chemical Components of Organisms: Water and its role in organisms. Proteins, lipids, carbohydrates – structure, classification, and function.
Biocatalysts: Structure and function of enzymes, enzyme mechanisms, enzyme classification.
Biotechnology in Environmental Protection: Bioremediation, biological wastewater treatment, the concept of biorefineries, bioproduction of energy and fuels, biosensors.
Laboratory Exercise Topics:
1. Preparation of organic substrates and initiation of the fermentation process.
2. Sample collection and selected analytical methods used in fermentation monitoring.
3. Transformation of nitrogen and phosphorus compounds in water and soil – inoculation.
4. Photosynthesis in algae.
5. Water chlorination to the breakpoint.
6. Respiration and microscopic analysis of activated sludge.

Course topics

none

Teaching methods

information lecture, lecture with multimedia presentation, problem lecture. Laboratories: exercise,

problem, case study, measurement, observation, experiment

Bibliography

Basic:
1. Michałkiewicz M., Fiszer M. Biologia sanitarna - ćwiczenia laboratoryjne. Skrypt Politechniki Poznańskiej, 2011
2. Lampert W., Sommer U. Ekologia wód śródlądowych. Warszawa, PWB, 2001.
3. Kunicki-Goldfinger W. Życie bakterii. Wydawnictwo Naukowe PWN, 2001

Additional:
1. Singleton P. Bakterie w biologii, biotechnologii i medycynie. PWN, 2000.
2. Nicklin J., Graeme-Cook K., Paget T., Killington R.A. Mikrobiologia - krótkie wykłady. PWN, 2000.
3. Zaremba M.L., Borowski J. Mikrobiologia lekarska. PZWL, 2001

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00