UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Study programme

Field of study: bioeconomy

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Field of study characteristics

Basic information

Field of study:	bioeconomy
Study level:	First-cycle (engineer) programme
Study profile:	General academic
Study form:	Full-time
Professional title awarded to graduates:	
Study duration (number of semesters):	7
Number of ECTS points required to complete the study programme:	210
Number of hours (including ones completed through remote learning methods and techniques):	2664 (10)
Number of hours for physical education classes*:	60

*) - applies to first-cycle programmes and long-cycle programmes

Assignment of field of study to disciplines:

Discipline	Percentage share	ECTS
Environmental engineering, mining and energy	100%	210

Graduate's profile

A graduate of the 1st degree studies in Bioeconomy has advanced knowledge in circular economy, biorenewable systems, bioproducts, bioreactors, and biorefineries, chemistry and bioorganic chemistry, biotransformation, microbiology, and process engineering. The graduate knows the graphic and computer design techniques and is able to use the GIS tools that are applied in bioeconomy. He/she is able to select the appropriate materials and equipment for the technologies used in bioeconomy. The graduate also possesses basic knowledge and skills related to the processing of raw materials of animal and plant origin and modern analytical methods used in bioeconomy. He/she is project-oriented and is able to work in a team. The graduate knows the principles of the protection of intellectual property and is able to start an enterprise. He/she possesses the knowledge related to bioeconomy, rational use of environmental resources, engineering in bioproduction, process engineering, environmental engineering, the logistics of the supply chain, and economy in the New Green Deal. The graduate is well prepared to establish and manage companies and to take up employment in the Bio-Based Industry sector, in newly created enterprises (including their own), which operate in the widely understood sustainable economy, in consulting and educational companies in the bioeconomy sector, in analytical, research, and diagnostic laboratories, in national and local public administration, in NGOs that operate in the bioeconomy sector and generate related knowledge in this area, in enterprises that deal with the manufacturing, transport, and distribution of bioproducts. The graduate may apply to enrol in 2nd degree studies, and start a postgraduate studies programme.

Duration (number of hours and ECTS points), rules and form of internships

The students complete the mandatory internship after the 6th semester of studies. The internship lasts 4 weeks (160 hours) and is completed at manufacturing companies, institutions, and laboratories connected with the Bio-Based Industry sector. After completing the internship, the student receives 6 ECTS points. The aim of the internship is to familiarise the students with all the issues related to the production and the functioning of facilities that apply the principles of bioeconomy, or the functioning of institutions and laboratories that are related to the industry based on bioeconomy, or in self-government institutions, and to prepare the students for performing professional duties after graduation. These objectives are achieved by means of learning about the specificity of individual departments of the facility or the procedures and processes used in institutions or laboratories connected with the bioeconomy industry, as well as through the work performed by the student at the given entity. The internship takes place pursuant to: - an agreement on the realisation of internships concluded

between the University and the Facility, - contract of mandate, - employment contract, - other types of contracts. The facility/institution/laboratory that organises the internship is responsible for appointing a competent internship supervisor, for conducting the internship according to schedule, for the organisation of worktime and supervision of the activities performed by the Student. On the last day of the internship, the student is evaluated by the internship supervisor on part of the work establishment. The learning outcomes achieved by the student are verified and assessed by an academic teacher designated by the Internship Proxy. The final result of completing the internship is the average of the grade assigned by the internship supervisor at the Facility and the teacher at the University.

Principles/Organisation of the degree awarding process

The process of granting the diploma consists of preparing the engineer's thesis and the examination. The thesis is completed under the supervision of an academic teacher who holds at least a doctor's degree. The Dean may authorise a specialist from outside the University who holds at least a doctor's degree, to supervise the thesis. The subject of the thesis should be agreed at least half a year before graduation. In justified cases, the subject may be modified by the Dean on request of the supervisor, subject to approval of the Programme Council. After completing all classes and lectures in the programme of studies, with the exclusion of the engineer's thesis and engineer's examination, the student enters the engineer's thesis into the APD system. The supervisor checks the file entered into the system and approves it or rejects it. If the thesis has been rejected, the student, upon agreement with the supervisor, corrects it and enters it into the APD system again, at the same time entering it into the anti-plagiarism system. Based on the General Report and Detailed Report generated in the APD system, the supervisor verifies whether the thesis does not contain any unauthorised borrowings and whether the properly marked borrowings (citations) in the thesis do not raise any doubts whether the work was performed by the student independently. If the reports do not raise any objections, the supervisor approves them and submits the thesis for review. If the thesis exceeds the permissible similarity coefficients, the anti-plagiarism procedure is initiated, in compliance with the binding Ordinance of the Rector. The engineer's thesis is assessed by the supervisor and one reviewer who hold at least a doctoral degree, provided that, if the supervisor holds a doctoral degree, the reviewer must have the degree of habilitated doctor. In order to be accepted to take the engineer's examination, the student has to receive positive grades for the thesis and file the required documents at the Dean's office. The engineer's examination takes place on the date scheduled by the Dean, in compliance with the binding Rules of Studies, before an examination committee appointed by the Dean. The committee is composed of the Chairperson (the Dean or an authorised academic teacher) and at least three teachers representing the discipline, to which the given field of studies belongs. The Dean may extend the committee by appointing representatives of the business environment. The engineer's examination is an oral examination. The student answers three questions, one from each thematic block: Bioproducts and their manufacturing, Biorenewable processes, environmental protection in bioeconomy. The final result of the studies is calculated in compliance with the provisions of the binding Rules of Studies.

ECTS

The number of ECTS points a student receives for courses requiring direct participation of academic teachers or other tutors, as well as students	107
The number of ECTS points the student receives in the humanities or social sciences **	15
The number of ECTS points a student receives for elective courses	76
The number of ECTS points allocated to courses related to the academic activity conducted at the institution in the discipline or disciplines to which the field of study is assigned	119
Number of ECTS points allocated to practical skill courses	

**) - applies to fields of study other than those assigned to the disciplines of humanities and social sciences

Allowable ECTS point deficit after each semester

Semester	Deficit	Comment
1	8	
2	1	
3	8	
4	8	
5	7	
6	7	
7	0	

Subject sequences

Semester	Name of the subject being implemented	Name of the preceding subject
3	Bioorganic chemistry	Chemistry
3	Insects as a food source	Chemistry
4	Biotechnological processes	Chemistry
5	Packages management	Chemistry
5	Recykling	Chemistry
6	Metorology and climatology	Mathematics and statistics

Learning outcomes

Knowledge

Code	Contents
IBE_P6S_WG01	the graduate knows and understands at an advanced level issues in the field of biology, chemistry, microbiology and related sciences useful for understanding and interpreting processes related to the bioeconomy
IBE_P6S_WG02	the graduate knows and understands issues in the field of mathematics, statistics used in formulating and solving simple tasks in the area of bioeconomy
IBE_P6S_WG_03	the graduate knows and understands at an advanced level issues in the field of water and sewage management, waste management and non-waste management
IBE_P6S_WG04	the graduate knows and understands at an advanced level issues in the field of key issues in the field of environmental protection, including the sustainable use of natural resources
IBE_P6S_WG05	the graduate knows and understands at an advanced level the issues of biotransformation, biorefining, bioconversion and the use of biomass and byproducts in the bioeconomy
IBE_P6S_WG06	the graduate knows and understands the knowledge of meteorology and climatology, protection and pollution of the atmosphere
IBE_P6S_WG07	the graduate knows and understands at an advanced level issues in the field of process engineering, including fluid mechanics, thermodynamics, rheology
IBE_P6S_WG08	the graduate knows and understands at an advanced level issues in the field of methods, techniques, tools and materials used for the purification, identification and characterization of bioproducts
IBE_P6S_WG09	the graduate knows and understands at an advanced level issues in the field of sustainable production, processing and use of raw materials in the bioeconomy
IBE_P6S_WG10	the graduate knows and understands at an advanced level issues in the field of construction, functions, how to use devices and technical systems used in production processes
IBE_P6S_WG11	the graduate knows and understands at an advanced level issues in the field of design and operation of bioreactors and biorefineries
IBE_P6S_WG12	the graduate knows and understands at an advanced level issues in the field of information technology, the basics of design and programming
IBE_P6S_WG13	the graduate knows and understands the rules that allow to predict the development of technology and innovation in the bioeconomy
IBE_P6S_WG14	the graduate knows and understands at an advanced level research methods, methods of use and evaluation of biomaterials and bioproducts
IBE_P6S_WG15	the graduate knows and understands the sources of scientific and technical-engineering information, has knowledge of new techniques and technologies used in bioeconomy; knows the rules of writing diploma theses, including using the works of other authors and preparing multimedia presentations and public speeches, knows the specialist terminology needed to prepare a diploma thesis
IBE_P6S_WG16	the graduate knows and understands at an advanced level the enzymatic, microbiological, physical, chemical and biological processes used in the bioeconomy
IBE_P6S_WG17	the graduate knows and understands at an advanced level the principles, methods and technologies of environmental monitoring, adaptation to climate change, the principles of sustainable development and product life cycle assessment
IBE_P6S_WG18	the graduate knows and understand the basic methods of supply chain design, including the use of artificial intelligence methods
IBE_P6S_WG19	

Code	Contents
IBE_P6S_WK01	the graduate has the knowledge necessary to understand the social, economic and legal principles of running a business
IBE_P6S_WK02	the graduate has basic knowledge in the field of intellectual property protection, copyright and knows the rules of commercialization
IBE_P6S_WK03	the graduate knows the basic methods used in design thinking

Skills

Code	Contents
IBE_P6S_UU01	the graduate has the ability to define the directions of further learning in order to improve professional competences
IBE_P6S_UW01	the graduate has the ability to search, understand, analyze and use information about bioeconomy in a creative way
IBE_P6S_UW02	the graduate has the ability to communicate using various techniques in a professional environment in the field of bioeconomy also in the language at the B2 level of the European System for the Description of Languages.
IBE_P6S_UW03	the graduate has the ability to prepare an engineering study (along with a presentation) in the field of bioeconomy
IBE_P6S_UW04	the graduate has the ability to use selected computer programs for design, data processing, analysis and graphic presentation
IBE_P6S_UW05	the graduate has the ability to solve interdisciplinary engineering tasks, also working in a group, using analytical, simulation and experimental methods in the field of bioeconomy
IBE_P6S_UW06	the graduate has the ability to test hypotheses related to simple research problems related to the bioeconomy, skilfully interprets the obtained results and formulates conclusions
IBE_P6S_UW07	the graduate has the ability to assess the usefulness and possibilities of using new achievements in the field of bioeconomy
IBE_P6S_UW08	the graduate has the ability to make a preliminary economic analysis of the engineering activities undertaken and the profitability of simple production processes
IBE_P6S_UW09	the graduate has the ability to identify threats, both theoretical and practical, processes taking place in the bioeconomy and has the preparation necessary to work in an industrial environment
IBE_P6S_UW10	the graduate recognizes non-technical aspects, including environmental, organizational, social, economic and legal when formulating and solving engineering tasks
IBE_P6S_UW11	the graduate has the ability to assess the suitability of appropriate analytical methods and laboratory techniques to assess the physical, chemical and biological properties of raw materials and products produced and used by the bioeconomy
IBE_P6S_UW12	the graduate has the ability to choose the conditions for conducting typical unit processes related to the processing of bioproducts and to estimate the demand for energy and raw materials in these processes
IBE_P6S_UW13	the graduate has the ability to use basic measurement methods to control the course of processes characteristic of the bioeconomy
IBE_P6S_UW14	the graduate has the ability to select typical devices and apparatus used in the bioeconomy
IBE_P6S_UW15	the graduate has the ability to design and optimize technological processes and supply chains used in the bioeconomy, taking into account the principles of process safety
IBE_P6S_UW16	the graduate has the ability to make a critical analysis of the functioning of the existing technical solutions, in particular systems, processes, services, devices and facilities

Code	Contents
IBE_P6S_UW17	the graduate has the ability to select water treatment and renewal technologies, wastewater treatment, use of sludge and residual materials
IBE_P6S_UW18	the graduate has the ability to apply the principle of rational management of natural resources

Social competence

Code	Contents
IBE_P6S_KK01	the graduate understands the need for development, updating his knowledge, knows the possibilities of developing professional and interpersonal competences and consulting experts
IBE_P6S_KO01	the graduate is responsible for his / her own work and the consequences of the decisions made
IBE_P6S_KO02	the graduate is able to correctly define the priorities for the implementation of tasks set, by himself or others, and to ensure their timely implementation
IBE_P6S_KO03	the graduate is ready to be ready to undertake economic undertaking
IBE_P6S_KO04	the graduate is ready to bear social, professional and ethical responsibility for the state of the environment
IBE_P6S_KR_01	the graduate is able to correctly identify and resolve dilemmas related to the profession of an engineer; is aware that the result of the engineer's activity depends on the correct recognition of the problem; adheres to the principles of professional ethics and personal culture and requires it from others

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Economics

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I1HSO.3367.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 1	graded credit **Activities and hours** lecture: 30	2.0

Goals

C1	The course aims to familiarize students with the general issues of micro and macroeconomics.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the graduate has the knowledge necessary to understand the social, economic and legal principles of running a business	IBE_P6S_WK01	test
Skills – Student can:			

U1	the graduate has the ability to make a preliminary economic analysis of the engineering activities undertaken and the profitability of simple production processes	IBE_P6S_UW08	test
Social competences – Student is ready to:			
K1	the graduate understands the need for development, updating his knowledge, knows the possibilities of developing professional and interpersonal competences and consulting experts	IBE_P6S_KK01	test

Balance of ECTS points

Activity form	**Activity hours***	
lecture	30	
lesson preparation	15	
exam / credit preparation	10	
consultations	3	
exam participation	2	
Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 35	**ECTS** 1.2

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Economics as a science 2. Market and market equilibrium. Elasticity of demand and supply 3. The theory of consumer choice 4. Production decisions. Basic market models 5. Work, land, capital 6. The role of the state in the economy 7. Basic macroeconomic data 8. Unemployment and inflation 9. Money and monetary policy. 10. State budget and fiscal policy. 11. Foreign trade and exchange rate 12. Economic growth and development 13. Business cycle 14. Globalization of economic processes 15. Final test	lecture

Course advanced

Teaching methods:

lecture, discussion, situation-based learning, problem-solving method, educational film, brainstorming, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	test	100.00%

Entry requirements

Basic knowledge of mathematics

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Mathematics and statistics

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I1AO.3368.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** general subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 1	graded credit **Activities and hours** lecture: 30, practical classes: 30	5.0

Goals

C1	To acquaint students with the methods of mathematical and statistical description of simple relationships occurring in practice.
C2	Improving problem solving skills with the use of known mathematical tools.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows and understands the methods and their limitations in the field of analytical description of issues in the bioeconomy.	IBE_P6S_WG02	written credit, test, participation in discussion, case study

Skills – Student can:			
U1	The graduate has the ability to search, understand, analyze, process and infer on the basis of information on the bioeconomy.	IBE_P6S_UW01	observation of student's work, test, participation in discussion, case study
U2	The graduate has the ability to construct, test and conclude on the basis of statistical hypotheses describing simple problems related to the bioeconomy.	IBE_P6S_UW06	observation of student's work, test, participation in discussion, case study
Social competences – Student is ready to:			
K1	The graduate is responsible for his / her own work and the effects of decisions made in the context of systematic work within the course implementation.	IBE_P6S_KO01	observation of student's work

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
practical classes	30
lesson preparation	30
exam / credit preparation	6
class preparation	30
consultations	6
collecting and studying literature	10

Student workload	**Hours** 142	**ECTS** 5.0
Workload involving teacher	**Hours** 66	**ECTS** 2.4
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Power function, polynomial function: graphs, exponentiation formulas 2. Exponential function: formulas, graphs 3. Logarythmic function: formulas, graphs 4. Logistic function and other functions with applications 5. Limit of a function, derivative of a function 6. Monotonicity and extremes of one variable functions 7. Basic statistical concepts: population, sample, sampling methods 8. Descriptive statistics - measures of position 9. Descriptive statistics - measures of variability 10. Confidence interval for the mean 11. Statistical hypotheses 12-13. Linear regression analysis, goodness of fit measures 14-15. Forecasting, forecast errors	lecture
2.	1. Solving practical problems with the use of properties and operations on elementary functions. 2. Solving simple, practical optimization problems. 3. Analysis of practical problems with the use of simple statistical hypotheses. 4. Solving practical problems with the use of regression analysis.	practical classes

Course advanced

Teaching methods:

Blended learning, classes, lecture, teamwork, problem-solving method, text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	20.00%
practical classes	observation of student’s work, test, participation in discussion, case study	80.00%

Additional info

Written credit for the lecture at the last class.

Entry requirements

Mathematics at the level of secondary school certificate.

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Programming principles

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I1AO.3369.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** general subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 1	graded credit **Activities and hours** lecture: 15, laboratory classes: 30	4.0

Goals

C1	To introduce students to the basics of the Python programming language to enable them to independently carry out typical engineering calculations
C2	To impart knowledge regarding various data structures and the use of a programming language to manipulate them
C3	Make the audience aware of the problems resulting from the amount of information engineers have to process and show solutions to facilitate their analysis

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Student knows and understands Python programming language, which enables him to solve engineering problems	IBE_P6S_WG12	written credit
Skills – Student can:			
U1	Student can independently prepare a program to automate his work	IBE_P6S_UW04	project, performing tasks
Social competences – Student is ready to:			
K1	The student is willing to expand his knowledge using the fundamentals of programming	IBE_P6S_KK01	project

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
laboratory classes	30
exam / credit preparation	10
consultations	2
project preparation	30
class preparation	30

Student workload	**Hours** 117	**ECTS** 4.0
Workload involving teacher	**Hours** 47	**ECTS** 1.8
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	Lecture 1 What is an Interactive shell, types of data in programming, storing values in variables, your first program Lecture 2 Dissecting your Program, understanding basic structures of my program Lecture 3 Flow control statements (boolean, if statement) Lecture 4 Flow control statements (while, for) Lecture 5 Importing modules (different group of functions) Lecture 6 How to create my own function, function parameters, return options Lecture 7 Introducing lists and how to work with them Lecture 8 Dictionaries, creating own data structures Lecutre 9 Working with time, how to measure it Lecture 10 Data visualization Lecture 11 Files and exceptions Lecture 12 How to use online data for analysis Lecture 13 Classes, How to create an object that represent real-world things Lecture 14 How to test my self ideas Lecture 15 Working with API, collaboration and version control system	lecture

2.	1. Using Python programming environment 2. Preparation of script programs that perform ad-hoc calculations (part 1) 3. Preparation of script programs that perform ad-hoc calculations (part 2) 4. Implementation of calculation programs on geometric topics (areas of figures, volumes of solids, centers of mass) 5. Transformation of data sets formats (part 1) 6. Format transformations of data sets (part 2) 7. 7. Time series analysis. 8. Implementation of programs supporting equation solving 9. Finding approximate values of functions 10. How to visualise data (part 1) 11. How to visualise data (part 2) 12. Implementation of the program automating problems concerning bioeconomy (project part 1) 13. Implementation of the program automating problems concerning bioeconomy (project part 2) 14. Implementation of the program automating problems related to bioeconomy (project part 3)	laboratory classes

Course advanced

Teaching methods:

Problem Base Learning, classes, lecture, discussion, computer lab/laboratory, teamwork, brainstorming, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	40.00%
laboratory classes	project, performing tasks	60.00%

Entry requirements

The course will enable the student to get acquainted with the basics of programming in the Python language

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Chemistry

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I1AO.0359.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** general subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 1	exam **Activities and hours** lecture: 30, laboratory classes: 30	5.0

Goals

C1	Knowledge acquisition in the extend necessary to understand phenomena occurring in engineering processes.
C2	Obtaining knowledge allowing for basic description of chemical and physicochemical phenomena and processes used in basic chemical technologies.
C3	Acquiring the ability for proper and effective application the learned principles and laws of chemistry to the analysis of engineering issues.
C4	Acquiring the ability to perform elementary chemical calculations necessary for the understanding and proper conduct of technological processes.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods

