Zał. nr 5 do ZW 78/2023

Attachment no. 4. to the Program of Studies

FACULTY OF CHEMISTRY

SUBJECT CARD

Name of subject in Polish **Zaawansowane technologie chemiczne – technologie biorafineryjne dla chemikaliów i paliw**

Name of subject in English : **Advanced Chemial Technologies – Biorafinery technologies for chemicals and fuels**

Main field of study (if applicable): Chemical Engineering and Technology

Specialization (if applicable): Advanced Chemical Technology

Profile: academic

Level and form of studies: 2nd level, full-time

Kind of subject: obligatory

Subject code W03CET-SM2012W, W03CET-SM2012L, W03CET-SM2012S

Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		45		15
Number of hours of total student workload (CNPS)	25		100		25
Form of crediting (Examination / crediting with grade)	exam		crediting with grade		crediting with grade
For group of courses mark (X) final course					
Number of ECTS points	1		4		1
including number of ECTS points for practical classes (P)			4		1
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0,6		1,8		0,6

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

n/a

SUBJECT OBJECTIVES

C1 to familiarize students with biorefinery systems for the production of chemicals
C2 presentation of issues related to fuel production in biorefineries
C3 developing the student's skills in planning and conducting technological and biotechnological processes

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEU_W01 the student has advanced knowledge of modern biorefinery technologies focused on the production of chemicals and fuels

PEU_W02 the student knows the principles of sustainable development in relation to biorefineries

PEU_W03 the student knows the latest trends in the development of biorefinery systems

relating to skills:

PEU_U01student is able to plan and carry out biomass conversion processes towards biofuels

PEU_U02 the student is able to plan and carry out biomass conversion processes towards chemicals

PEU_U03 the student critically processes the information obtained in the field of processes and technologies used in biorefineries, is able to discuss

PEU_U04 the student demonstrates the ability to work in a team

relating to social competences:

PEU_K01 the student is ready to critically evaluate his knowledge

PEU_K02 is aware of the importance of technical and non-technical aspects related to the operation of a biorefinery, also in the context of environmental protection and sustainable development goals

PROGRAMME CONTENT

	Lecture	**Number of hours**
Wy1	Principles of a sustainable biorefinery. Biomass resources for use in biorefineries.	2
Wy2-Wy4	Biorefinery technologies for chemical production Biorefinery approach to the production of industrially important C4, C5 and C6 chemicals	5
Wy4-Wy6	Biorefinery technologies in the production of alternative fuels and energy. Biorefinery production of bioethanol and biomethanol. Oleorefineries. Biogas plants – production and applications of biogas.	5
Wy7	Biochemical and thermochemical microalgae	2
Wy8	Enzymes in biorefinery systems	1
	Total hours	**15**

	Laboratory	**Number of hours**
Lab 1	Occupational health and safety rules, discussion of the conditions for passing the exam	1
Lab 2	Production and characteristics of liquid biofuels	12
Lab 3	Microalgae – a modern raw material in biorefinery systems	8
Lab 4	Conversion of sugars and polysaccharides into chemicals	12
Lab 5	Production and characterization of fine chemicals	12
	Total hours	45

Seminar	**Number of hours**

Se1	Biorefineries in the concept of sustainable development	2
Se2	Levulinic acid – a modern chemical platform	2
Se3	Biofuels – bioethanol, biomethanol	2
Se4	Biofuels – biodiesel	2
Se5	Biodegradable polymers as environmentally friendly materials	2
Se6	Microalgae – a modern raw material in biorefinery systems	2
Se7	Bioactive phytochemicals. Preparation, characteristics and applications.	2
Se8	Summary discussions	1
	Total hours	15

TEACHING TOOLS USED

N1. Multimedia presentation
N2. Discussion
N3. Case study
N4. Laboratory instructions

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
F1=P (lecture)	PEU_W01-PEU_W03, PEU_K01	Exam result (50% of points required to pass) + 10% for activity (possibility of increasing the grade by 0.5)
F2=P (laboratory)	PEU_U01, PEU_U02, PEU_U04, PEU_K01	Grades from reports, evaluation of laboratory work, activity
F3=P (seminar)	PEU_U03, PEU_U04, PEU_K01, PEU_K02	Quality of presentation, assessment of individual and group work

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Biorefineries: Production of Fuels and Platform Chemicals, Wiley&Sons 2024, ISBN-13: 9781119724728
[2] Biorefinery: A Sustainable Approach for the Production of Biomaterials, Biochemicals and Biofuels, Springer 2023
[3] Biorefinery Integrated Sustainable Processes for Biomass Conversion to Biomaterials, Biofuels, and Fertilizers, Springer 2019

SECONDARY LITERATURE:

[1] Specialized literature provided by the teacher at the beginning of the class
[2] Laboratory instructions

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Team of lecturers