COURSE DESCRIPTION CARD - SYLLABUS

Course name
Biotechnology for biorefineries [S2ZE1E>BdB]

Course

Field of study
Green Energy

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

1. Knowledge: Basic knowledge in environmental engineering, chemistry, environmental & indusrtial biotechnology, chemical engineering. 2. Skills: Reading research articles and reports with understanding. Ability to use existing knowledge and its application in a new perspective. Basic principles of working in a group and writing project reports. Basic experience in laboratory wor and ability to use computer software. 3. Social competences Awareness of the need to constansly update own knowledge and skills.

Course objective

Expanding the knowledge in biorefining processes to convert waste and biomass into energy, fuels and commodity chemcials. The objective of the course is to develop a knowledge on biorefinery process design, simulation and modeling along with basic principles in laboratory work. The course will be divided in lectures providing theroetical knowledge, tutorials using process flow simulation sotfware for designing a biorefinery, and laboratory to understand the pricincples behind biotechnological processes.

Course-related learning outcomes

Knowledge:
Student has structured and theoretically founded knowledge of the existing biorefinery systems

(lecture).
Student has structured and theoretically founded knowledge in terms related to the generation of substrates for biorefineries (lecture).
Student knows and understands the role of properly designed biorefinery (lecture, tutorial).
Student knows and understands the consequences of wrongly designed biorefinery system (lecture, tutorial).
Student knows and understands the basic technologies used in biorefiing (lecture, tutorial, laboratory).
Student knows the basics of multi-year assessment of biorefinery (tutorial).
Student knows the basics of multi-criteria assessment of biorefinery (tutorial)

Skills:
Student is able to plan biorefinery in accordance with the demand in the region (lecture, tutorial).
Student is able to design and explain the unit operations in biorefinery (lecture, tutorial, laboratory).
Student can describe the technologies applied in biorefinery and explain the associated physical, chemical and biological processes (lecture, tutorial).
Student can describe pretreatment technologies for important fractions of waste and biomass used as substrates (lecture).
Student can describe important aspects related to resource use and emissions associated with the particular unit operations in biorefinery and describe their impact on the environment and economy. (lecture, tutorial, laboratory).

Social competences:
Student understands the need for teamwork in solving theoretical and practical problems (tutorial, laboratory).
Student understands the different roles in a teamwork and the need for information and knowledge exchange in a group work (tutorial, laboratory).
Student is aware of the need for sustainable development in energy, fuels and chemicals production. (lecture, tutorial).
Student understands the need for a systematic deepening and broadening his/her competences. (lecture, tutorial).

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Joint assessment from lectures, tutorials and laboratory in form of exam:
students will be divided in a small groups and during the line of the course will prepare a smimulation model of a biorefinery. Based on the knowledge from lectures, built model and conducted laboratory exeprcises, the group will prepare a project of a biorefinery and presentin a form of written report. The project will be defended in form of oral presentation in front of lecturers. The final mark will be based on the following criteria: (1) evaluation of the project report (30%), (2) evaluation of the simulation model nd laboratory work (30%), (3) defending the project + general questions (30%), (4) activity (10%) .
Failure of one the above mentioned assessment components disqualifies for the entire course.

Programme content

Lectures: Introduction to biorefineries. Substrates for biorefineries and bioprocessing. Biomass pretreatment and fractionation. Unit operations in biorefineries. Core techonolgies in biorefineries: enzymatic, biological (fermentation, GMM fermetnation, open culture fermentation), chemical, thermochemical. Economic and environmental evaluation mehods for biorefineries.
Tutorials: process simualtion (e.g. with SuperPro Designer software): introduction to software and unit operations, flow diagram design, processes operational parameters, ecomonic parameters, process evaluation.
Laboratory: substrate characterization and preparation, fermentation process, analytical procedures for effluent characterisation

Course topics

none

Teaching methods

Lecture: informative and interactive lecture, lecture with ppt presentation, activation and problem-based lecture.
Tutorial: problem-based, case study, group work, problem solving, data interpretation, process simulation with e.g. SuperPro Designer.
Laboratory: teaching by experimentation.

Bibliography

Basic:
Blanch H.W.., Clark D.C.: Biochemical Engineering. CRC Press, 1997, ISBN 0-8247-0099-6.
Kamm B., Gruber PR., Kamm M.: Biorefineries - industrial processes and products. Wiley-VCH, 2011, ISBN 987-3-527-32953-3

Additional:
TBD

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