Knowledge – Student knows and understands:			
W1	Is aware of the chemical and physicochemical properties of matter.	IBE_P6S_WG01	written exam
W2	Is aware of the basic principles of the reactions and chemical processes.	IBE_P6S_WG01	written exam, performing tasks
W3	Knows the basics of chemical calculations for aqueous solutions.	IBE_P6S_WG16	written exam, performing tasks
Skills – Student can:			
U1	Is able to search and analyze chemical information necessary for the basic description of the process.	IBE_P6S_UW01	written exam, performing tasks
U2	Is able to predict the directions and nature of chemical and physicochemical changes.	IBE_P6S_UU01, IBE_P6S_UW01, IBE_P6S_UW05	written exam, performing tasks
U3	Is able to distinguish chemical features of technological processes and describe them.	IBE_P6S_UW03	written exam
Social competences – Student is ready to:			
K1	Is able to relate and present the threats to the natural environment and the human environment resulting from the chemistry of materials and substances.	IBE_P6S_KK01, IBE_P6S_KO04	performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
laboratory classes	30
lesson preparation	30
exam participation	2
exam / credit preparation	35
consultations	6

Student workload	**Hours** 133	**ECTS** 5.0
Workload involving teacher	**Hours** 68	**ECTS** 2.5
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	Lec1 Basic concepts and units, quantity, water solutions, concentration and activity of a component, pH, weak and strong electrolytes, gas solutions, the equilibrium constant of the reaction for gas and water solutions. Lec2 Buffer solutions, hydrolysis, solubility and solubility product. Lec3 Theories of atomic structure, elementary particles, electronic structure of an atom, expansion of electron shells, elements, periodic table of elements, ionization energy, electronegativity, polarizability, atomic radius, extension of the electronic structure and position in the periodic table, atomic and molecular orbitals, orbitals hybridization, free electron pairs and their importance, dipo Lec4 Gases, liquids, solids, types of bonds, covalent and ionic bonds, metallic, weak (intermolecular) interactions, hydrogen bond, water, solid and its structure, crystallography, defects in crystals, ionic rays, electrical conductivity of ionic crystals, solids electrolytes. Lec5 The energy effect of a reaction, chemical equilibrium, active complex and the role of a catalyst, reaction kinetics, order of reaction, speed of a complex chemical process. Lec6 Elements of chemical thermodynamics, free enthalpy, chemical equilibrium constant and the change of free enthalpy, specific heat, phase transitions. Lec7 Phase equilibria, phase equilibrium diagrams, eutectic systems, congruent and incongruent melting compounds, azeotrope, distillation (rectification), crystallization. Lec8 Solutions, colloidal systems, suspensions, structure and properties of colloidal particles, electrokinetic phenomena, surface phenomena. Lec9 Coordination compounds (complex), donor-acceptor bond, central ion, ligands and their types, equilibria in solutions of complex compounds, the importance of complexes in sediment solubility. Lec10 Oxidation and reduction in cells, half-cell and oxidation-reduction reaction, half-cell potential, electrochemical series, cells, dependence of half-cell potential on reagent concentrations (reaction quotient), electrolysis, types of cells. Lec11 Chemical energy conversion processes into electricity, energy storage (lead batteries, fuel cells - types and chemical reactions), electrochemical corrosion, electrochemical protection. Lec12 Operation of pH indicators - litmus / universal paper, dyes used in acid-base measurement. Automatic ion concentration measurement systems (ion-selective electrodes), discussion of the process of ion group determination (group analysis). Lec 13 Review of instrumental analysis methods - discussion of the physicochemical foundations of such processes: absorption and emission spectroscopy, IR (FT - ATR), Raman Lec14 Review of instrumental analysis methods - discussion of the physicochemical foundations of such processes: chromatographic methods, mass spectrometry, NMR, EPR Lec15 Basic characteristics of s- and p- as well as d- and f- electron elements. Chemical compounds, characteristics of properties.	lecture

2.	Lab1 Introduction, discussion of the scope of exercises and health and safety rules in a chemical laboratory. Performing determinations: pH, conductivity, color and turbidity of a water sample. Lab2 Performing the determinations: general alkalinity, total hardness, calcium, magnesium. Lab3 Performing the determinations: basicity F, total iron, manganese and aluminum. Lab4 Determination of: ammoniacal nitrogen, nitrite nitrogen and nitrate nitrogen, chlorides. Lab5 Determination of: phosphates (based on the prepared calibration curve) and dry residue (1) Lab6 Determination of: oxidisability, dissolved oxygen, dry residue (2) Lab7 Determination of BOD5 (1) Lab8 Determination of BOD5 (2) Lab9 Determination of: fluorides, sodium, potassium and sulphates Lab10 Electrolyte balance, water quality decision	laboratory classes

Course advanced

Teaching methods:

lecture, participation in research, presentation / demonstration, problem-solving method

Activities	Examination methods	Percentage in subject assessment
lecture	written exam	65.00%
laboratory classes	performing tasks	35.00%

Entry requirements

Has the knowledge and skills required for studying in the specified field

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Information Technologies

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I1AO.0947.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** general subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period Semester 1	**Examination** graded credit **Activities and hours** laboratory classes: 30	**Number of ECTS points** 2.0

Goals

C1	The aim of the course is to develop critical thinking in the context of using information technology.
C2	The aim of the course is to integrate information technology with environmental knowledge for the bioeconomy
C3	The aim of the course is to encourage students to work effectively in the cloud in teams and individually
C4	The aim of the course is to develop an understanding of professional responsibility in society in the context of using and processing information.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student knows and understands the concepts of information and communication technology, indicates and recognizes services in the information media,	IBE_P6S_WG12	test
W2	The student knows and understands the rules of using spreadsheets, word processors, raster graphics tools and vector graphics tools.	IBE_P6S_WG12	test
W3	The student knows and understands the principles of database design and operation and lists examples of the use of specialized software in their field of education.	IBE_P6S_WG12	test
Skills – Student can:			
U1	the student creatively uses information from internet sources,	IBE_P6S_UW01, IBE_P6S_UW04	project
U2	he learns and works in the cloud (cloud computing). Uses the programs in the package in an extended range MS Office and similar internet applications for the purpose of presenting and processing information. It does from online databases.	IBE_P6S_UW01, IBE_P6S_UW05	project
U3	The student is able to choose the graphic software to be made professional media presentations with respect for intellectual property. He analyzes, under supervision, problematic issues in terms of the use of IT tools to solve a specific problem and justify selection of IT tools	IBE_P6S_UW04, IBE_P6S_UW16	project
Social competences – Student is ready to:			
K1	Is willing to recognize professional and ethical responsibilities for the use and processing of information, its effects the impact on the environment and associated with it responsibility for decisions made.	IBE_P6S_KO04, IBE_P6S_KR_01	project

Balance of ECTS points

Activity form	**Activity hours***
laboratory classes	30
presentation/report preparation	20
consultations	10

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 40	**ECTS** 1.5
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Information Technology is a blended learning course on the Moodle platform. The course includes four modules for individual work divided into thematic blocks: • Module 1: Information Technology Fundamentals, (interface of user's, word processing, open source software). Word processor, spreadsheet. • Module 2:, database, presentation of the content. Internet databases. • Module 3: Information society- collaborative society. Copyright. Internet of Things. • Module 4: Computer graphics: vector and raster, 2D and 3D • Module 5/topic/separate online course for teamwork.	laboratory classes

Course advanced

Teaching methods:

Blended learning, teamwork, project-based learning (PBL), brainstorming

Activities	Examination methods	Percentage in subject assessment
laboratory classes	project, test	100.00%

Additional info

M1] BLOCK 1 open source programming BLOCK 2 Text Editor,, BLOCK 3. Spreadsheet; [M2] BLOCK 1 Databases, BLOCK 2. Data presentation, BLOCK 3. Internet databases (library databases, GUS databases, Geoportal, Geoportal KZGW / Polish Waters); [M3] BLOCK 1. Copyright. BLOCK 2. Licenses, BLOCK 3 Collaborative society, BLOCK 4. Internet of Things; [M4] BLOCK 1. Raster graphics, BLOCK 2. Vector graphics, BLOCK 3. 3D modeling, BLOCK 3. 3D modeling. [M5] Teamwork During the course students work in the teams, on the basis of project work. They realize 3-minute film (Animated / documentary / fictional / educational film). The exercise includes: team building, leader choosing, determination and allocation of roles/function between members of the group, scriptwriting, storyboard creating with choice of music/sound, filming, editing. During teamwork students use various applications from special word processing software application to applications of storyboards and animations. The choice of techniques and methods is unlimited.

Entry requirements

Training in the use of e-learning platform.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Man and environment

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I1BO.3370.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 1	graded credit **Activities and hours** lecture: 30, project classes: 30	4.0

Goals

C1	The aim is to familiarize students with the impact of humans on the environment, the consequences of this impact and possible countermeasures

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student knows and understands at an advanced level the issues of human impact on animate and inanimate components of the environment, human impact on climate changes, natural resources and habitats, and knows the issues of sustainable use of natural resources	IBE_P6S_WG04	written credit
Skills – Student can:			
U1	The student has the ability to apply the assessment of human impact on the environment and its effects, knows how to apply the principles of rational management of natural resources	IBE_P6S_UW18	project
Social competences – Student is ready to:			
K1	The student is ready to bear social, professional and ethical responsibility for the state of the environment, and to undertake activities minimizing human impact on the environment	IBE_P6S_KO04	project

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
presentation/report preparation	20
project preparation	30
exam / credit preparation	10

Student workload	**Hours** 120	**ECTS** 4.0
Workload involving teacher	**Hours** 60	**ECTS** 2.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Human impact on the environment over the centuries. Global environmental problems, climate change, droughts, floods, land degradation, loss of biodiversity, deforestization. The influence of industry and agriculture on the environment. The development of the human population and the pollution and degradation of the environment. Forms of nature protection. Protection of biodiversity. Sustainable management methods for the natural environment. Environmental protection technologies.	lecture

2.	A project of the concept of local activities aimed at implementing the principles of sustainable development, developed using the PBL method.	project classes

Course advanced

Teaching methods:

problem-solving method, classes, lecture, discussion, project-based learning (PBL), educational film, brainstorming, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	project	50.00%

Entry requirements

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UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Bioeconomy principles

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I1BO.3371.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 1	exam **Activities and hours** lecture: 30, project classes: 30	4.0

Goals

C1	The aim of the education is to present knowledge and transfer skills and competencies covering the implementation and development of bioeconomy, including closing supply chains, creating waste-free energy self-sufficient bio-refinery systems, application of advanced IT systems, and creating new solutions in the field of bioeconomy both at the level of households, local and supra-regional structures.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student knows and understands at an advanced level selected issues in the field of chemistry, biochemistry, and biology necessary to understand the processes used in bioeconomy	IBE_P6S_WG01	written exam, project
W2	The student knows and understands at an advanced level selected issues in the field of bioeconomy	IBE_P6S_WG_03	written exam, project
W3	The student knows and understands at an advanced level selected issues in the field of the functioning of the bioeceonomy in the natural environment, its threats, and protection in a global society	IBE_P6S_WG09	written exam, project
Skills – Student can:			
U1	The student is able to obtain information about bioeconomy from literature, databases, and other sources; is able to integrate the obtained information, interpret it, as well as draw conclusions and formulate and justify opinions	IBE_P6S_UW01	project, participation in discussion
U2	The student is able to prepare and present a short presentation on the results of an engineering task related to bioeconomy	IBE_P6S_UW03	presentation
U3	The student is able to independently and in a team plan and performs research and design tasks related to the bioeconomy	IBE_P6S_UW05	project, active participation, presentation, participation in discussion
Social competences – Student is ready to:			
K1	The student is ready to recognize the special responsibility of an engineer dealing with bioeconomy for the quality of human life and the condition of the natural environment	IBE_P6S_KR_01	project, participation in discussion
K2	The student is ready to accept responsibility for their own work and to submit to the rules of teamwork and responsibility for jointly performed tasks	IBE_P6S_KO01	project, active participation, participation in discussion

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
presentation/report preparation	10
project preparation	30
exam participation	2
collecting and studying literature	18

Student workload	**Hours**	**ECTS**
	120	4.0

Workload involving teacher	**Hours** 62	**ECTS** 2.1
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	• Introduction, the concept of bioeconomy, goals of bioeconomy • Chemical, biological and physical processes in the bioeconomy • The concept of closing the supply chain • Factors favoring the development of bioeconomy • Bio-refineries • Waste-free systems • Renewable biosystems • Ways of creating scenarios and development paths of selected technologies in the field of bioeconomy • Inventions and innovations in the bioeconomy	lecture
2.	Problem-based classes in the field of analysis of opportunities and barriers to the development of bioeconomy in Poland - Problem-Based Learning. Problem-based classes in the field of developing a new product in accordance with the idea of bioeconomy, taking into account the environmental safety aspect of the newly introduced product - Problem-Based Learning. Classes in the field of biorefinery design and management - Problem-Based Learning. Discussion on the future challenges in the bioeconomy, taking into account the use of artificial intelligence solutions	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, presentation / demonstration, problem-solving method, brainstorming

Activities	Examination methods	Percentage in subject assessment
lecture	written exam	50.00%
project classes	project, active participation, presentation, participation in discussion	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Semestral project 1

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I1BO.3372.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period Semester 1	**Examination** graded credit **Activities and hours** project classes: 45	**Number of ECTS points** 4.0

Goals

C1	The aim is to familiarize students with the possibilities of creative solving problems in the field of environmental protection and bioeconomy based on teamwork and case studies.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows and understands the principles of creative problem solving in the field of environmental protection and bioeconomy.	IBE_P6S_WK03	project
Skills – Student can:			

U1	The student has the ability to apply the principle of rational management of natural resources when solving problems in the field of environmental protection and bioeconomy.	IBE_P6S_UW18	project
Social competences – Student is ready to:			
K1	The student is ready to assume social, professional and ethical responsibility when solving problems in the field of environmental protection and bioeconomy.	IBE_P6S_KO04	project

Balance of ECTS points

Activity form	**Activity hours***
project classes	45
project preparation	40
collecting and studying literature	10
lesson preparation	10
consultations	15

Student workload	**Hours** 120	**ECTS** 4.0
Workload involving teacher	**Hours** 60	**ECTS** 2.0
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The student learns the basics of project work and teamwork, searching for information, including scientific information, analyzing problems and identifying their creative solutions. Based on the collected information, group work and creative thinking, he prepares a project that solves a simple problem in the field of bioeconomy or environmental protection.	project classes

Course advanced

Teaching methods:

classes, discussion, problem-solving method, brainstorming, case analysis

Activities	**Examination methods**	**Percentage in subject assessment**
project classes	project	100.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Sport

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I6AO.3375.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** general subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** physical education PE: 30	0.0

Period	**Examination**	**Number of ECTS points**
Semester 3	graded credit **Activities and hours** physical education PE: 30	0.0

Goals

C1	Developing skills in assessing own physical fitness.
C2	Increasing the awareness around healthy style
C3	Introduction to health and safety rules during physical activity.
C4	Developing personal and social skills enhancing lifelong physical activity.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the goal and role of each physical exercise.		observation of student’s work, active participation
Skills – Student can:			
U1	perform exercises improving his/her physical condition.		observation of student’s work, active participation
Social competences – Student is ready to:			
K1	to consciously keep fit in the future and understands how it impacts his/her heath.		observation of student’s work, active participation
K2	to follow all rules and regulations in place.		observation of student’s work, active participation

Balance of ECTS points

Semester 2

Activity form	Activity hours*	
physical education PE	30	
Student workload	**Hours** 30	**ECTS** 0.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Semester 3

Activity form	Activity hours*	
physical education PE	30	
Student workload	**Hours** 30	**ECTS** 0.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Students choose the type of class before the semester start from the offer available on the webpage of Department of Physical Eduacation and Sport as well as the USOS system. Registration is done via the electronic system in place. Particular classes are designed based on the chosen sport discipline and is enhances by additional elements such as warm-up or strechting exercises. Detailed list of available classes can be found on this webpage: http://swfis.upwr.edu.pl/zajecia-dydaktyczne/	physical education PE

Course advanced

Semester 2

Teaching methods:

PE (physical education), classes

Activities	Examination methods	Percentage in subject assessment
physical education PE	observation of student’s work, active participation	100.00%

Semester 3

Teaching methods:

PE (physical education), classes

Activities	Examination methods	Percentage in subject assessment
physical education PE	observation of student’s work, active participation	100.00%

Additional info

Registration is done via the electronic system in place (USOS UL).

Entry requirements

No medical contraindications to participate in physical education classes.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Biorenewable systems

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3376.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period Semester 2	**Examination** exam **Activities and hours** lecture: 30, project classes: 60	**Number of ECTS points** 5.0

Goals

C1	The aim of education is to provide knowledge and skills in the field of converting biorenewable resources into bioenergy and biobased products, including the biorenewable concepts in relation to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Has the knowledge to identify and discuss bioeconomy drivers of change	IBE_P6S_WG01, IBE_P6S_WG04	written exam, project

W2	Has the knowledge to describe, discuss, and analyze major components of biorefining products, processes, feedstock production, and by-products.	IBE_P6S_WG05	written exam, project
W3	Has the knowledge to understand and apply firm- and market-level economics of biorenewable products to analyze profitability, technological change, and policies	IBE_P6S_WG09	written exam, project
Skills – Student can:			
U1	Is able to apply knowledge of mathematics, science, and engineering/technology	IBE_P6S_UW08	project
U2	Is able to function on interdisciplinary teams	IBE_P6S_UW05	project, observation of student’s work
U3	Is able to identify, formulate, and solve engineering/technology problems	IBE_P6S_UW10	project, observation of student’s work
Social competences – Student is ready to:			
K1	Is aware of the necessity of broad education to understand the impact of engineering/technology solutions in a global, economic, environmental, and societal context	IBE_P6S_KO01	project, observation of student’s work, active participation, report
K2	Is aware of the recognition of the need for, and an ability to engage in lifelong learning	IBE_P6S_KK01	project, observation of student’s work, active participation, report

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	60
lesson preparation	20
project preparation	30
exam / credit preparation	10

Student workload	**Hours** 150	**ECTS** 5.0
Workload involving teacher	**Hours** 90	**ECTS** 3.0
Practical workload	**Hours** 60	**ECTS** 2.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	• Drivers of change of biorenewable systems • Biorenewable systems fundamentals • Biofuels in biorenewable systems • Thermochemical processing in biorenewable systems • Agronomic fundamentals of biorenewable systems • Financial fundamentals of biorenewable systems • Transportation and logistics for biorenewable systems	lecture
2.	• Global energy use; climate change; public policy; economic development • Mathematical conversions and the unit factor method; basic chemistry; mass and energy balances; characterizing biomass and biowaste, biomass and biowaste as substrate • Biodiesel, ethanol from corn, ethanol from cellulose, algal biofuels, others • Pyrolysis, gasification, thermal depolymerization, combustion, others • Biomass and biowaste production fundamentals, “ideal” biomass crops, alternative biomass crops • Basic financial terms, biorefinery financial statements, break-even pricing points, financial modeling • Biomass and biowaste transportation and logistics, transportation alternatives, relative costs of transportation/logistics decisions	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, problem-solving method, brainstorming, text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written exam	30.00%
project classes	project, observation of student’s work, active participation, report	70.00%

Additional info

Each week there will be assignments that are a mixture of readings, numerical problems, and reflections. The assignments will be clearly designated when the independent work of students is expected. Students will do also the collaborative work in class, a.k.a., “team problems.” The semester project will be either a poster or paper examining an issue relative to biorenewables. A public poster session will be
held during the final examination period at which time students will present the poster as a team. Attendance is required.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Fundamentals of engineering drawing

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3377.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** project classes: 30	2.0

Goals

C1	Acquainting the students with the basics of Monge's method of recording spatial geometric forms on the projection plane.
C2	Preparation for understanding the principles of engineering drawing that is used to convey information necessary for reading simple technical drawings.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Student has knowledge of geometric structure mapping onto drawing's plane using Monge's projection method.	IBE_P6S_WG15	test, performing tasks
W2	Student has skills in creating perspective and in the field of axonometric perspective application.	IBE_P6S_WG15	test, performing tasks
W3	Student can interpret technical drawings and is able to explain the basic rules of notation of a structure.	IBE_P6S_WG15	test, performing tasks
Skills – Student can:			
U1	Student can practically use the principles of Monge's projection method to map the space-defining elements on the drawing's plane.	IBE_P6S_UW05	test, performing tasks
U2	Student can make the machine drawing in accordance with technical rules with the use of connections of elements.	IBE_P6S_UW05	test, performing tasks
Social competences – Student is ready to:			
K1	Student can present a technical problem graphically, using a technical drawing, in a way understandable for a group of employees.	IBE_P6S_KK01	performing tasks
K2	Student can work independently and solve tasks that require the use of typical technical documentation.	IBE_P6S_KK01	performing tasks

Balance of ECTS points

Activity form	**Activity hours***
project classes	30
class preparation	30

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Mapping three-dimensional objects onto the plane - rectangular projection by Monge. Mapping of basic geometric elements (point, line, plane). Preparing technical drawings. 2. Extraction of geometric elements. Determination of common elements - edges and breakdown points. Transformation of the position and the reference system. Preparing technical drawings. 3. Solids - definitions. Mapping the solid on three orthogonal planes. Dragging, projection, construction plane. Preparing technical drawings. 4. Fundamentals of polyhedra shapes. Sections of polyhedra with projecting planes and cutting planes. Preparing technical drawings. 5. Fundamentals of revolving solids (cone, cylinder, sphere). Sections of revolving solids with projecting planes and cutting planes. Preparing technical drawings. 6. Penetration of surfaces, drawing of surface development. Cylindrical surfaces. The interpenetration of penetration curve of a cylinder. Preparing technical drawings. 7. Colloquium K1 (includes exercise material of 1 - 6). 8. Engineering drawing - section view fundamentals (partial views, half-views), types of sections (full sections, half sections, broken out sections). Preparing technical drawings. 9. Completing the missing solid's projection - use of the axonometric projection. Preparing technical drawings. 10. Drawing standardized machine connections. Design of welded connections. Preparing technical drawings. 11. Drawing standardized machine connections. Threaded connections. Preparing technical drawings. 12. Dimensions and tolerances of mating machined parts. Preparing technical drawings. 13. Assembly drawing and drawings of components (drawing rules). Preparing technical drawings. 14. Colloquium K2 (includes exercise material of 8 - 13). 15. Correction exercise. Passing.	project classes

Course advanced

Teaching methods:

classes, presentation / demonstration, project-based learning (PBL), case analysis

Activities	Examination methods	Percentage in subject assessment
project classes	test, performing tasks	100.00%

Additional info

The form of completing the course:
- all technical drawings completed and estimated - 70%;
- test including exercise material - 30%.

Entry requirements

Understanding of basic concepts of Euclidean geometry.
Skills with pencil drawing techniques.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

GIS in bioeconomy

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3378.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period Semester 2	**Examination** graded credit **Activities and hours** project classes: 30	**Number of ECTS points** 3.0

Goals

C1	Providing students with knowledge and practical skills in the field of spatial information systems (data, information and spatial analyzes, GIS applications in bioeconomy and environmental protection and development) and learning about the use of GIS software (types of spatial data, entering and using spatial data, data visualization, spatial analysis).

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student has knowledge of spatial information systems, GIS methods and tools and spatial data, including in terms of types of spatial data, the possibility of obtaining and processing data; vector and raster analyzes; multi-criteria analyzes.	IBE_P6S_WG12	project, performing tasks
Skills – Student can:			
U1	The student is able to use GIS tools in the field of bioeconomy and environmental shaping; acquire, prepare and visualize spatial data in the GIS program; integrate spatial data; perform vector and raster analyzes; perform multi-criteria analyzes for an object with specific location conditions.	IBE_P6S_UW04	project, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
project classes	30
project preparation	30
report preparation	25
consultations	5

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 35	**ECTS** 1.2
Practical workload	**Hours** 55	**ECTS** 2.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Exercise 1. Visualization of spatial data, map elements, print layout on the example of elements of land-use and terrain maps. Exercise 2. Working with the attribute table, data selection by SQL queries, table join, editing and calculations in attribute table, creating and editing vector maps. Exercise 3. Methods and tools for data interpolation on the example of spatial distribution of meteorological phenomena and qualitative indicators of the environment. Exercise 4. Raster analyzes of the identification of hydrographic conditions and catchment designation with the use of the numerical terrain model. Exercise 5. Multi-criteria analyzes using spatial data for an object with specific location conditions.	project classes

Course advanced

Teaching methods:

classes, computer lab/laboratory

Activities	Examination methods	Percentage in subject assessment
project classes	project, performing tasks	100.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Semestral project 2

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3379.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** project classes: 45	4.0

Goals

C1	The aim is to creatively solve problems in the field of bioeconomy by students using design thinking, teamwork, and critical analysis of data and examples from both the literature on the subject and reported by the economy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows and understands the principles of creative problem-solving in the field of bioeconomy from both the economy and the literature on the subject, based on teamwork, critical case analysis, and problem-solving through design thinking.	IBE_P6S_WG04	project

Skills – Student can:			
U1	The student has the ability to apply the principle of rational management of natural resources, to solve simple problems in the field of bioeconomy, both from the economy and from the literature on the subject.	IBE_P6S_UW16	project
Social competences – Student is ready to:			
K1	The student is ready to bear social, professional, and ethical responsibility when solving simple problems in the field of bioeconomy coming from both the economy and the literature on the subject.	IBE_P6S_KO04	project, presentation

Balance of ECTS points

Activity form	**Activity hours***
project classes	45
project preparation	45
collecting and studying literature	10
lesson preparation	10
consultations	10

Student workload	**Hours** 120	**ECTS** 4.0
Workload involving teacher	**Hours** 55	**ECTS** 2.0
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The student works using the principles of project work and teamwork, solves advanced problems in the field of bioeconomy, including social aspects, coming from both industry and the subject's literature. Based on the collected information, group work, and creative thinking, he prepares a project solving a technical, organizational, and/or social problem in the field of bioeconomy.	project classes

Course advanced

Teaching methods:

project-based learning (PBL), problem-solving method, brainstorming

Activities	Examination methods	Percentage in subject assessment
project classes	project, presentation	100.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Interpersonal communication

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2HSO.3465.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 15, practical classes: 15	2.0

Goals

C1	The course deals with the issues of communication, both verbal (word) and nonverbal (gestures, facial expressions, tone of voice etc.). It teaches the principles of effective communication, being aware of the barrier in relations, discusses the specifics of communication on the Internet. It shows the role of communication in self-presentation and public speaking.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Knows and understands the complex rules of human functioning in society.	IBE_P6S_WK01	written credit

W2	Knows the basic terminology that is used in the humanities and social sciences: knows the basic, areas, models and phases.	IBE_P6S_WK01	written credit
W3	Has a basic concept how to get other information on the topic of the course.	IBE_P6S_WK01	written credit
W4	Has a basic knowledge of social relationships and is able to indicate the relationship between the humanities and the social and agricultural sciences, forestry, veterinary and natural.	IBE_P6S_WK01	written credit
Skills – Student can:			
U1	Learns independently in a targeted manner.	IBE_P6S_UU01	active participation
U2	Uses all available sources of information, including electronic, to learn, to prepare a speech and presentations, to plan research activities.	IBE_P6S_UW04	written credit, observation of student's work, active participation
U3	Is able to search for information, analyzes and uses the literature on the subject of the course.	IBE_P6S_UW05	written credit, active participation
U4	Uses specialized terminology in the language of the subject.	IBE_P6S_UW07	active participation
U5	Has self-developmental awareness.	IBE_P6S_UW16	active participation
U6	Recognizes issues, can act in accordance with applicable standards and principles.	IBE_P6S_UW10	active participation
Social competences – Student is ready to:			
K1	Is willing to systematically update their knowledge and is aware of the need to improve their knowledge throughout the lifelong learning process.	IBE_P6S_KK01	active participation
K2	Is aware of the effects of team work and is able to lead a team and to work in it.	IBE_P6S_KO01	active participation
K3	Is able to work in a team and take on different roles.	IBE_P6S_KO02	active participation
K4	Understands the need for lifelong learning.	IBE_P6S_KR_01	active participation
K5	Is able to think and act creatively.	IBE_P6S_KO04	active participation
K6	Correctly identifies dilemmas associated with making life and work choices, follows ethical rules.	IBE_P6S_KO03	active participation

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
practical classes	15
lesson preparation	15
exam / credit preparation	5

Student workload	**Hours**	**ECTS**
	50	2.0

Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	The concept of interpersonal communication. The impact of perception on the process of communication. Nonverbal communication - cooperation and participation with words in establishing a personal relationship interactions. Principles of effective communication. Barriers in communication. Informative and persuasive functions of communication. Communicating on the Internet. The role of communication in self-presentation. Public speaking. Interpersonal conflicts - ways of solving them. Assertive communication in contrast to other strategies: dominant, manipulative, and submissive. The principle of group communication. Debate - the basis of eristics. Intercultural communication.	lecture
2.	Participation in discussions	practical classes

Course advanced

Teaching methods:

lecture, discussion, foreign language (conversation classes), brainstorming, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	60.00%
practical classes	observation of student’s work, active participation	40.00%

Entry requirements

High school level humanities.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Introduction to Polish culture

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2HSO.0993.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 30	2.0

Goals

C1	The course focuses on Polish culture, history and tradition in order to present the most important aspects of Polish society
C2	The course should influence its participants to develop their intercultural awareness and to promote a stereotype-free cooperation

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Student knows and understands basic social, economic and legal aspects of existence in Poland	IBE_P6S_WK01	written credit, active participation
Skills – Student can:			
U1	Student is able to find and take advantage of opportunities for intelectual and social develoment	IBE_P6S_UU01	active participation
Social competences – Student is ready to:			
K1	Student is ready to deepen his/her knowledge and improve social skills.	IBE_P6S_KO01	active participation

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
lesson preparation	30

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	During the course students learn about Polish history and its influence on the contemporary society. They find out about Polish symbols and archetypes. They are told about Polish customs and traditions. They are informed about most important institutions which operate in Polish society. They discuss international perception of Poland and its culture.	lecture

Course advanced

Teaching methods:

educational film, lecture, discussion

Activities	Examination methods	Percentage in subject assessment
lecture	written credit, active participation	100.00%

Entry requirements

Knowledge of English at the upper intermediate level - B2 according to the Common European Framework

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Efficient learning

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2HSO.3381.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 15, practical classes: 15	2.0

Goals

C1	To gain knowledge about learning processes and mechanisms.
C2	To learn the techniques supporting effective learning.
C3	To develop chosen academic study skills.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	learning processes and mechanisms	IBE_P6S_WG19	written credit

Skills – Student can:			
U1	how to study effectively and how to control their process of learning	IBE_P6S_UU01, IBE_P6S_UW01	active participation, presentation, performing tasks
U2	how to practice speed reading and effectively obtain reliable information	IBE_P6S_UU01, IBE_P6S_UW01	active participation, presentation, performing tasks
U3	how to prepare and deliver presentations within their academic specialties	IBE_P6S_UW01, IBE_P6S_UW03	active participation, presentation, performing tasks
Social competences – Student is ready to:			
K1	the graduate understands the need for development, updating their knowledge and knows the possibilities of developing professional competences	IBE_P6S_KK01	active participation, presentation
K2	the graduate is responsible for their own work and understands the importance of lifelong learning	IBE_P6S_KO01	active participation, presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
practical classes	15
presentation/report preparation	4
lesson preparation	6
exam / credit preparation	8
consultations	2

Student workload	**Hours** 50	**ECTS** 2.0
Workload involving teacher	**Hours** 32	**ECTS** 1.1
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. From brain to mind - brief history, main ideas and concepts (1h) 2. How we learn part 1 - how our brains learn (2h) 3. How we learn part 2 - the four pillars of learning (2h) 4. Study skills - mind maps and how to obtain reliable information (2h) 5. Study skills - speed reading and note-taking (2h) 6. How to develop a brilliant memeory - memory techniques (2h) 7. Study skills - presentations (2h) 8. Mental wellbeing and cognitive health (2h)	lecture
2.	1. From brain to mind - brief history, main ideas and concepts (1h) 2. Study skills - mind maps (2h) 3. Study skills - how to obtain reliable information (2h) 4. Study skills - speed reading and note taking (2h) 5. Study skills - memory techniques (2h) 6. Study skills - presentations (2h) 7. Study skills - presentations (2h) 8. Mental wellbeing and cognitive health (2h)	practical classes

Course advanced

Teaching methods:

lecture, discussion, teamwork, educational film, brainstorming

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
practical classes	active participation, presentation, performing tasks	50.00%

Entry requirements

The ability to learn effectively is necessary to operate successfully both at the level of higher education and later in life. The aim of this course is to provide the knowledge about the brain and cognition as well as to enhnace the student's ability to learn, retain and recall information. It is designed to help develop study skills necessary for improved educational results.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Social Psychology

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2HSO.3594.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 15, practical classes: 15	2.0

Goals

C1	Lectures and workshops approximate the rules governing social cognition. They focus on problems of the social impact, the role of stereotypes and interpersonal attractiveness. They shape the selected competence and social skills. They teach how to deal with interpersonal aggression and prejudice. They describe the characteristics of social groups and the processes governing them. They discuss topics of social idleness and facilitation.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	(The student knows and understands) basic social relationships and is able to indicate the relationship between the humanities and the social and natural sciences.	IBE_P6S_WG19	written credit
Skills – Student can:			
U1	(The student can) use all available sources of information, including electronic, to learn, prepare a speech and presentations, and plan research activities.	IBE_P6S_UU01	presentation, participation in discussion
Social competences – Student is ready to:			
K1	(The student) is willing to systematically update knowledge and is aware of the need to improve his/her knowledge in a lifelong learning process.	IBE_P6S_KK01	active participation, participation in discussion
K2	(The student) Is aware of the effects of teamwork and is able to lead a team and to cooperate in it.	IBE_P6S_KO02	active participation, participation in discussion

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
practical classes	15
lesson preparation	30

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	During the lectures, students become familiar with the concepts connected with social psychology: social cognition and perception, the self, attitudes and attitude change, conformity and obedience, group processes, attraction and relationships, prosocial behaviour, aggression and prejudice.	lecture
2.	During the workshops, students work on particular case studies used in order to illustrate a concept present in social psychology: social cognition and perception, the self, attitudes and attitude change, conformity and obedience, group processes, attraction and relationships, prosocial behaviour, aggression and prejudice.	practical classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, educational film, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
practical classes	written credit, active participation, presentation, participation in discussion	50.00%

Additional info

Final evaluation of the lectures and workshops is a component of the scoring in the knowledge, skills and social competence. There are summed points obtained from the written test, activity, discussions, attendance and additional tasks. Knowledge shall be verified with the use of the written test. The written test includes two problem questions, to assess skills. Social competence is evaluated based on participation in class discussions and thematic attendance and performing additional tasks. Required level necessary to pass: 60%

Entry requirements

Humanities at the secondary school
An adequate level of English is required (min. level B2)

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

English

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.IEJO.0623.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Periods	**Examination**	**Number of ECTS points**
Semester 2, Semester 3, Semester 4	graded credit **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with educational contents required at a given level of the English language for the purpose of achieving the relevant language competence.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	make use of general vocabulary and idiomatic phrases required at a given level, apply grammar rules at a given level, understand utterances related to the subject matter and specified for a given level, prepare a written statement in accordance with the requirements at a given level, comprehensively read general texts at a given level, communicate in accordance with the requirements assigned to a given level.	IBE_P6S_UW02	observation of student's work, active participation, test, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
foreign language (course)	26
e-learning	4
consultations	2
lesson preparation	28

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 32	**ECTS** 1.1
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	**Examination methods**	**Percentage in subject assessment**
foreign language (course)	observation of student's work, active participation, test	90.00%

Activities	Examination methods	Percentage in subject assessment
e-learning	performing tasks	10.00%

Additional info

The student is taught the selected language for 4 semesters to take the exam at the minimum B2 level. The student can study the selected language at a level lower than B2 for 3 semesters, but during semester 4 he/she has to attend a course at the minimum B2 level.
The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).

LEVEL A1
The student, who commands a language at this level, can understand and use the learnt simple utterances for the purpose of communicating specific needs of everyday life.
The student can introduce himself/herself and others; can ask questions concerning private life, residence, friends and possessions as well as answer such questions; can have simple conversations provided that the interlocutor speaks slowly and clearly, and is ready to help.

LEVEL A2
The student, who commands a language at this level, can understand utterances, common at this level, related to the most important matters (e.g. basic information concerning his/her family, shopping, environment, work; can communicate in typical communication situations which only require direct exchanges of information about known and often repeated topics; can easily describe the direct environment as well as that of his/her origin; can speak in a very simple way about topics related to the most important needs.

LEVEL B1
The student, who commands a language at this level, can understand the importance of the main contents of communication and standard utterances referring to familiar matters as well as typical situations related to work, school, leisure time, etc.; can cope with typical travel situations to the country of the studied language; can create consistent oral and written statements on topics that are familiar or interesting to him/her; can describe events, personal experiences, plans, projects and future plans.

LEVEL B2
The student, who commands a language at this level, understands the importance of main messages contained in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate smoothly and spontaneously enough to have a free conversation with a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehend not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=090000168045bc7d

Verification of learning outcomes
Learning outcomes are verified by means of grammatical and lexical tests, oral and written statements, reading and listening comprehension tests.

Entry requirements

Adequate level of language is required.

Group level	Min. level
A1	--> 0, A1
A2	--> A1, A2
B1	--> A2, B1
B2	--> B1, B2
C1	--> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

French

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.IEJO.3383.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Periods	**Examination**	**Number of ECTS points**
Semester 2, Semester 3, Semester 4	graded credit **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with educational contents required at a given level of the French language for the purpose of achieving the relevant language competence.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at a given level, apply grammar rules at a given level, understand utterances related to the subject matter and specified for a given level, prepare a written statement in accordance with the requirements at a given level, comprehensively read general texts at a given level, communicate in accordance with the requirements assigned to a given level.	IBE_P6S_UW02	observation of student's work, active participation, test, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
foreign language (course)	26
e-learning	4
consultations	4
lesson preparation	26

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 34	**ECTS** 1.2
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	**Examination methods**	**Percentage in subject assessment**
foreign language (course)	observation of student's work, active participation, test	90.00%

Activities	Examination methods	Percentage in subject assessment
e-learning	performing tasks	10.00%

Additional info

The student is taught the selected language for 4 semesters to take the exam at the minimum B2 level. The student can study the selected language at a level lower than B2 for 3 semesters, but during semester 4 he/she has to attend a course at the minimum B2 level.

The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).

LEVEL A1
The student, who commands a language at this level, can understand and use the learnt simple utterances for the purpose of communicating specific needs of everyday life.
The student can introduce himself/herself and others; can ask questions concerning private life, residence, friends and possessions as well as answer such questions; can have simple conversations provided that the interlocutor speaks slowly and clearly, and is ready to help,

LEVEL A2
The student, who commands a language at this level, can understand utterances, common at this level, related to the most important matters (e.g. basic information concerning his/her family, shopping, environment, work; can communicate in typical communication situations which only require direct exchanges of information about known and often repeated topics; can easily describe the direct environment as well as that of his/her origin; can speak in a very simple way about topics related to the most important needs.

LEVEL B1
The student, who commands a language at this level, can understand the importance of the main contents of communication and standard utterances referring to familiar matters as well as typical situations related to work, school, leisure time, etc.; can cope with typical travel situations to the country of the studied language; can create consistent oral and written statements on topics that are familiar or interesting to him/her; can describe events, personal experiences, plans, projects and future plans.

LEVEL B2
The student, who commands a language at this level, understands the importance of main
messages contained in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate smoothly and spontaneously enough to have a free conversation with
a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehended not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of
topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

http://www.sjo.agh.edu.pl/dane/ESOKJ.pdf

Verification of learning outcomes
Learning outcomes are verified by means of grammatical and lexical tests, oral and written statements, reading and listening comprehension tests.

Entry requirements

Adequate level of language is required.

Group level	Min. level
A1	--> 0, A1
A2	--> A1, A2
B1	--> A2, B1
B2	--> B1, B2
C1	--> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Chineese

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.IEJO.3384.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Periods	**Examination**	**Number of ECTS points**
Semester 2, Semester 3, Semester 4	graded credit **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with educational contents required at a given level of the Chinese language for the purpose of achieving the relevant language competence.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at the minimum B2 level; apply grammar rules at the minimum B2 level; understand statements related to the subject matter and specified for the minimum B2 level; prepare a written statement in accordance with the requirements at the minimum B2 level; comprehensively read general texts at the minimum B2 level; communicate in accordance with the requirements assigned to the minimum B2 level.	IBE_P6S_UW02	observation of student's work, active participation, test, performing tasks

Balance of ECTS points

Activity form	**Activity hours***	
foreign language (course)	26	
e-learning	4	
consultations	4	
lesson preparation	26	
Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 34	**ECTS** 1.2
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	**Examination methods**	**Percentage in subject assessment**

Activities	Examination methods	Percentage in subject assessment
foreign language (course)	observation of student’s work, active participation, test	90.00%
e-learning	performing tasks	10.00%

Additional info

The student is taught the selected language for 4 semesters to take the written and oral exam at the minimum B2 level. The student can study the selected language at a level lower than B2 for 3 semesters, but during semester 4 he/she has to attend a course at the minimum B2 level.
The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).
LEVEL A1
The student, who commands a language at this level, can understand and use the learnt simple utterances for the purpose of communicating specific needs of everyday life.
The student can introduce himself/herself and others; can ask questions concerning private life, residence, friends and possessions as well as answer such questions; can have simple conversations provided that the interlocutor speaks slowly and clearly, and is ready to help,

LEVEL A2
The student, who commands a language at this level, can understand utterances, common at this level, related to the most important matters (e.g. basic information concerning his/her family, shopping, environment, work; can communicate in typical communication situations which only require direct exchanges of information about known and often repeated topics; can easily describe the direct environment as well as that of his/her origin; can speak in a very simple way about topics related to the most important needs.

LEVEL B1
The student, who commands a language at this level, can understand the importance of the main contents of communication and standard utterances referring to familiar matters as well as typical situations related to work, school, leisure time, etc.; can cope with typical travel situations to the country of the studied language; can create consistent oral and written statements on topics that are familiar or interesting to him/her; can describe events, personal experiences, plans, projects and future plans.

LEVEL B2
The student, who commands a language at this level, understands the importance of main messages contained in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate smoothly and spontaneously enough to have a free conversation with a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehended not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of
topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

http://www.sjo.agh.edu.pl/dane/ESOKJ.pdf

Entry requirements

Adequate level of language is required.

Group level	Min. level
A1	--> 0, A1
A2	--> A1, A2
B1	--> A2, B1
B2	--> B1, B2
C1	--> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Spanish

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.IEJO.2350.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Periods	**Examination**	**Number of ECTS points**
Semester 2, Semester 3, Semester 4	graded credit **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with educational contents required at a given level of the Spanish language for the purpose of achieving the relevant language competence.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at a given level, apply grammar rules at a given level, understand utterances related to the subject matter and specified for a given level, prepare a written statement in accordance with the requirements at a given level, comprehensively read general texts at a given level, communicate in accordance with the requirements assigned to a given level.	IBE_P6S_UW02	observation of student's work, active participation, test, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
foreign language (course)	26
e-learning	4
consultations	4
lesson preparation	26

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 34	**ECTS** 1.2
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	**Examination methods**	**Percentage in subject assessment**
foreign language (course)	observation of student's work, active participation, test	80.00%

Activities	Examination methods	Percentage in subject assessment
e-learning	performing tasks	20.00%

Additional info

The student is taught the selected language for 4 semesters to take the written and oral exam at the minimum B2 level. The student can study the selected language at a level lower than B2 for 3 semesters, but during semester 4 he/she has to attend a course at the minimum B2 level.
The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).
LEVEL A1
The student, who commands a language at this level, can understand and use the learnt simple utterances for the purpose of communicating specific needs of everyday life.
The student can introduce himself/herself and others; can ask questions concerning private life, residence, friends and possessions as well as answer such questions; can have simple conversations provided that the interlocutor speaks slowly and clearly, and is ready to help,

LEVEL A2
The student, who commands a language at this level, can understand utterances, common at this level, related to the most important matters (e.g. basic information concerning his/her family, shopping, environment, work; can communicate in typical communication situations which only require direct exchanges of information about known and often repeated topics; can easily describe the direct environment as well as that of his/her origin; can speak in a very simple way about topics related to the most important needs.

LEVEL B1
The student, who commands a language at this level, can understand the importance of the main contents of communication and standard utterances referring to familiar matters as well as typical situations related to work, school, leisure time, etc.; can cope with typical travel situations to the country of the studied language; can create consistent oral and written statements on topics that are familiar or interesting to him/her; can describe events, personal experiences, plans, projects and future plans.

LEVEL B2
The student, who commands a language at this level, understands the importance of main
messages contained in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate smoothly and spontaneously enough to have a free conversation with
a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehended not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of
topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

http://www.sjo.agh.edu.pl/dane/ESOKJ.pdf

Entry requirements

Adequate level of language is required.

Group level	Min. level
A1	--> 0, A1
A2	--> A1, A2
B1	--> A2, B1
B2	--> B1, B2
C1	--> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Russian

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.IEJO.3385.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Periods	**Examination**	**Number of ECTS points**
Semester 2, Semester 3, Semester 4	graded credit **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	Objectives The student is made acquainted with educational contents required at a given level of the Russian language for the purpose of achieving the relevant language competence.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at a given level, apply grammar rules at a given level, understand utterances related to the subject matter and specified for a given level, prepare a written statement in accordance with the requirements at a given level, comprehensively read general texts at a given level, communicate in accordance with the requirements assigned to a given level.	IBE_P6S_UW02	observation of student's work, active participation, test, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
foreign language (course)	26
e-learning	4
consultations	4
lesson preparation	26

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 34	**ECTS** 1.2
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	**Examination methods**	**Percentage in subject assessment**
foreign language (course)	observation of student's work, active participation, test	90.00%

Activities	Examination methods	Percentage in subject assessment
e-learning	performing tasks	10.00%

Additional info

Additional information
The student is taught the selected language for 4 semesters to take the exam at the minimum B2 level. The student can study the selected language at a level lower than B2 for 3 semesters, but during semester 4 he/she has to attend a course at the minimum B2 level.
The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).

LEVEL A1
The student, who commands a language at this level, can understand and use the learnt simple utterances for the purpose of communicating specific needs of everyday life.
The student can introduce himself/herself and others; can ask questions concerning private life, residence, friends and possessions as well as answer such questions; can have simple conversations provided that the interlocutor speaks slowly and clearly, and is ready to help,

LEVEL A2
The student, who commands a language at this level, can understand utterances, common at this level, related to the most important matters (e.g. basic information concerning his/her family, shopping, environment, work; can communicate in typical communication situations which only require direct exchanges of information about known and often repeated topics; can easily describe the direct environment as well as that of his/her origin; can speak in a very simple way about topics related to the most important needs.

LEVEL B1
The student, who commands a language at this level, can understand the importance of the main contents of communication and standard utterances referring to familiar matters as well as typical situations related to work, school, leisure time, etc.; can cope with typical travel situations to the country of the studied language; can create consistent oral and written statements on topics that are familiar or interesting to him/her; can describe events, personal experiences, plans, projects and future plans.

LEVEL B2
The student, who commands a language at this level, understands the importance of main
messages contained in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate smoothly and spontaneously enough to have a free conversation with
a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehended not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of
topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

Verification of learning outcomes
Learning outcomes are verified by means of grammatical and lexical tests, oral and written statements, reading and

listening comprehension tests.

Entry requirements

Adequate level of language is required.

Group level	Min. level
A1	--> 0, A1
A2	--> A1, A2
B1	--> A2, B1
B2	--> B1, B2
C1	--> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

German

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.IEJO.0801.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Periods	**Examination**	**Number of ECTS points**
Semester 2, Semester 3, Semester 4	graded credit **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with educational contents required at a given level of the Chinese language for the purpose of achieving the relevant language competence.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	make use of general vocabulary and idiomatic phrases required at a given level, apply grammar rules at a given level, understand utterances related to the subject matter and specified for a given level, prepare a written statement in accordance with the requirements at a given level, comprehensively read general texts at a given level, communicate in accordance with the requirements assigned to a given level.	IBE_P6S_UW02	observation of student's work, active participation, test, performing tasks

Balance of ECTS points

Activity form	Activity hours*
foreign language (course)	26
e-learning	4
lesson preparation	28
consultations	2

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 32	**ECTS** 1.1
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Treści programowe są realizowane w oparciu o odpowiednie podręczniki kursowe. Szczegółowy zakres zagadnień dostępny jest na stronie SJOiNHS	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	Examination methods	Percentage in subject assessment
foreign language (course)	observation of student's work, active participation, test	90.00%
e-learning	performing tasks	10.00%

Additional info

The student is taught the selected language for 4 semesters to take the exam at the minimum B2 level. The student can study the selected language at a level lower than B2 for 3 semesters, but during semester 4 he/she has to attend a course at the minimum B2 level.
The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).

LEVEL A1
The student, who commands a language at this level, can understand and use the learnt simple utterances for the purpose of communicating specific needs of everyday life.
The student can introduce himself/herself and others; can ask questions concerning private life, residence, friends and possessions as well as answer such questions; can have simple conversations provided that the interlocutor speaks slowly and clearly, and is ready to help.

LEVEL A2
The student, who commands a language at this level, can understand utterances, common at this level, related to the most important matters (e.g. basic information concerning his/her family, shopping, environment, work; can communicate in typical communication situations which only require direct exchanges of information about known and often repeated topics; can easily describe the direct environment as well as that of his/her origin; can speak in a very simple way about topics related to the most important needs.

LEVEL B1
The student, who commands a language at this level, can understand the importance of the main contents of communication and standard utterances referring to familiar matters as well as typical situations related to work, school, leisure time, etc.; can cope with typical travel situations to the country of the studied language; can create consistent oral and written statements on topics that are familiar or interesting to him/her; can describe events, personal experiences, plans, projects and future plans.

LEVEL B2
The student, who commands a language at this level, understands the importance of main messages contained in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate smoothly and spontaneously enough to have a free conversation with a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehend not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

http://www.sjo.agh.edu.pl/dane/ESOKJ.pdf

Verification of learning outcomes
Learning outcomes are verified by means of grammatical and lexical tests, oral and written statements, reading and listening comprehension tests.

Entry requirements

Adequate level of language is required.

Group level	Min. level
A1	--> 0, A1
A2	--> A1, A2
B1	--> A2, B1

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B2              --> B1, B2
C1              --> B2, C1
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UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Italian

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.IEJO.3386.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Periods	**Examination**	**Number of ECTS points**
Semester 2, Semester 3, Semester 4	graded credit **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with educational contents required at a given level of the Italian language for the purpose of achieving the relevant language competence.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	make use of general vocabulary and idiomatic phrases required at a given level, apply grammar rules at a given level, understand utterances related to the subject matter and specified for a given level, prepare a written statement in accordance with the requirements at a given level, comprehensively read general texts at a given level, communicate in accordance with the requirements assigned to a given level.	IBE_P6S_UW02	observation of student's work, active participation, presentation, test, participation in discussion, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
foreign language (course)	26
e-learning	4
consultations	4
lesson preparation	26

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 34	**ECTS** 1.2
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

teamwork, presentation / demonstration, situation-based learning, educational film, classes, discussion, foreign language (conversation classes)

Activities	Examination methods	Percentage in subject assessment
foreign language (course)	observation of student’s work, active participation, presentation, test, participation in discussion	90.00%
e-learning	test, performing tasks	10.00%

Additional info

The student is taught the selected language for 4 semesters to take the written and oral exam at the minimum B2 level. The student can study the selected language at a level lower than B2 for 3 semesters, but during semester 4 he/she has to attend a course at the minimum B2 level.

The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).
LEVEL A1
The student, who commands a language at this level, can understand and use the learnt simple utterances for the purpose of communicating specific needs of everyday life.
The student can introduce himself/herself and others; can ask questions concerning private life, residence, friends and possessions as well as answer such questions; can have simple conversations provided that the interlocutor speaks slowly and clearly, and is ready to help.

LEVEL A2
The student, who commands a language at this level, can understand utterances, common at this level, related to the most important matters (e.g. basic information concerning his/her family, shopping, environment, work; can communicate in typical communication situations which only require direct exchanges of information about known and often repeated topics; can easily describe the direct environment as well as that of his/her origin; can speak in a very simple way about topics related to the most important needs.

LEVEL B1
The student, who commands a language at this level, can understand the importance of the main contents of communication and standard utterances referring to familiar matters as well as typical situations related to work, school, leisure time, etc.; can cope with typical travel situations to the country of the studied language; can create consistent oral and written statements on topics that are familiar or interesting to him/her; can describe events, personal experiences, plans, projects and future plans.

LEVEL B2
The student, who commands a language at this level, understands the importance of main
messages contained in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate smoothly and spontaneously enough to have a free conversation with a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehended not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=090000168045bc7d

Verification of learning outcomes
Learning outcomes are verified by means of grammatical and lexical tests, oral and written statements, reading and listening comprehension tests.

Entry requirements

Adequate level of language is required.

Group level	Min. level
A1	--> 0, A1
A2	--> A1, A2
B1	--> A2, B1
B2	--> B1, B2
C1	--> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Hydraulics and fluid mechanics

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3388.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 30, project classes: 30	6.0

Goals

C1	The subject is to acquaint the students with the physical properties of fluids and fundamental rights that describe their movement and static and dynamic impact on the surrounding surfaces. Hydraulic calculation policies closer and modeling fluid flow by the engineering equipment (pipelines, channels, structures and others) and trough the opened and liquid and solid particles, with a focus on the bioeconomy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows the principles of static and dynamic action of liquid onto flat and curved surfaces, either floating or submerged;	IBE_P6S_WG07	written credit

W2	is familiar with the laws related to the flow of liquids and can describe related phenomena;	IBE_P6S_WG07	written credit
W3	is familiar with modelling in fluid mechanics.	IBE_P6S_WG07	written credit
Skills – Student can:			
U1	The student can calculate the static and dynamic forces acting onto the surfaces limiting the liquid both in rest and in motion;	IBE_P6S_UW05	test, performing tasks
U2	can perform hydraulic calculations required to dimension the conduits, channels and hydro-engineering structures;	IBE_P6S_UW05	test, performing tasks
U3	can do laboratory experiments to investigate the basic hydraulic phenomena and to get the most important hydraulic parameters.	IBE_P6S_UW05	performing tasks
Social competences – Student is ready to:			
K1	The knowledge of fundamental laws describing the motion of liquids and gases will allow him/her to take correct decisions in critical situations based on the analyses carried out thanks to his/her knowledge of these phenomena.	IBE_P6S_KO04	test

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
lesson preparation	20
exam / credit preparation	25
consultations	10
exam participation	5
collecting and studying literature	10
class preparation	10
project preparation	15

Student workload	**Hours** 155	**ECTS** 6.0
Workload involving teacher	**Hours** 75	**ECTS** 3.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	1. Subject of fluid mechanics. Fundamental physical properties of liquids and gases, viscometers, Newtonian and non-Newtonian viscosity (1). 2. Hydrostatics – hydrostatic pressure and thrust, balance equation for fluids. Thrust of liquid onto flat and curved walls (2-3). 3. Basic notions of fluid kinetics, method for investigation of motion, continuity equation, Euler equation (4). 4. Bernoulli equation for the ideal fluid and for the real fluid, Ancona diagram, Saint-Venant coefficient, hydraulic head and hydraulic gradient (5). 5. Laminar and turbulent flow - Reynolds experiment, resistance to motion in general, loss along the length - the Darcy-Weisbach formula, linear drag coefficient, local loss, calculation of flows through pressurised pipes, water hammer (6-7). 6. Motion of liquid in open flumes and channels, channel roughness, Chezy formula, hydraulic design of channel sections, flow conditions in compound channels. Specific energy, critical depth, rapid motion and calm motion, hydraulic jump (8-9). 7. Effects of vegetation and biotechnical built-up on hydraulic flow conditions in open channels. Biological continuity of rivers, hydraulic calculation of fish ladders (10). 8. Overfalls: classification and hydraulic calculations. General equation for changeable motion, backwater, simplified methods for calculation of the swelling curve (11). 9. Outflow of liquid through openings and mouthpieces, outflow through small and big openings, outflow though no-submerged and submerged openings, steady and unsteady outflow. Hydrodynamic thrust onto the walls, reaction of the stream of liquid (12). 10. Steady and unsteady flow of gas in pipelines, calculation of discharge and flow for gases. Gas discharge through openings and nozzles. Bernoulli equation for gases in the adiabatic process (13). 11. Modelling of phenomena in fluid mechanics - principles and criteria of similarity in modelling, examples of practical application. Hydrometry, basic principles of liquid and gas measurements, measuring instruments and apparatus (14). 12. Settling of solid particles in liquids. Flow of mixtures in pipelines. Models of flow for Newtonian and non-Newtonian mixtures (15).	lecture

2.	A) in class calculation (computational) exercises (Nos. 1-13): 1. Thrust onto flat and curved surfaces. 2. Hydraulic calculations for pipelines (application of Bernoulli equation, calculation of flow drag, Ancona diagram, siphons). 3. Outflow of liquid through openings and mouthpieces. 4. Hydraulic calculations for open channels (incl. biotechnical built-up). Design of channel cross-section. 5. Calculation of overfalls (submersion conditions, discharge and width of overfall, head on weir). 6. Calculation of gas flow in pipelines and ventilation ducts. B) laboratory exercises (Nos. 14-15): 1. Properties of liquids (viscosity). 2. Laminar and turbulent motion. 3. Velocity profile. Basic principles of measurements, measuring instruments and apparatus. 4. Chart of pressure and energy lines (local drag coefficient). 5. Linear drag coefficient. 6. Venturi tube. 7. Measuring overfall. 8. Open channel flow conditions.	project classes

Course advanced

Teaching methods:

classes, lecture

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	test, performing tasks	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Thermodynamics

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3389.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 30, project classes: 30	6.0

Goals

C1	The subject is to acquaint students with the basics of thermodynamics are essential for understanding and the description of the basic physical phenomena and processes occurring in the devices and engineering facilities, and households, with a focus on the bioeconomy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student has knowledge in the field of physics, which includes the basic notions of thermodynamics required to understand reversible and irreversible processes;	IBE_P6S_WG07	written credit

W2	has knowledge required to describe the thermodynamic states and systems; is familiar with the most important parameters characterizing the thermodynamic fluid and the effects of thermodynamic processes and heat cycles;	IBE_P6S_WG07	written credit
W3	knows the basic principles of heat loss reduction though barriers; knows and understands the processes of energy transfer and heat exchange applied in engineering installations and structures as well as in household installations.	IBE_P6S_WG07	written credit
Skills – Student can:			
U1	The student can use his/her knowledge of thermodynamics to analyse technical problems;	IBE_P6S_UW05	written credit, test
U2	can describe a problem in the field of thermodynamic processes and cycles in heat exchangers;	IBE_P6S_UW05	written credit, test
U3	can perform basic thermodynamic calculations related to energy transfer; can calculate heat loss through barriers.	IBE_P6S_UW05	written credit, test
Social competences – Student is ready to:			
K1	Knowledge of the basic notions of thermodynamics helps the student to analyse safety-related problems; it can be applied to manage heat energy in both professional and private life and to promote in the society appropriate attitudes and energy-saving solutions; the student understands the importance of energy saving both for the society and for the environment.	IBE_P6S_KO02	test

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
lesson preparation	20
exam / credit preparation	25
consultations	10
exam participation	10
collecting and studying literature	15
class preparation	10

Student workload	**Hours** 150	**ECTS** 6.0
Workload involving teacher	**Hours** 80	**ECTS** 3.0

Practical workload	Hours 30	ECTS 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	1. Basic information about the course of engineering thermodynamics. Phenomenological and statistical methods in the thermodynamics. Fundamental concepts and definitions – substance, state, parameters and functions of state (1). 2. Thermodynamic systems – closed systems, open systems, isolated systems. Energy and its forms; internal energy (2). 3. Gas properties. Ideal gas, semiideal and real gas. Ideal gas laws. Equation of state of ideal gas. Van der Waals equation. Gas mixtures (3-4). 4. Characteristic of thermodynamic processes of ideal gas (5). 5. Balance of substance and balance of energy. The first and the second law of thermodynamics; the concept of entropy. Carnot cycle. Thermodynamics of reversible and irreversible processes (6-7). 6. Characterization of selected clockwise and counter-clockwise thermodynamic cycles and their applications (8). 7. Phase transitions of water. Selected problems of steam thermodynamics. The functions “p-v”, T-s” and “i-s” for steam (9). 8. Basis of humid-air theory; fundamental concepts, dry and wet thermometer, dew point. Characteristic processes of the humid-air. Mollier “i-x” diagram (10). 9. Combustion processes - art of fuels, calorific value of fuels, heat of combustion, air demand, amount of emission (combustion gas) (11). 10. Steady and nonsteady heat transfer, fundamental mathematical description, boundary conditions. Heat similarity. Complex heat transfer; heat conduction through a composite wall (12-13). 11. Heat convection; overall heat transfer coefficient. Heat transfer from a vertical wall by free convection. Mechanical convection of heat by flow through a tube. Heat exchangers (14-15).	lecture

2.	1. Unit system of thermodynamics. Basic calculations of thermodynamic quantities and parameters. Tables of thermodynamic parameters – principles of using. (1) 2. Clapeyron equation. Using the Boyle-Mariotte`s law, Guy-Lussac`s law, Charles` law and Avogadro`s law by solving thermodynamic problems. (2) 3. Calculations of thermodynamic processes of ideal gas. (3) 4. Van der Waals equation; calculations of real gas parameters. (4) 5. Gas mixtures calculations. (5) 6. The first law of thermodynamics. Balance of substance and balance of energy by thermodynamic problems calculations. (6) 7. The second law of thermodynamics. Solving of thermodynamic problems based on the second law of thermodynamics. Calculations of clockwise and counter-clockwise thermodynamic cycles. (7-8) 8. State parameters and characteristic processes calculations for superheated steam and saturated vapour; usage of the “p-v”, “T-s” and “i-s” diagrams. (9) 9. Calculations of humid-air processes: mixing, humidification, drying, heating and cooling. usage of the Mollier “i-x” diagram. (10-11) 10. Fundamental calculations of combustion processes; air demand, amount of combustion gas. (12) 11. Basis of steady and non-steady heat transfer calculations for plane composite wall and for wall of a composite tube. Complex heat transfer calculations. (13-14) 12. Heat exchanger calculation; balance of energy, temperature difference, heat transfer area, overall heat transfer coefficient. (15)	project classes

Course advanced

Teaching methods:

classes, lecture

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	test	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Hydrotransport and reology

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3390.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 30, project classes: 30	6.0

Goals

C1	To provide knowledge on the physical properties of the carrier liquids used to transport the solid phase and its influence on the type of motion of the hydro-mixture "solid phase - liquid phase" in the hydrotransport process.
C2	To familiarize students with the instruments and principles of measuring basic parameters in the hydrotransport process (equation of the continuity of the stream and Bernoulli), with the devices used for measurement and control, as well as with the types of hydrotransport installations and hydro-mixture conveyors.
C3	To acquaint students with the basic knowledge of rheology and the properties of Newtonian and non-Newtonian fluids, rheometry and the methodology of pressure loss calculations.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods

Knowledge – Student knows and understands:			
W1	physical properties of the carrier liquid used to transport the solid phase and its influence on the type of movement of the mixture "solid phase - liquid phase ”in the process of hydrotransport.	IBE_P6S_WG07	written credit, project, observation of student’s work, active participation, report, presentation, test, participation in discussion
W2	the specificity of the operation of devices used in hydrotransport, physical quantities and the principles of their measurement and control.	IBE_P6S_WG10, IBE_P6S_WG12	written credit, project, observation of student’s work, active participation, report, presentation, test, participation in discussion
W3	basic rheological concepts, properties of rheological fluids and methods of their measurement.	IBE_P6S_WG07, IBE_P6S_WG08	written credit, project, observation of student’s work, active participation, report, presentation, test, participation in discussion
Skills – Student can:			
U1	determine the basic parameters of the hydro-mixture and apply the appropriate equation to determine the characteristics of the hydrotransport installation.	IBE_P6S_UW11	written credit, project, observation of student’s work, active participation, presentation, test, participation in discussion
U2	select the appropriate measurement method to determine the various rheological properties of fluids and combine the rheological properties of the fluid with their performance properties.	IBE_P6S_UW13	written credit, project, observation of student’s work, active participation, presentation, test, participation in discussion
Social competences – Student is ready to:			
K1	lifelong learning to improve your professional qualifications in the field of hydrotransport.	IBE_P6S_KK01	observation of student’s work, active participation, presentation, participation in discussion

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
presentation/report preparation	10

lesson preparation	10
exam / credit preparation	15
exam participation	5
consultations	5
project preparation	30
class preparation	5
conducting research	5
collecting and studying literature	10

Student workload	**Hours** 155	**ECTS** 6.0
Workload involving teacher	**Hours** 70	**ECTS** 2.6
Practical workload	**Hours** 35	**ECTS** 1.2

* hour means 45 minutes

Study content

No.	Course content	Activities

1.	1. The use of hydrotransport in various branches of the economy: energy, construction, mining, agriculture, chemical and food industries. 2. Types of hydrotransport installations and design parameters. 3. Kinds and properties of hydro-mixtures and their components. 4. Continuity equation and Bernoulli equation for perfect and real fluid, resistance to fluid motion. Beginning of movement and sedimentation of solid particles. 5. Flow machines, dosing devices, pipelines and fittings in hydrotransport. 6. The flow of hydro-mixtures in horizontal pipes. 7. The flow of hydro-mixtures in vertical and inclined pipelines. 8. Hydrotransport in open conduits and gravity installations. 9. Drainage of water from hydro-mixtures in hydrotransport installations, automation. 10. Laboratory and field tests of selected hydro-mixtures, measurements of parameters in hydrotransport installations. 11. Rheological concepts: dynamic viscosity, kinematic viscosity, longitudinal viscosity and other viscosity concepts, flow and viscosity curves, Deborah number, fluid division. 12. Properties of rheologically stable and unstable, viscoelastic, magneto- and electroreological fluids and methods of their description. 13. Methods, devices and instruments (viscometers, rheometers) for measuring the rheological properties of various types of fluids. 14. Principles of calculating pressure losses with the flow of Newtonian and non-Newtonian fluids in pipelines, determining the operating point of the installation. 15. Economic analysis in hydrotransport.	lecture
2.	Performing rheological measurements using a viscometer and rheometer, and designing a hydrotransport installation for the selected hydro-mixture.	project classes

Course advanced

Teaching methods:

Online lectures and exercises depending on the pandemic situation., Blended learning, classes, lecture, discussion, teamwork

Activities	Examination methods	Percentage in subject assessment
lecture	written credit, active participation, participation in discussion	40.00%
project classes	written credit, project, observation of student’s work, active participation, report, presentation, test, participation in discussion	60.00%

Entry requirements

mathematics and statistics

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Water scarcity resources management

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3391.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period Semester 2	**Examination** graded credit **Activities and hours** lecture: 30, project classes: 30	**Number of ECTS points** 6.0

Goals

C1	Creating a new professional profile called “Resource Manager”, a highly skilled person able to integrate the development of strategies to better manage water and other natural resources with business innovation and competitiveness.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Student knows and understand the role and scope of water resource management.	IBE_P6S_WG04	written credit
Skills – Student can:			

U1	Student can identify and measure exposure to loss, as well as develop strategies and methods of handling water related risks.	IBE_P6S_UW18	project, presentation
Social competences – Student is ready to:			
K1	Student is ready for interdisciplinary cooperation and to spread awareness (new thinking) in their neighbourhood about scarcity of water resources.	IBE_P6S_KK01	presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
presentation/report preparation	15
exam / credit preparation	30
project preparation	25
report preparation	15
class preparation	30
consultations	2

Student workload	**Hours** 177	**ECTS** 6.0
Workload involving teacher	**Hours** 62	**ECTS** 2.1
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Introduction to relevant environmental issues and scarce resource 2. Introduction on tools to scarce resource management (Life Cycle Thinking, Environmental Management Systems; Footprinting) 3. ISO 14001 and EMAS regulations: presentation of requirements and applications to manage water related aspects 4. Water Footprint of products and organizations: the evolution of water footprint concepts from virtual water to ISO14046 5. Local Application of Water Footprint approach (URBAN_WFTP approach) 6. Technologies and management practices to reduce Water Footprint 7. Carbon and Energy footprint of products and organizations 8. European Environmental Footprint - methodologies and case studies 9. Water-saving technologies applied in a water and sewage company 10. Presentation of a company with practical application of water footprint thinking 11. Economic strategies and metrics to manage water scare resources 12. Communication of Environmental Performances	lecture

2.	1. Presentation of own case studies related to personal water footprinting. 2. Open discussion about different diets and behaviours with regards to water usage to show the potential for water savings. 3. Life Cycle Analysis of selected products. 4. Working groups with the aim to find improvements in management of hypothetical companies. 5. Calculating water footprint of selected products using two approaches: Water Footprint Network (WFN) and ISO14046. 6. Presentation of the results by groups and open discussion. 7. Brainstorming to find alternatives for water efficient production of goods. 8. Study visit to company with the water-saving technology. 9. Water footprint accounting of cities. 10. Presentation of results, peer-to-peer discussion and comparison of cities performance. 11. Presentation of good practices. Creating thematic working groups to search for additional practices in different sectors. 12. Common elaboration of a guide containing the best practices in water management. 13. Group working on developing strategies for cities targeted to sustainable scarce resources management. 14. Brain storming on opportunities and perspectives of applying Water Footprint in practice, searching for new metrics.	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, brainstorming

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	40.00%
project classes	project, presentation	60.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Energy systems

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3393.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	To acquaint students with solutions of energy systems producing electricity and heat.
C2	Make the audience aware of the problems related to providing energy in a sustainable manner.
C3	Transfer of knowledge in the field of energy production from conventional fuels and renewable sources.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows the methods and devices for generating electricity and heat.	IBE_P6S_WG09, IBE_P6S_WG10	written credit, performing tasks

W2	The student understands the issues of energy production from fossil fuels and renewable sources.	IBE_P6S_WG04, IBE_P6S_WG13	written credit, performing tasks
Skills – Student can:			
U1	The student is able to assess the possibility of using a given energy system for energy production.	IBE_P6S_UW06, IBE_P6S_UW07	written credit, observation of student's work, active participation, performing tasks
U2	The student is able to assess the suitability of a given solution for the bioeconomy in energy production.	IBE_P6S_UU01, IBE_P6S_UW14, IBE_P6S_UW16	written credit, observation of student's work, active participation
Social competences – Student is ready to:			
K1	The student is ready to make decisions regarding the choice of an energy system, taking into account its impact on the environment.	IBE_P6S_KK01, IBE_P6S_KO04	observation of student's work, active participation, performing tasks
K2	The student is ready to work individually and in a team to assess the functioning and suitability of a given energy system.	IBE_P6S_KO01, IBE_P6S_KO02, IBE_P6S_KO04	observation of student's work, active participation, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
consultations	2
lesson preparation	4
exam / credit preparation	15
exam participation	1
class preparation	6
report preparation	15
presentation/report preparation	4

Student workload	**Hours** 77	**ECTS** 3.0
Workload involving teacher	**Hours** 33	**ECTS** 1.1
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Characteristics of energy sources. Share of fossil fuels and alternative sources in energy production. Stability of electricity and heat supplies. Centralized and distributed energy. Power generation systems on an industrial and individual scale. Commercial power plants and combined heat and power plants. Alternative electricity and heat generation systems. Photovoltaic and solar installations. Wind and water energy. Biomass energy generation systems. Heat pumps and ORC systems. Hybrid and combined systems. Energy self-sufficiency in the bioeconomy. Energy cooperatives.	lecture
2.	Determining the demand for electricity and heat. Estimating the power of an installation producing electricity and / or heat on the example of selected energy sources. Laboratory tests of electricity and heat production by installations based on renewable energy sources.	project classes

Course advanced

Teaching methods:

classes, lecture, participation in research, discussion, teamwork, problem-solving method, educational film, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	written credit, observation of student’s work, active participation, performing tasks	50.00%

Additional info

Classes include tests on laboratory stands.

Entry requirements

Fundamentals of technology and physics.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Minimization of waste production

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3394.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	To familiarize students with the concept of waste prevention throughout the value chain.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	at an advanced level, issues in the field of zero waste management	IBE_P6S_WG_03	test
Skills – Student can:			

U1	under supervision, perform simple research and design tasks in the area of waste prevention, taking into account environmental, organizational, social, economic and legal aspects.	IBE_P6S_UW05, IBE_P6S_UW10, IBE_P6S_UW18	project, report
Social competences – Student is ready to:			
K1	act within the zero waste idea	IBE_P6S_KO04	project, report

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
presentation/report preparation	6
project preparation	30
exam / credit preparation	8
lesson preparation	15

Student workload	**Hours** 89	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Introduction 2. Circular Economy and Zero Waste. 3. Polish National Waste Prevention Programme. 4. Waste prevention indicators, goals and monitoring. 5. Waste prevention in primary production. 6. Prevention of municipal waste. 7. Reuse of waste considered products. 8. The role of donation in waste prevention. 9. Food waste prevention in schools. 10. Food waste prevention in the hospitality sector. 11. Food waste prevention in households. 12. Packaging refund systems. 13. Pay-As-You-Throw as a means for waste prevention. 14. Reversed collection of household waste. 15. Design for ReUse and Reduce.	lecture
2.	A Waste Prevention Hackathon (2 hour meetings or 3 possibly consequentive days of 6 hours) 1. Introduction 2. Team formation 3. Problems to solve (external problem owners or internal by teacher or teams) 4. Idea development: what, how, for whom, partners, business opportunities, funding, outreaching, technology 5. Intermediate presentations 6. Fine tuning 7. Final pitching for jury	project classes

Course advanced

Teaching methods:

Hackathon, practical simulation training, lecture, teamwork, educational game, brainstorming, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	test	50.00%
project classes	project, report	50.00%

Entry requirements

None.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Byproducts transformation

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3395.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	The aim of the training is to present knowledge as well as to transfer skills and competencies including definitions of by-product transformation processes, presentation of types of systems, techniques, and technologies of physical, chemical, biological, and thermal transformation of by-products.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Has elementary knowledge of designing systems and devices for the physical, chemical, biological and thermal transformation of by-products	IBE_P6S_WG_03, IBE_P6S_WG05	written credit, project

W2	Has a general knowledge of systems, technologies, techniques, devices, and tools used in the management of by-products in the bioeconomy.	IBE_P6S_WG09, IBE_P6S_WG10	written credit, project
Skills – Student can:			
U1	The student is able to identify and define the specificity of simple engineering tasks and prepare a text containing the identification of an engineering problem in the field of transformation of by-products in the bioeconomy	IBE_P6S_UU01, IBE_P6S_UW01	project
U2	The student is able to use basic information technologies to obtain and process the information on the transformation of by-products in the bioeconomy	IBE_P6S_UW04	project, presentation
Social competences – Student is ready to:			
K1	Is aware of the importance, responsibility, and effects of the engineer's activity in the Bioeconomy program in terms of responsibility for the quality of human life and the condition of the natural environment	IBE_P6S_KO04	project, presentation
K2	Is aware of the responsibility for their own work and readiness to submit to the principles of teamwork and responsibility for jointly performed tasks	IBE_P6S_KO02	project, presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
lesson preparation	10
exam / credit preparation	10
report preparation	30
collecting and studying literature	10

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	• Definitions of by-products • Types of by-products in the bioeconomy • Goals of the transformation of by-products in the bioeconomy • Types of by-product transformation processes, • Processes of physical transformation of by-products, types, technological parameters, and efficiency • Processes of chemical transformation of by-products, types, technological parameters, and efficiency • Processes of biological transformation of by-products, types, technological parameters, and efficiency • Processes of thermal transformation of by-products, types, technological parameters, and efficiency • Technical supporting infrastructure • Basics of monitoring and control	lecture
2.	• Teamwork: Identification of key physical and chemical properties of by-products from the point of view of designing a system for their transformation - Problem-Based Learning • Teamwork: Identifying the key features of products made from by-products from the point of view of the market and consumer needs - Problem-Based Learning • Semester project: Basics of designing a system for the transformation of by-products - Process Flow Diagram and mass balance	project classes

Course advanced

Teaching methods:

classes, lecture, teamwork, problem-solving method, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	project, presentation	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Upcycling

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I2BO.3055.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	The aim of the education is to present knowledge and transfer skills and competencies covering the implementation and development of upcycling, including closing supply chains, creating waste-free self-sufficient energy production systems, and creating new solutions in the field of upcycling at the level of households and industry in order to develop a circular economy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student knows and understands at an advanced level selected issues in the field of chemistry, biochemistry and biology necessary to understand the processes taking place during upcycling	IBE_P6S_WG01	written credit, project
Skills – Student can:			
U1	The student knows and understands at an advanced level selected issues in the field of the functioning of the natural environment, its threats, and protection in a global society	IBE_P6S_UW18	project, active participation
Social competences – Student is ready to:			
K1	The student is able to obtain information from literature, databases, and other sources; is able to integrate the obtained information, interpret it, as well as draw conclusions and formulate and justify opinions	IBE_P6S_KK01	project, presentation, participation in discussion
K2	The graduate is able to assess technical solutions and analyze the factors influencing the quality of life and health of humans and animals as well as the condition of the natural environment, and determine the life cycle of technical systems	IBE_P6S_KO04	project, participation in discussion

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
project preparation	30
exam / credit preparation	10
collecting and studying literature	10
presentation/report preparation	10

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	• Introduction, the concept of upcycling, goals of upcycling • The concepts of multidisciplinarity, interdisciplinarity, and transdisciplinarity in creating advanced systems, taking into account the challenges of the circular economy • Introduction to a circular economy • Introduction to closing the supply chain • Factors favoring the development of upcycling • Introduction to Zero Waste systems • Introduction to renewable biosystems • Ways of creating scenarios and development paths of selected technologies in the field of upcycling • Inventions and innovations in the field of upcycling	lecture
2.	Introduction to problem classes, a division into teams, assigning topics. Problem classes in the field of upcycling of the selected type of by-prduct. Discussion of problems concerning future challenges in bioeconomy.	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, problem-solving method, brainstorming

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	40.00%
project classes	project, active participation, presentation, participation in discussion	60.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Bioorganic chemistry

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3397.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period Semester 3	**Examination** exam **Activities and hours** lecture: 30, laboratory classes: 30	**Number of ECTS points** 4.0

Goals

C1	To provide students with the fundamentals of organic chemistry and biochemistry in terms of presenting the structure, properties, characteristic reactions and reaction mechanism of organic compounds.
C2	To acquaint students with the properties of macromolecules of organic compounds in a practical aspect including their reactivity and potential applications.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Students will know and understand the structure and related reactivity of macromolecules of organic compounds.	IBE_P6S_WG01, IBE_P6S_WG16	written credit
Skills – Student can:			
U1	Students will be able to carry out the process of obtaining selected biochemical preparations.	IBE_P6S_UW11	observation of student's work, active participation
U2	Students will be able to analyse research material by carrying out reactions characteristic for organic compounds.	IBE_P6S_UW11	observation of student's work, performing tasks
U3	Students will be able to interpret the results obtained and prepare a written report.	IBE_P6S_UW06	active participation, performing tasks
Social competences – Student is ready to:			
K1	The student is ready to apply the acquired knowledge to explore related issues in a further study.	IBE_P6S_KO01	test

Balance of ECTS points

Activity form	**Activity hours***	
lecture	30	
laboratory classes	30	
exam / credit preparation	30	
class preparation	10	
consultations	2	
report preparation	10	
Student workload	**Hours** 112	**ECTS** 4.0
Workload involving teacher	**Hours** 62	**ECTS** 2.1
Practical workload	**Hours** 40	**ECTS** 1.5

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Chemical formulas and equations. 2. Chemical bonds. Spatial structures. 3. Organic compounds - classification, nomenclature. 4. Organic compounds - properties, reactivity. 5. Aromatic compounds. Heterocyclic compounds. 6. Chemical kinetics. Influence of physical and chemical factors. The role of catalyst. 7. Biologically important organic compounds. 8. Macromolecules - sugars. 9. Macromolecules - lipids. 10. Macromolecules - proteins. 11. Enzymes. 12. The genetic code. 13. Protein synthesis. 14. Metabolic homeostasis. 15. credit	lecture
2.	1. Elemental composition of organic material 2. Properties of sugars. Characteristic reactions. 3. Properties of proteins. Characteristic reactions. 4. Properties of lipids. Characteristic reactions. 5. The nucleic acids - hydrolysis, analysis of chemical composition. 6. Preparation of selected biochemical preparations. 7. The enzymes. The influence of physical factors on enzymatic reactions. 8. Susceptibility of selected substances to biodegradation. 9. Analysis of natural products. 10. Metabolism of microorganisms.	laboratory classes

Course advanced

Teaching methods:

laboratory, lecture, teamwork, presentation / demonstration

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%

Activities	Examination methods	Percentage in subject assessment
laboratory classes	observation of student’s work, active participation, test, performing tasks	50.00%

Entry requirements

A knowledge of general chemistry regarding the structure of elements, reactivity of acids, bases and salts, basic chemical reactions, geometry of molecules is required.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Water and sewage technology

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3398.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 3	exam **Activities and hours** lecture: 30, laboratory classes: 30	4.0

Goals

C1	The main aim of the course is to refer the students with the basic measures of water and wastewater pollution, wastewater treatment processes as well as technologies used to achieve the necessary degree of pollution reduction as well as recovery of raw materials and water for re-use.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Student knows the basic measure of water and wastewater pollution; knows the operation and performance of equipment for water and wastewater purification; Student knows methods of water and wastewater treatment; Student knows examples of technological solutions for water and wastewater treatment plants; knows technical and technological	IBE_P6S_WG_03	written exam, presentation, participation in discussion
Skills – Student can:			
U1	Student can describe and match the suitable method and technological equipment for water and wastewater treatment due to the type of contaminants removed from water and sewage; can design selected equipment for treatment of technological wastewater (mechanical and biological stage);	IBE_P6S_UW17	project, test

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
laboratory classes	30
lesson preparation	5
exam / credit preparation	15
project preparation	30
consultations	10

Student workload	**Hours** 120	**ECTS** 4.0
Workload involving teacher	**Hours** 70	**ECTS** 2.6
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	Block 1: Water technology: Requirements for drinking water. Water stability in water supply systems; Removal of iron and manganese compounds from water; Coagulation process; Ion exchange; Pressure membrane processes. Block 2: Sewage technology: Wastewater characteristics; wastewater receivers; requirements for wastewater discharged to receivers; the necessary degree of wastewater treatment; Mechanical and physicochemical wastewater treatment (phase separation) - filtration, sedimentation - devices; Block 3: Sewage technology: Biological processes in wastewater treatment; activated sludge method; technological systems; mass balance, kinetics of treatment process; Nitrification and denitrification processes; dephosphatation; Block 4: Sustainable water and sewage management. Model of linear and circular economy in a water and sewage company/ WWTP. Case study: Plan for the recovery of raw materials from wastewater (a task carried out using the Problem Based Learning method)	lecture
2.	Exercise 1: Design of a water treatment plant. Exercise 2: Basic calculations in the field of wastewater technology: wastewater balances (quantitative, qualitative), determination of PE, the necessary degree of treatment, mass balance. Exercise 3: Design of elements of a sewage treatment plant from a mechanical and biological stage.	laboratory classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, problem-solving method

Activities	Examination methods	Percentage in subject assessment
lecture	written exam, presentation, participation in discussion	50.00%
laboratory classes	project, test	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Circular economy

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3466.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 3	exam **Activities and hours** lecture: 30, project classes: 30	4.0

Goals

C1	The aim of education is to provide knowledge and skills in the field of the circular economy designed to provide an alternative to the linear economy, as an approach that in a circular economy, all systems are designed to be regenerative so that materials are recycled with consideration of the sustainable development that ideally maintains the quality of life for consumers and is achieved without loss of revenue or additional costs for producers.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Has the knowledge allowing for referring to basic knowledge of the circular economy and explaining the importance of that sustainable approach.	IBE_P6S_WG02	written exam
W2	Has the knowledge allowing for a critical discussion of sustainable development and its impact on the economy of households, companies, countries and organizations, including making decisions and strategic choices in practice.	IBE_P6S_WK01	written exam
W3	Has the knowledge allowing for assessing in what way network theory and stakeholder theory play a role in possible value creation potential.	IBE_P6S_WG04	written exam
Skills – Student can:			
U1	Is able to analyze the complexity of the circular economy and the connection with a holistic approach to sustainable development.	IBE_P6S_UW08	project, observation of student’s work
U2	Is able to select an appropriate methodology for product design that contributes to an increased degree of the circular economy.	IBE_P6S_UW16	project
U3	Is able to make decisions by applying theoretical and practical knowledge of sustainable business models.	IBE_P6S_UW18	project
Social competences – Student is ready to:			
K1	Is aware of the necessity of contributing to new ways of thinking toward a paradigm shift within the economy and society.	IBE_P6S_KO02	project, observation of student’s work, active participation
K2	Is aware of the importance of the differences and connections between a linear and circular economy.	IBE_P6S_KK01	project, observation of student’s work, active participation

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
lesson preparation	10
project preparation	30
presentation/report preparation	10
exam / credit preparation	10
project classes	30

Student workload	**Hours** 120	**ECTS** 4.0
Workload involving teacher	**Hours** 60	**ECTS** 2.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	The linear and circular economy concepts, industrial ecology, cradle to cradle, biomimicry, and bionic approaches, closed-loop supply chains and reversed logistics approaches, factors driving the circular economy, development and implementation of circular economy, the smaller the loop, the greater the profitability of the system concept, case studies about the transition from the linear to the circular economy, remanufacturing, reconciling profitability with sustainability, circular economy as a driver for innovations.	lecture
2.	Preparation of a project of a new product or service that meets the principles of the circular economy. Will be used: Oxford's Discussion, e.g. what is the circular economy? is the circular economy really sustainable?, waste equals food, case study analyses: e.g. business value in a circular economy, remanufacturing, team work: e.g. longer lasting products, innovative product designing meeting the principles of circular economy, presentation of the Innovative product meeting the principles of circular economy.	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, problem-solving method, brainstorming, text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written exam	40.00%
project classes	project, observation of student’s work, active participation	60.00%

Entry requirements

The prerequisites for the course are economics, mathematics. From these introductory courses, students are expected to understand the fundamentals of economics and be able to perform comprehensive algebraic calculations and bioeconomy systems analysis.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Semestral project 3

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3399.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 3	graded credit **Activities and hours** project classes: 45	4.0

Goals

C1	The aim of the course is to develop teamwork skills oriented towards joint development of a specific task in the field of bioeconomy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	basic methods used in solving research tasks.	IBE_P6S_WK03	case study
Skills – Student can:			
U1	find, understand and analyze bioeconomy information.	IBE_P6S_UW01	presentation

Social competences – Student is ready to:			
K1	define an action plan for the implementation of tasks defined by oneself or by others and ensure their timely	IBE_P6S_KO02	presentation

Balance of ECTS points

Activity form	Activity hours*
project classes	45
lesson preparation	20
collecting and studying literature	25
presentation/report preparation	10
consultations	15

Student workload	**Hours** 115	**ECTS** 4.0
Workload involving teacher	**Hours** 60	**ECTS** 2.0
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Students will be assigned to groups in which they will have the task of developing issues related to the bioeconomy specified by the lecturer. The task will include, inter alia, the analysis of the current state, identification of problems, collection of information, including from scientific sources, databases, etc. on technological solutions used in the world, analysis of quantitative and qualitative data related to the economic, social and environmental sphere. The group will be tasked with developing and delivering a presentation, in the initial phase of implementation and after completion. Members of the remaining groups take an active part in the discussion and evaluation of the presented issues and solutions.	project classes

Course advanced

Teaching methods:

classes, discussion, teamwork, problem-solving method, brainstorming

Activities	Examination methods	Percentage in subject assessment
project classes	presentation, case study	100.00%

Entry requirements

Basic knowledge of mathematics, physics, statistics used in formulating and solving simple tasks in the area of bioeconomy.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Odors

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3401.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period Semester 3	**Examination** graded credit **Activities and hours** lecture: 15, laboratory classes: 15	**Number of ECTS points** 3.0

Goals

C1	Gaining knowledge in the field of legislation in Poland and in the world in the field of odors.
C2	Acquiring knowledge of the formation and emission of odors in the atmospheric air.
C3	Ability to take samples for olfactometric determinations.
C4	The ability to assess the odor of air for various types of odor emission sources.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	the principles underlying the emission of odors to the air and the assessment of odorous air quality.	IBE_P6S_WG06	written credit, presentation
Skills – Student can:			
U1	to independently take a sample for olfactometric determinations.	IBE_P6S_UW05	presentation
U2	to correctly carry out calculations in the field of odor air quality evaluation.	IBE_P6S_UW04, IBE_P6S_UW06, IBE_P6S_UW07	presentation
Social competences – Student is ready to:			
K1	to work in a team and implement joint projects.	IBE_P6S_KO01, IBE_P6S_KO02	presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
laboratory classes	15
exam participation	2
exam / credit preparation	15
lesson preparation	15
presentation/report preparation	10
consultations	3
class preparation	15

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 35	**ECTS** 1.2
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Introductory lecture. The most important concepts: odors, odorants, odor unit, odor concentration, odor emission. Norm and legal basics of odors in Poland and in the world. Odor quality assessment methods. Types of odor emission sources (analytical, sensor, sensory). Sampling for olfactometric tests. Field studies of the properties of odors (frequency, intensity, hedonic tone). Odor nuisance - assessment methods.	lecture

2.	Stationary olfactometry: sampling for olfactometric determinations; determination of the odor concentration. Field olfactometry. Field studies of odor properties: calculations.	laboratory classes

Course advanced

Teaching methods:

classes, practical simulation training, lecture, discussion, teamwork, presentation / demonstration

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
laboratory classes	presentation	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Air protection

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3402.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period Semester 3	**Examination** graded credit **Activities and hours** lecture: 15, project classes: 15	**Number of ECTS points** 3.0

Goals

C1	C1. Acquiring knowledge of physical and chemical processes in the atmosphere.
C2	C2. Getting to know the methods of modeling the spread of pollutants in the air and the principles of drawing up air protection programs.
C3	Acquiring the ability to prepare data for the reference model of air pollution dispersion, its use for calculations of the air pollution state for a selected emission source, along with the interpretation of the results.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	the basic physical and chemical processes affecting the transport and spread of pollutants in the atmosphere.	IBE_P6S_WG06	written credit, oral credit
W2	the basics of modeling the phenomenon of transport and dispersion of pollutants in the atmosphere.	IBE_P6S_WG06	written credit, oral credit
Skills – Student can:			
U1	to collect the necessary input data for the reference model.	IBE_P6S_UW01	oral credit, project
U2	to operate the reference model.	IBE_P6S_UW04	project
U3	to interpret the results of model calculations.	IBE_P6S_UW04	oral credit, project

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
exam / credit preparation	10
exam participation	2
consultations	5
lesson preparation	10
project preparation	18
report preparation	15

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 37	**ECTS** 1.3
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Introduction: Earth and its atmosphere. Emission of pollutants to the atmosphere. Thermal, dynamic and thermodynamic processes in the atmosphere. Global Atmospheric Circulation. Basics of modeling the phenomenon of the spread of pollutants in the atmospheric air. Overview of the models of transport and spread of pollution. Construction of air protection programs.	lecture

2.	Overview of the reference model and the scope of exercises. Preliminary calculations, preparation of input data. Data input and verification. Carrying out model calculations for the condition before and after modernization, proposing methods and devices to meet the immission standards.	project classes

Course advanced

Teaching methods:

lecture, computer lab/laboratory, project-based learning (PBL)

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	oral credit, project	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Air pollutants emission

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3403.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period Semester 3	**Examination** graded credit **Activities and hours** lecture: 15, project classes: 15	**Number of ECTS points** 3.0

Goals

C1	Teaching issues related to the type of air pollutants, their sources and propagation processes in the atmosphere and methods of reducing emissions.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	on air pollutants and their sources as well as basic legal instruments in air protection	IBE_P6S_WG06	test
Skills – Student can:			

U1	make a case study, prepare a documented study in the field of atmosphere protection, present a presentation on the current problem in atmosphere protection, indicate the best available techniques for reducing emissions	IBE_P6S_UW03, IBE_P6S_UW16	report, presentation
Social competences – Student is ready to:			
K1	taking responsibility for non-technical aspects and effects of human activity	IBE_P6S_KO04	test

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
exam / credit preparation	15
report preparation	30

Student workload	**Hours** 75	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Definitions of basic terms, classification of the sources of emissions and air pollutants. Legal aspects related to air and climate protection. Characteristics of basic air pollutants, main sources. Transformation of pollutants in the air. Characteristics of selected technologies as sources of air pollution emissions. Volatile organic compounds and odors. Characteristics of aerosols. Equipment and technologies in gas purification. Biological systems for gas purification. Market analysis of available solutions in the field of gas purification systems.	lecture
2.	Case study of the object being the source of air pollution, problem analysis, proposed solutions, presentation of results.	project classes

Course advanced

Teaching methods:

lecture, discussion, teamwork, case analysis

Activities	**Examination methods**	**Percentage in subject assessment**

Activities	Examination methods	Percentage in subject assessment
lecture	test	50.00%
project classes	report, presentation	50.00%

Entry requirements

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UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Waste gas treatment technologies

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3404.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 3	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	Teaching issues in the field of technological installations for the purification of selected waste gases.
C2	Acquainting with the methods of selecting apparatus and designing installations for the purification of selected waste gases.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	basics of the selection of processes, unit operations and equipment for the purification of waste gases	IBE_P6S_WG06, IBE_P6S_WG07	test

W2	issues of technology of flue gas purification from dust and gaseous pollutants	IBE_P6S_WG06	test
Skills – Student can:			
U1	select a unit process or operation and equipment for exhaust gas treatment	IBE_P6S_UW14	project
U2	use the literature and databases to perform simple process calculations and design a plant for the treatment of selected waste gases	IBE_P6S_UW14	project
Social competences – Student is ready to:			
K1	assuming the designer's responsibility in terms of the effects of his activities on the environment	IBE_P6S_KO04	test

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
project preparation	30
exam / credit preparation	15

Student workload	**Hours** 75	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Gravity, inertial and centrifugal dedusting. Dry filter dedusting. Dust removal and wet dust collectors. Dry and wet electrostatic precipitators. Absorption and absorbers. Adsorption and adsorbers. Combustion methods and condensation methods in gas purification. Dry and semi-dry methods of flue gas desulphurization. Wet flue gas desulphurization methods. Flue gas denitrification methods. Examples of industrial waste gas treatment installations.	lecture
2.	Design of a two-stage dedusting installation	project classes

Course advanced

Teaching methods:

lecture, project-based learning (PBL)

Activities	Examination methods	Percentage in subject assessment
lecture	test	60.00%
project classes	project	40.00%

Entry requirements

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UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Bioproducts processing

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3406.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 3	graded credit **Activities and hours** lecture: 30, project classes: 30	6.0

Goals

C1	The aim of the course is to provide knowledge on the impact of processing on the quality of food products in the context of changes in both basic ingredients and bioactive compounds. Processing causes a number of alterations in food products and may lead to the degradation of basic chemical compounds and health-promoting components as well as may influence their final properties. Additionally, the processing may cause the formation of hazardous compounds to human. Learning about the methods of sustainable processing of bioproducts will allow students to acquire the ability to independently select the appropriate method of processing depending on the specificity of raw materials and to design processing taking into account the the highest quality and safety of food merchandises.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	basic processing techniques and methods and their influence on the food products quality	IBE_P6S_WG01, IBE_P6S_WG04, IBE_P6S_WG08	observation of student's work, participation in discussion
Skills – Student can:			
U1	select the appropriate processing methods and techniques depending on the composition of the raw material and recognize their impact on the quality of processed products	IBE_P6S_UW01, IBE_P6S_UW11	project
U2	has an ability to use a specific terminology in English	IBE_P6S_UW02	project, observation of student's work, participation in discussion
Social competences – Student is ready to:			
K1	independent design of processing processes for selected food products, taking into account technological innovations	IBE_P6S_KK01	project

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
presentation/report preparation	60
class preparation	40
collecting and studying literature	20

Student workload	**Hours** 180	**ECTS** 6.0
Workload involving teacher	**Hours** 60	**ECTS** 2.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. basic processing methods and techniques used for processing of bioproducts 2. the impact of processing methods on the quality of products 3. classification of the processed foods – consumers perception 4. processing induced modifications of basic chemical composition and bioactives in foods 5. indicators of processed foods 6. analytical methods for determination of processing indicators 7. new technological solutions towards sustainable processing	lecture
2.	1. determination of the influence of processing on final quality of foods - case study 2. processing design and selection of equipment for processing of bioproducts	project classes

Course advanced

Teaching methods:

blended learning, Blended learning, classes, lecture, teamwork, problem-solving method, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	observation of student’s work, participation in discussion	30.00%
project classes	project	70.00%

Entry requirements

the basic knowledge of food technology

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Enzymatic processes in food production

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3601.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 3	graded credit **Activities and hours** lecture: 30, project classes: 30	6.0

Goals

C1	The aim of the course is to familiarize students with the conditions and basic directions of the use of enzyme preparations in food production and the modification of food ingredients. The lecture program covers the use of enzymes, among others from the class of hydrolases, oxidoreductases and transferases in industrial processes related to food production and covers new, potential areas of their application. The program also includes a description of selected food production technologies with particular emphasis on the enzymatic processes used, i.e. brewing beer, cheese making, baking, fruit processing.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	knows the possibilities of using exo- and endogenous enzymes to obtain traditional and functional foods	IBE_P6S_WG05, IBE_P6S_WG16	written credit
W2	the impact of modification of food ingredients on their functional, technological, organoleptic and health properties	IBE_P6S_WG05, IBE_P6S_WG16	written credit
W3	knows the legal conditions related to the use of enzymes in food production	IBE_P6S_WG16	written credit
Skills – Student can:			
U1	develop a biocatalytic scheme for obtaining selected food ingredients with different biological functions and develop the concept of a new food product or modification of a traditional one	IBE_P6S_UW02, IBE_P6S_UW12	project, performing tasks
U2	design an outline of enzymatic modification of food components aimed at improvement of the functional, technological, organoleptic and health properties	IBE_P6S_UW02, IBE_P6S_UW12	project, performing tasks
Social competences – Student is ready to:			
K1	critical assessment of his own knowledge and be able to consulting experts	IBE_P6S_KK01	performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
lesson preparation	20
exam / credit preparation	20
consultations	10
class preparation	10
project preparation	30

Student workload	**Hours** 150	**ECTS** 6.0
Workload involving teacher	**Hours** 70	**ECTS** 2.6
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	Directions, possibilities and legal aspects of using biocatalysis in food production. Directions and possibilities of using biocatalysis in food production. Food ingredient modification; functional foods. Modification of protein components of food with the participation of proteases, oxidoreductases and isomerases. Shaping the functional properties of proteins; proteolysis. The use of plastination reaction to modify proteins. Enzymes in the dairy industry. The use of transglutaminase in the modification of food ingredients. Bioactive peptides. Enzymes in baking. Enzymes in brewing. Enzymes in juice industry.	lecture
2.	1. Performing the enzymatic process with the use of a selected biocatalyst 2. Optimization of the process conditions with statistical methods of experiment planning (DoE) 3. Analysis and interpretation of experimental results 4. Preparation of the project	project classes

Course advanced

Teaching methods:

classes, lecture

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	project, performing tasks	50.00%

Entry requirements

biochemistry, enzymology, general microbiology

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Insects as a food source

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3408.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills Yes

Period Semester 3	**Examination** graded credit **Activities and hours** lecture: 15, project classes: 45	**Number of ECTS points** 6.0

Goals

C1	the aim is to enable students to become familiar with material concerning the benefits, opportunities and impact of insects on humans and their environment
C2	the aim is to analyze the nutritional value of edible insects and to make students aware of the advantages of their consumption based on a review of the available scientific literature
C3	the aim is to convey to students the knowledge about insect husbandry according to the principles of circular economy

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Student know and understand the structure and properties of the nutrients present in insects and their importance	IBE_P6S_WG01	project, observation of student’s work, presentation
W2	Students know and understands the latest trends related to the use of edible insects in human and animal nutrition (domestic and farm animals)	IBE_P6S_WG04, IBE_P6S_WG05	project, observation of student’s work, presentation
Skills – Student can:			
U1	Student is able to justify the use of innovative technologies, select actions aimed at increasing the quality of food using edible insect	IBE_P6S_UW01, IBE_P6S_UW07, IBE_P6S_UW11	active participation, participation in discussion
U2	Student is able to use professional terminology in a foreign language	IBE_P6S_UW02	project, active participation, presentation, participation in discussion
Social competences – Student is ready to:			
K1	Student is ready to use scientific reports in solving problems related to innovative ways of nutrition (use of edible insects as an alternative source of protein)	IBE_P6S_KK01, IBE_P6S_KO02	observation of student’s work, active participation

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	45
presentation/report preparation	20
project preparation	20
collecting and studying literature	15
literature study	20
class preparation	15
consultations	2

Student workload	**Hours** 152	**ECTS** 6.0
Workload involving teacher	**Hours** 62	**ECTS** 2.1
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	History and popularity of entomophagy in the world. Beneficial roles of insects for nature and humans Species of edible insects. Legal issues concerning the consumption of insects. Nutritional properties of different species and different developmental forms of insects (quantitative and qualitative composition: protein, fat, carbohydrates, non-nutrients, minerals, vitamins). Alternative sources of protein in food. Use of insects and products of their processing in human nutrition and in various industries. Methods of preparing insects. The economic and environmental aspects of entomophagy. Environmental opportunities of insect rearing for food and feed. Breeding of insects in a circular economy system. Cultural taboos connected with entomophagy. Negative attitudes towards insects. Methods of insect breeding. The use of insects in animal nutrition. Advantages and disadvantages of entomophagy.	lecture
2.	Evaluation of the effect of feed (whole food and agro-food industry waste) on the profile of fatty acids in the fat fraction and odor compounds after roasting selected insect species (culture, freeze-drying, extraction, roasting, GC-MS analysis, SPME, data processing). Project - survey on the acceptance of eating insects - conducting the survey and analyzing the results. PBL project - why do Europeans have a problem with the acceptability of insects in the diet? PBL project - what can be done to make insects acceptable in the diet?	project classes

Course advanced

Teaching methods:

Blended learning, lecture, discussion, teamwork, project-based learning (PBL), problem-solving method, brainstorming, text analysis

Activities	Examination methods	Percentage in subject assessment
lecture	presentation, participation in discussion	30.00%
project classes	project, observation of student’s work, active participation, presentation, participation in discussion	70.00%

Entry requirements

chemistry

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Biorafinering technologies

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I4BO.3409.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period Semester 3	**Examination** graded credit **Activities and hours** lecture: 30, project classes: 30	**Number of ECTS points** 6.0

Goals

C1	Familiarizing the students with the biorefinery concept and its place in the circular economy. Explanation of technical, process and biocatalytical issues related to waste and by-products processing. Familiarizing with principal groups of products produced in biorefineries. Presentation of priciples for technological processes design in biorefineries.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The graduate knows and understands at an advanced level the issues of biorefining, bioconversion and the use of biomass and byproducts in the designing of biorefining technologies	IBE_P6S_WG05	written credit, project, observation of student’s work, active participation, presentation
W2	The graduate knows and understands at an advanced level issues in the field of sustainable production, processing and use of raw materials in the designed biorefining processes	IBE_P6S_WG09	written credit, project, observation of student’s work, active participation, presentation
W3	The graduate knows and understands at an advanced level issues in the field of design and operation of biorefining technologies	IBE_P6S_WG11	written credit, project, observation of student’s work, active participation, presentation
Skills – Student can:			
U1	The graduate has the ability to prepare an engineering study (along with a presentation) in the field of biorefining technologies	IBE_P6S_UW03	written credit, project, observation of student’s work, active participation, presentation
U2	The graduate has the ability to search, understand, analyze and use information about biorefining processes design in a creative way	IBE_P6S_UW01	written credit, project, observation of student’s work, active participation, presentation
U3	The graduate has the ability to choose the conditions for conducting typical unit processes related to the biorefining processes and to estimate the demand for raw and supportive materials in these processes	IBE_P6S_UW12	written credit, project, observation of student’s work, active participation, presentation
U4	The graduate has the ability to communicate using professional terminology within biorefining technologies in foreign language	IBE_P6S_UW02	written credit, project, observation of student’s work, active participation, presentation
Social competences – Student is ready to:			
K1	The graduate is able to correctly identify and resolve dilemmas related to the profession of an engineer; is aware that the result of the engineer's activity depends on the correct recognition of the problem; adheres to the principles of professional ethics and personal culture and requires it from others	IBE_P6S_KR_01	written credit, project, observation of student’s work, active participation, presentation
K2	The graduate understands the need for development, updating his knowledge, knows the possibilities of developing professional and interpersonal competences and consulting experts	IBE_P6S_KK01	written credit, project, observation of student’s work, active participation, presentation
K3	The graduate is able to correctly define the priorities for the implementation of tasks set, by himself or others, and to ensure their timely implementation	IBE_P6S_KO02	written credit, project, observation of student’s work, active participation, presentation

Balance of ECTS points

Activity form	Activity hours*
lecture	30
project classes	30
lesson preparation	20
exam / credit preparation	40
project preparation	20
presentation/report preparation	10
consultations	2
exam participation	2
class preparation	15
collecting and studying literature	10

Student workload	**Hours** 179	**ECTS** 6.0
Workload involving teacher	**Hours** 64	**ECTS** 2.2
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities

1.	1. Introduction to biorefinery concept. By-products and wastes as resources in industrial processes. (2h) 2. Susbtrates and feedstocks for biorefining and their properties. (2h) 3. Principal unit operations and processes used in biorefineries (4h) 4. Process apparatus used in biorefineries (2h) 5. Biocatalysts: enzymes (2h) 6. Biocatalysts: microorganisms (2h) 7. Bionergy production: biogas (2h) 8. Bioenergy production: biodiesel and bioalcohols (2h) 9. Biomaterials production (2h) 10. Examples of bioproducts with high-value addedition: platform and specialty chemicals, fragrances, foodstuffs, pharmaceuticals (2h) 11. Process integration in biorefineries (1h) 12. Dynamic and kinetic calculations examples in biorefining processes, preparation of mass balances (2h) 13. Principles of life cycle assessment and techno-economic feasibility analysis of biorefining technologies (2h) 14. Examples of commercial biorefineries installations (4h)	lecture
2.	1. Introduction to biorefinery design. Deiscussing of the elements of the design. (3h) 2. Selection of the feedstocks for the design with discussing of their composition and properties. (3h) 3. Selection of processes for feedstocks processing (3h) 4. Selection of process apparatus. (3h) 5. Selection of biocatalytic processes. (3h) 6. Potential products of desingned biorefineries. (3h) 7. Technological scheme of designed processes. (3h) 8. Calculative and balance issues. (3h) 9. Presentation of designs. (6h)	project classes

Course advanced

Teaching methods:

It is allowed to conduct part of the lectures and classes in distance form, classes, lecture

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%

Activities	Examination methods	Percentage in subject assessment
project classes	project, observation of student’s work, active participation, presentation	50.00%

Entry requirements

Chemistry, Bioeconomy principles, Biorenewable systems, Byproducts transformation, Upcycling, Man and environment

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Biomass conversion

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3411.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 4	exam **Activities and hours** lecture: 30, laboratory classes: 30	4.0

Goals

C1	Transfer of knowledge in the field of processing and management of biomass for energy purposes.
C2	Making the audience aware of the necessity of appropriate biomass conversion in order to enable its further use in the energy sector.
C3	To acquaint students with the techniques of conversion of biomass to valuable solid fuel.

Subject's learning outcomes

Code	**Outcomes in terms of**	**Effects**	**Examination methods**
Knowledge – Student knows and understands:			

W1	The student knows and understands the methods of biomass conversion for its further use for energy purposes.	IBE_P6S_WG05, IBE_P6S_WG09	written exam, active participation, participation in discussion, performing tasks
W2	The student understands the need for biomass valorization and changes in its physico-chemical properties.	IBE_P6S_WG05, IBE_P6S_WG14	written exam, active participation, participation in discussion, performing tasks
Skills – Student can:			
U1	The student is able to characterize the biomass conversion processes and justify the need for their application.	IBE_P6S_UW05, IBE_P6S_UW14	written exam, active participation, presentation, participation in discussion, performing tasks
U2	The student is able to apply selected research methods to determine the necessary physicochemical properties of biomass.	IBE_P6S_UW05, IBE_P6S_UW06, IBE_P6S_UW11	written exam, active participation, participation in discussion, performing tasks
Social competences – Student is ready to:			
K1	The student is aware of the need to improve his professional qualifications and constantly expand knowledge in the field of technological processes.	IBE_P6S_KK01	performing tasks
K2	The student is prepared for individual and team work, is aware of the responsibility for the tasks performed.	IBE_P6S_KO01, IBE_P6S_KO02	active participation, presentation, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
laboratory classes	30
exam participation	2
lesson preparation	2
exam / credit preparation	15
consultations	2
class preparation	4
report preparation	12
presentation/report preparation	6

Student workload	Hours 103	ECTS 4.0
Workload involving teacher	Hours 64	ECTS 2.2
Practical workload	Hours 42	ECTS 1.6

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Potential for the use of biomass in the economy. Characteristics of biomass and factors influencing the necessity of its conversion. Methods of biomass conversion focused on its physico-chemical properties and adaptation to its use in the bioeconomy for the production of electricity and heat. Technologies of biomass grinding, compaction and conversion to energy. Technological processes related to pelleting, briquetting and biomass baling. Parameterization of physico-chemical properties of biomass after its conversion. Advantages and disadvantages of selected biomass conversion processes. The impact of biomass conversion on environmental aspects and its usable values.	lecture
2.	Analysis of selected biomass properties before and after the conversion process. Grinding of biomass. Production of pellets and briquettes from waste biomass. Testing the mechanical durability of pellets and briquettes. Analysis of biomass resistance to weather conditions. The impact of biomass conversion to specific forms on logistic processes (storage and transport). Determination of specific physical and chemical properties of raw and processed biomass.	laboratory classes

Course advanced

Teaching methods:

classes, lecture, participation in research, discussion, teamwork, presentation / demonstration, educational film

Activities	Examination methods	Percentage in subject assessment
lecture	written exam	50.00%
laboratory classes	active participation, presentation, participation in discussion, performing tasks	50.00%

Additional info

Laboratory exercises, research, report.

Entry requirements

Fundamentals of technology, physics and chemistry

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Microbiology

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3412.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 4	exam **Activities and hours** lecture: 30, laboratory classes: 30	4.0

Goals

C1	Knowledge of the structure, function, occurrence, sensitivity to environmental factors, and systematics of the most important groups of microorganisms.
C2	Knowledge of microbial culture methods and the use of microorganisms in environmental cleaning.
C3	Knowledge of the sanitary risks posed by microorganisms and microbiological methods for the assessment of the sanitary state of the environment.
C4	Acquisition of the ability to isolate and identify microorganisms.
C5	Acquisition of the ability to test the influence of physical and chemical factors on microorganisms.
C6	Acquisition of the ability to inoculate and culture microorganisms and perform microbiological analysis of the environmental samples.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows and understands the structural similarities and differences between microbes and the unique structure/function relationships of prokaryotic cells.	IBE_P6S_WG01	written credit, active participation, participation in discussion
W2	The student knows and understands the importance of microorganisms for people and the environment, together with the dangers resulting from their presence in the environment.	IBE_P6S_WG01	written credit, active participation, participation in discussion
W3	The student knows and understands microbiological sanitary requirements for water, soil, air and sewage sludge.	IBE_P6S_WG17	written credit, active participation, participation in discussion
W4	The student knows and understands microbiological processes being the basis of biological methods of environment cleaning and using in bioeconomy.	IBE_P6S_WG17	written credit, active participation, participation in discussion
Skills – Student can:			
U1	Students will be able to appreciate the diversity of microorganisms and microbial communities and recognize how microorganisms solve fundamental problems posed by the environment in which they live.	IBE_P6S_UW01	written credit, observation of student’s work, performing tasks
U2	The student is able to perform basic types of inoculations and conduct cultures of microorganisms with different requirements.	IBE_P6S_UW05	observation of student’s work, performing tasks
U3	The student is able to perform sanitary analysis of water, soil and assess the sanitary quality of the tested sample according to current standards.	IBE_P6S_UW05	observation of student’s work, performing tasks
Social competences – Student is ready to:			
K1	The student is ready to take responsibility for the environmental risks associated with microbial emissions and is aware of the possibility of using microorganisms in the bioeconomy.	IBE_P6S_KO04	written credit

Balance of ECTS points

Activity form	Activity hours*
lecture	30
laboratory classes	30
lesson preparation	10
report preparation	15

exam / credit preparation	10
class preparation	20

Student workload	**Hours** 115	**ECTS** 4.0
Workload involving teacher	**Hours** 60	**ECTS** 2.0
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	1. Introduction, History and Scope of Microbiology 2. Instruments used in Microbiology 3. Analytical Techniques 4. Cell structure and sub cellular organelles of bacteria 5. The influence of physical and chemical factors on microorganisms 6. Antibiotics and other chemotherapeutic agents according to the microbes 7. Virology 8. Control of microbes 9. Stains and staining of microorganisms. 10. Cultivation of bacteria 11. Air microbiology 12. Microbiology of water and wastewater 13. Soil microbiology	lecture

2.	1. Introduction. Presentation of safety rules and regulations of the microbiological laboratory. Discussing the aim and scope of the exercises. Presentation of the conditions for passing 2. Selected staining methods. 3. Visualization of bacteria and yeast with measurement of cell size using microscopy. Division of cells into dead and alive using fluorescence microscopy. 4. Sterilisation and disinfection - performing cultures to determine sensitivity of microorganisms to disinfectants. 5. Assessment of antimicrobial susceptibility of bacteria using the Kirby-Bauera method and minimum inhibitory concentration for selected organisms 6. Methods of inoculation and cultivation of microorganisms 7. Monitoring of microbial growth in liquid batch culture 8. Selected topics on bacterial and yeast metabolism: carbon sources, respiratory processes, fermentation. 9. Bacteriological evaluation of water according to current standards. 10. Effectiveness of water treatment processes. 11. Microbiological analysis of ambient and indoor air. Comparison of the sedimentation method and the impaction method. 12. Microbiological analysis of soil and sewage sludge.	laboratory classes

Course advanced

Teaching methods:

classes, lecture, discussion, presentation / demonstration, problem-solving method, brainstorming

Activities	Examination methods	Percentage in subject assessment
lecture	written credit, active participation, participation in discussion	50.00%
laboratory classes	written credit, observation of student’s work, active participation, performing tasks	50.00%

Entry requirements

The student has basic knowledge in the field of biology.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Semestral project 4

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3413.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 4	graded credit **Activities and hours** project classes: 45	4.0

Goals

C1	The aim is to familiarize students with the possibilities of creative problem solving in the field of bioeconomy based on teamwork and case analysis and problem solving.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows and understands the principles of creative problem solving in the field of bioeconomy based on teamwork, case analysis and problem solving.	IBE_P6S_WK03	project

Skills – Student can:			
U1	The student has the ability to apply the principle of rational management of natural resources, critical data analysis, team development of solutions when solving problems in the field of bioeconomy.	IBE_P6S_UW18	project
Social competences – Student is ready to:			
K1	The student is ready to incur social, professional and ethical responsibility for solving security problems environment and bioeconomy.	IBE_P6S_KO04	project

Balance of ECTS points

Activity form	**Activity hours***
project classes	45
project preparation	30
presentation/report preparation	10
consultations	10
lesson preparation	10

Student workload	**Hours** 105	**ECTS** 4.0
Workload involving teacher	**Hours** 55	**ECTS** 2.0
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The student works using the principles of project work and team work, freely searches for and critically reviews information, including scientific information, analyzes problems and indicates the possibilities of their creative solution. Based on the collected information, group work and creative thinking, he prepares a project solving a technical, organizational and / or social problem in the field of bioeconomy.	project classes

Course advanced

Teaching methods:

classes, teamwork, project-based learning (PBL), problem-solving method, brainstorming, case analysis

Activities	Examination methods	Percentage in subject assessment
project classes	project	100.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Process engineering

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3414.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 4	exam **Activities and hours** lecture: 30, laboratory classes: 30	4.0

Goals

C1	Teaching the issues of flow hydrodynamic and mass transfer process in gas-liquid and gas-solid systems.
C2	Teaching the issues of bioprocesses used in the bioeconomy

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	unit processes, hydrodynamics of gas-liquid / gas-solid flow and the basics of mass transfer in column devices.	IBE_P6S_WG07	test

W2	the basic concepts of bioprocess engineering, the basis of bioreactor operation and kinetics of biotechnological processes, including control of physico-chemical parameters and the optimization of biotechnological processes used in bioeconomy.	IBE_P6S_WG16	test
Skills – Student can:			
U1	perform the calculations necessary to describe the mass transfer balance and design of devices and make a mathematical description of the basic processes of process and bioprocess engineering.	IBE_P6S_UW12	test
U2	to outline methods and techniques suitable for solving standard problems connected with planning and conducting biotechnological processes in bioeconomy.	IBE_P6S_UW05, IBE_P6S_UW12	performing tasks
Social competences – Student is ready to:			
K1	to interact in a group to perform a number of analytical determinations and analyse the obtained data.	IBE_P6S_KO02	performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
laboratory classes	30
lesson preparation	60

Student workload	**Hours** 120	**ECTS** 4.0
Workload involving teacher	**Hours** 60	**ECTS** 2.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Physicochemical unit processes in environmental engineering. Problems of mass transfer. Gas and liquid flow through packed columns. Absorption, adsorption, barbortage hydraulics, atomization of a liquid, gas flow through a fixed and fluidized bed of a solid. Basic concepts of bioprocess engineering, technical aspects of biotechnology, stages of the biotechnological process used in the bioeconomy with a general bioprocess diagram. Pre-processing procedures in bioeconomy. Bioreactors in the production process with principles and criteria for their selection. Microbial population growth, used in the bioeconomy. Fermentation processes, biomass multiplication, bioprocess balancing. Conditions for the optimization of biotechnological processes.	lecture

2.	Methods of expressing and calculating pollutant concentrations in gases. Physicochemical properties of gases. Diffusion coefficients, mass transfer calculations. Fluid flow. Mass balances in columns with packed. Control of substrate consumption culture and product growth rates by selected microorganisms in a bioreactor. Growth kinetics of microorganisms. Ultrasonic disintegration of organisms used in bioeconomy. Mechanical methods of separation of post-culture mixtures used in bioeconomy. Methods of control and evaluation of bioprocesses.	laboratory classes

Course advanced

Teaching methods:

classes, lecture, participation in research

Activities	Examination methods	Percentage in subject assessment
lecture	test	60.00%
laboratory classes	test, performing tasks	40.00%

Entry requirements

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UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Biotechnological processes

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3374.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 4	graded credit **Activities and hours** lecture: 15, seminar: 15	3.0

Goals

C1	To provide knowledge on the biotechnological potential of economically useful organisms
C2	To familiarise students with technological processes using biological material.
C3	To acquaint students with the methods of modern biotechnology and their application in various fields of the economy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Students will know and understand the specifics of the technological process with biological issue.	IBE_P6S_WG01, IBE_P6S_WG04, IBE_P6S_WG08, IBE_P6S_WG16	written credit
W2	Student knows and understands and can give examples of using the possibilities of modern biotechnology in selected areas of economy	IBE_P6S_WG08, IBE_P6S_WG13, IBE_P6S_WG16	written credit, presentation
Skills – Student can:			
U1	Student is able to communicate the application potential of biotechnological processes	IBE_P6S_UW07, IBE_P6S_UW18	written credit, presentation, participation in discussion
U2	Student is able to propose a biotechnological process for the extraction of valuable products, raw materials, environmental protection and bioremediation.	IBE_P6S_UW07, IBE_P6S_UW17	presentation, participation in discussion
U3	Student is able to prepare and present a study of the literature on an agreed topic	IBE_P6S_UW02, IBE_P6S_UW04	presentation, participation in discussion
Social competences – Student is ready to:			
K1	Student is ready to evaluate and identify the benefits of biotechnological processes in the modern economy.	IBE_P6S_KK01	presentation, participation in discussion
K2	The student is ready to independently search, verify and prepare materials about the achievements of biotechnology.	IBE_P6S_KO01	presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
seminar	15
presentation/report preparation	10
exam / credit preparation	15
exam participation	1
literature study	15
consultations	4

Student workload	**Hours** 75	**ECTS** 3.0
Workload involving teacher	**Hours** 35	**ECTS** 1.2

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	1. Biotechnology - an interdisciplinary science. The aspect of modern technological process or adaptation of natural processes. 2. Biological basis of biotechnological processes. Biocatalysis. The use of enzymes in industrial processes. 3. Products of microbial metabolism. Biotechnological obtaining of economically valuable substances and compounds. 4. Biotechnology in environmental protection. Biotechnology in ensuring sustainable development. 5. Biotechnological methods of obtaining raw materials and energy carriers. 6. Biotechnological use of plants and biomass processing. 7. Bioremediation of contaminated environments. Potential of extreme environments microorganisms. 8. Credit	lecture
2.	Internet data search and verification. Bibliographic databases. Tools for creating a bibliography. Working with presentation tools. Presentation of search results and development of materials on a given topic in the field of the use of biotechnological methods in various aspects of life and economy.	seminar

Course advanced

Teaching methods:

presentation of students work, lecture, discussion, text analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	60.00%
seminar	presentation, participation in discussion	40.00%

Entry requirements

1. Knowledge of biology as it relates to the functioning of the living cell.
2. Credit for Microbiology course.
3. Credit for Bioorganic Chemistry course.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

New trends in biotechnology

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3396.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 4	graded credit **Activities and hours** lecture: 15, seminar: 15	3.0

Goals

C1	Gaining knowledge about new developments in bioscience.
C2	Gaining inspiration to apply and create new solutions in different disciplines.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	the latest developments in biological sciences.	IBE_P6S_WG01, IBE_P6S_WG04, IBE_P6S_WG09, IBE_P6S_WG13, IBE_P6S_WG16	written credit, participation in discussion
W2	rules for predicting the development of biological technologies, in terms of climate change.	IBE_P6S_WG01, IBE_P6S_WG09, IBE_P6S_WG10, IBE_P6S_WG13	written credit, participation in discussion
Skills – Student can:			
U1	use in practice the knowledge of the latest solutions in the field of biological sciences.	IBE_P6S_UW01, IBE_P6S_UW06, IBE_P6S_UW07, IBE_P6S_UW11, IBE_P6S_UW18	oral credit, observation of student's work, presentation, participation in discussion
U2	independently develop a simple concept of using selected solutions present in nature for practical use based on the available literature.	IBE_P6S_UW01, IBE_P6S_UW06	oral credit, observation of student's work, presentation, participation in discussion
Social competences – Student is ready to:			
K1	formulating and communicating with the public, e.g. through the mass media - information and opinions on the achievements in the field of applying modern technologies with biological sciences; Such information and opinions should be provided in a generally comprehensible manner, with the justification of different points of view as well as possibilities offered by nature in the context of their potential practical application.	IBE_P6S_KK01, IBE_P6S_KO01, IBE_P6S_KO02, IBE_P6S_KO04	written credit, oral credit, presentation, participation in discussion

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
seminar	15
lesson preparation	10
presentation/report preparation	5
exam participation	2
collecting and studying literature	10
literature study	10
report preparation	20

Student workload	**Hours**	**ECTS**
	87	3.0

Workload involving teacher	**Hours** 32	**ECTS** 1.1
Practical workload	**Hours** 20	**ECTS** 0.8

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Synthetic biology - definition, examples, and perspectives. Impact of pollution on humans - new ideas, new achievements. Cancer biology - prospects and new achievements. Issues concerning the immune system – new challenges. The use of biological material as a source of energy - examples, new perspectives. Drones, lasers, and artificial intelligence - new technologies. Bioacoustics - new ideas and perspectives. Agriculture of the future. Food and new challenges. Organ donation - new perspectives. The human brain - new discoveries. Selected case studies and other new trends.	lecture
2.	Introducing the latest trends in biological sciences. Development of selected concepts for the use of solutions present in nature for practical application. Presenting ideas. Analysis of available scientific material. Presentation and discussion of selected solutions. Scientific innovations of the year - overview and analysis with discussion. Summary.	seminar

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, problem-solving method, brainstorming, text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
seminar	oral credit, observation of student’s work, presentation, participation in discussion	50.00%

Entry requirements

none

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Biomonitoring

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3410.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 4	graded credit **Activities and hours** lecture: 15, laboratory classes: 15	3.0

Goals

C1	Understanding the influence of pollutants on living organisms.
C2	Acquiring knowledge about biological processes and threats such as anthropopressure occurring in the natural environment.
C3	Getting to know biological techniques of environmental monitoring consistent with the Chief Inspectorate of Environmental Protection.
C4	Acquiring practical skills in using bioindicators in biological environmental monitoring

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods

Knowledge – Student knows and understands:			
W1	conditions affecting the occurrence of aquatic and terrestrial organisms, diversity of fauna and flora, the methods to assess the quality of the environment based on living organisms	IBE_P6S_WG01, IBE_P6S_WG13, IBE_P6S_WG16, IBE_P6S_WG17	written credit
Skills – Student can:			
U1	applies biological environmental monitoring techniques recommended by CIEP/ GIOŚ and assess the quality of the environment	IBE_P6S_UU01, IBE_P6S_UW01, IBE_P6S_UW11	oral credit, observation of student's work, presentation
Social competences – Student is ready to:			
K1	understanding the threats that man creates for ecosystems and knowing how to prevent them	IBE_P6S_KO01, IBE_P6S_KO02, IBE_P6S_KO04	written credit, oral credit, observation of student's work, presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
laboratory classes	15
exam participation	2
lesson preparation	10
exam / credit preparation	3
report preparation	5
collecting and studying literature	20
presentation/report preparation	5

Student workload	**Hours** 75	**ECTS** 3.0
Workload involving teacher	**Hours** 32	**ECTS** 1.1
Practical workload	**Hours** 20	**ECTS** 0.8

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	The importance of biological monitoring for environmental protection in climate change. Features of systematic groups with bioindication functions. Water environment. Rivers as a living environment. Groups of flowing water organisms. Lakes and ponds as a living environment. Groups of organisms in lakes. The use of invertebrates in the monitoring of the aquatic environment. The use of algae (phytobenthos and phytoplankton), aquatic plants (macrophytes), and aquatic vertebrates in the monitoring of the water environment. Terrestrial environment: Biodiversity and its importance in biomonitoring. The impact of climate change on biodiversity. Methods of biodiversity measurement. Monitoring of ecosystems: forests, agrocenoses and cities. Organisms used in biodiversity assessment and monitoring of the terrestrial environment. Plants, invertebrates. Birds and Mammals. Air. Plant and animals used in air monitoring. Review of monitoring methods using these taxa recommended by GIOŚ/CIEP. The most important biological monitoring systems in Poland.	lecture
2.	Methodology of monitoring studies. Air quality testing with mosses and lichens. Ozone indication with sensitive tobacco plant varieties. The assessment of the environment quality with the use of products of living organisms: fur, hair, bird feathers, and spider webs. Use of selected benthic indicators (MMI PL, LMI, BMWP-PL, ASPT-PL, FBI, EPT, BBI, TBI, CBS). Methods using phytobenthos and phytoplankton for monitoring assessment (Phytoplankton Index - IFPL, Phytoplankton Index for Polish Lakes - PMPL, Multimetric Diatomaceous Index for rivers - IO, Multimetric Diatomaceous Index for lakes - IOJ). Application of other methods used in biomonitoring (Macrophyte River Index - MIR, Macrophyte Ecological Status Index - ESMI, European Ichthyological Index - EFI + _PL; Biotic Integrity Index - IBI_PL, Lake Fish Index LFI +; Lake Fish Index LFI-EN). Measures of biodiversity. Environmental valorization and assessment of anthropogenic transformations of selected areas (monitoring of terrestrial ecosystems). Test report - quality assessment of selected elements of the environment. Presentation of the results and final discussion.	laboratory classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, project-based learning (PBL), brainstorming, text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
laboratory classes	oral credit, observation of student’s work, presentation	50.00%

Entry requirements

None

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Microorganisms and enzymes in bioeconomy

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3415.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 4	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	To acquaint students with the properties and functions of enzymes in biochemical processes in the bioeconomy.
C2	To familiarise students with the principles of performing analyses using enzymes.
C3	To familiarise students with the use of enzymes in the bioeconomy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student knows and understands the physicochemical properties of enzymes used in bioeconomy.	IBE_P6S_WG01	written credit
W2	The student knows and understands the importance of the conditions of performing the analysis for the kinetics of enzymatic reactions.	IBE_P6S_WG16	written credit, project, active participation
W3	The student knows and understands the use of enzymes in bioeconomy, especially in planning, performing and interpreting complex analyses.	IBE_P6S_WG16	written credit, project
Skills – Student can:			
U1	The student is able to acquire scientific information from the literature, including scientific articles and experimental procedures, databases and other sources, interpret them and formulate conclusions.	IBE_P6S_UU01	written credit, project, active participation
U2	The student is able to select an appropriate analytical method, use appropriate analytical tools and methods and prepare a workstation for enzymatic analysis, taking into account the properties of the matrix tested, the substance determined and the enzyme.	IBE_P6S_UW05	project, active participation
U3	The student is able to plan and carry out analytic experiments with the use of enzymes independently and in a team, presents a written study of the procedures used and elaborates on the results.	IBE_P6S_UW06	project, active participation
Social competences – Student is ready to:			
K1	The student is ready to assimilate novelties in the possibilities of using biocatalysts in bioeconomy.	IBE_P6S_KK01	written credit, project, active participation
K2	The student is ready to take care of the entrusted equipment, research material and reagents, his own and his colleagues' safety.	IBE_P6S_KO01	project
K3	The student is ready to use only objective sources of scientific information, using them to critically evaluate obtained analytical results.	IBE_P6S_KO02	written credit, project

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
lesson preparation	10
exam / credit preparation	15
project preparation	10
collecting and studying literature	10

Student workload	**Hours** 75	**ECTS** 3.0

Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	1. Enzymes as biological catalysts. 2. Basic information on the properties of enzymes. 3. Thermodynamic aspect of enzyme activity. 4. Application of enzymes in bioeconomy. Immobilization of enzymes. The use of enzymes for biotransformation processes. 5. types of enzyme inhibitors and inactivators. 6. Construction of new enzymes.	lecture
2.	1. Kinetic data of enzyme catalysed reactions 2. Downloading kinetic data from reaction kinetics database 3. Simulating irreversible enzyme kinetics using downloaded enzyme kinetic data with Complex Pathway Simulation (COPASI) software 4. Simulating reversible enzyme kinetics using COPASI	project classes

Course advanced

Teaching methods:

lecture, discussion, computer lab/laboratory, teamwork, presentation / demonstration, project-based learning (PBL), brainstorming, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit, active participation	50.00%
project classes	project, active participation	50.00%

Entry requirements

A basic knowledge of biology.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Water suply systems

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3417.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 4	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	The aim of the course is to familiarize students with the water supply infrastructure.
C2	The course aims to familiarize students with the maintenance of an appropriate quantitative and qualitative condition in drinking water distribution systems.
C3	The aim of the course is to familiarize students with the methods of managing water supply systems.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Knows the method of determining the reliability of the operation and safety of water supply systems	IBE_P6S_WG_03	written credit
W2	Knows how to identify the spread of contamination in the water supply systems and mechanisms resulting in the loss of biological and chemical stability of drinking water	IBE_P6S_WG_03	written credit
W3	Knows the requirements placed on pipelines used for the construction of water supply systems.	IBE_P6S_WG_03	written credit
W4	Knows the principles of the optimal management of the water distribution system.	IBE_P6S_WG_03	written credit
Skills – Student can:			
U1	Student knows how to use modern tools and methods supporting the modelling of water distribution systems.	IBE_P6S_UW09	project, report
U2	a	IBE_P6S_UW10	project
Social competences – Student is ready to:			
K1	Student is able to indicate the role of water supply systems in maintaining the safe distribution of drinking water in residential and industrial areas. Knows how to promote remedial actions and model their functioning.	IBE_P6S_KO01	report

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
project preparation	30
exam / credit preparation	20
consultations	10

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 40	**ECTS** 1.5
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Water and water-economic balances; global, European and Polish water resources. 2. Planning in water management - features and principles, criteria of water resources management. 3. Collection of water, types of water reservoirs. Principles of calculating the capacity of water reservoirs. 4. Systems of water supply networks. 5. Construction of water supply networks - theoretical aspects. 6. Construction of water supply networks - practical aspects. 7. Water lifting devices, water supply pumping stations. 8. Hydrophore sets, principles of selection and operation. 9. Failure frequency of the water supply network. 10. Managing pressure in the water supply network. 11. Monitoring water quantity and quality to maintain the safety of water distribution systems. 12. Stability of water in water systems. 13. Water treatment processes. 14. Waste management after the water treatment process. 15. Repertory	lecture
2.	Balance of water requirements for water supply zone. Analysis of the operating conditions of the water supply network supported by modern solutions for hydraulic modeling.	project classes

Course advanced

Teaching methods:

classes, lecture, computer lab/laboratory

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	35.00%
project classes	project, report	65.00%

Entry requirements

water and sewage technology

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Adaptation to climate change

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3418.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period Semester 4	**Examination** graded credit **Activities and hours** lecture: 15, project classes: 15	**Number of ECTS points** 3.0

Goals

C1	The aim is to familiarize students with the principles, methods and technologies implemented in cities and industry in the field of adaptation to climate change.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows and understands at an advanced level the principles, methods and technologies of adaptation to climate change.	IBE_P6S_WG17	written credit
Skills – Student can:			

U1	The student has the ability to apply the principle of rational management of natural resources in order to adapt to climate change.	IBE_P6S_UW18	project
Social competences – Student is ready to:			
K1	The student is ready to bear social, professional and ethical responsibility for the state of the environment, including adaptation to climate change.	IBE_P6S_KO04	project

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
lesson preparation	20
project preparation	20
consultations	5

Student workload	**Hours** 75	**ECTS** 3.0
Workload involving teacher	**Hours** 35	**ECTS** 1.2
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The causes and effects of climate change. The sensitivity of cities to climate change. Urban plans of adaptation to climate change - projects in selected cities. Innovative technologies supporting plant vegetation. Sustainable methods of rainwater management. Methods of counteracting the urban heat island phenomenon. Energy self-sufficiency of cities. Vertical food production technologies. Possibilities of increasing the biologically active surface. Innovative biodegradable materials. The use of digital technologies to increase the efficiency of solving environmental problems.	lecture
2.	Concept design for the use of climate change adaptation technology in a selected location.	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, project-based learning (PBL), problem-solving method, brainstorming, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	project	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Membrane processes

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3419.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 4	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	The aim of the course is to acquaint students with new separation processes and the practical application of membrane techniques. To explain the concept of membranes and their classification, division into natural and synthetic. To make students acquainted with mechanisms of membrane separation and laws of mass transport in membranes. To make students familiar with product recovery from waste using membrane processes.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	understands the basic processes that determine the course and efficiency of membrane processes	IBE_P6S_WG07, IBE_P6S_WG08, IBE_P6S_WG09, IBE_P6S_WG10	written credit
W2	how to choose the right membrane process for desire application	IBE_P6S_WG08, IBE_P6S_WG09, IBE_P6S_WG10	written credit
W3	Membrane separation mechanisms and mass transport laws in membranes and the phenomena affecting the reduction of membrane performance	IBE_P6S_WG07, IBE_P6S_WG08, IBE_P6S_WG09, IBE_P6S_WG10	written credit
Skills – Student can:			
U1	Select the right membrane process for desire application	IBE_P6S_UW07, IBE_P6S_UW12, IBE_P6S_UW14	project
U2	determine the basic processes that determine the course and efficiency of membrane processes	IBE_P6S_UW07, IBE_P6S_UW12, IBE_P6S_UW14	project
Social competences – Student is ready to:			
K1	acquiring new information and gaining the knowledge needed to solve engineering issues in the bioeconomy.	IBE_P6S_KK01	project

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
consultations	20
lesson preparation	6
class preparation	6
project preparation	20
collecting and studying literature	4
exam / credit preparation	4

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 50	**ECTS** 2.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Separation of mixtures, tasks and techniques. General characteristics of membranes. Membrane techniques (classification, mass transport in membranes). Membrane composition, structure and fabrication. Membrane modules. Microfiltration, ultrafiltration, nanofiltration, reverse osmosis (characteristics, type of membranes, application). Osmotic distillation and membrane evaporation. Membrane techniques as an alternative to classical methods of water treatment. Membrane techniques in wastewater treatment. Membrane techniques in bioeconomy. Clean technologies.	lecture
2.	Membrane system design	project classes

Course advanced

Teaching methods:

classes, lecture, presentation / demonstration, project-based learning (PBL)

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	60.00%
project classes	project	40.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Suistanable hydropower

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I8BO.3420.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 4	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	Transfer of knowledge in the field of Hydropower Development (HD) in Poland and in the world, estimating hydropower potential and designing HD facilities.
C2	To familiarize students with the impact of HD on the environment, with modern technologies of energy generation from water in run-of-river and tank-pump power plants (pumped storage power plants - energy storage and electro-energetic system regulators), devices and turbines, and the possibilities of financing hydropower in Poland.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	He knows the world and national water resources, their energy use and the current directions of development of hydropower in Poland and the European Union (European Green Deal, Polish Energy Program 2040, Water Framework Directive, Directive of the European Parliament and the EU Council 2018 on promoting the use of energy from renewable sources) .	IBE_P6S_WG04	written credit, project, observation of student's work, active participation, participation in discussion
W2	Has a general knowledge of the types of hydropower plants and the possibilities of their construction in Poland.	IBE_P6S_WG10	written credit, project, observation of student's work, active participation, participation in discussion
W3	He knows the basic parameters of hydropower plants and the methodology of their design.	IBE_P6S_WG12	written credit, project, observation of student's work, active participation, participation in discussion
Skills – Student can:			
U1	Can characterize flow-type and tank-pump hydroelectric power plants as well as water turbines.	IBE_P6S_UW13, IBE_P6S_UW16	written credit, project, observation of student's work, active participation, participation in discussion
U2	He can estimate the basic hydropower parameters and select structures and devices in a hydropower plant.	IBE_P6S_UW05, IBE_P6S_UW08	written credit, project, observation of student's work, active participation, participation in discussion
Social competences – Student is ready to:			
K1	Assessment of the impact of hydropower plants on human energy needs, economy and the natural environment.	IBE_P6S_KO03, IBE_P6S_KO04	written credit, project, observation of student's work, active participation, participation in discussion

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
lesson preparation	5
exam / credit preparation	10
exam participation	4

consultations	3
project preparation	10
class preparation	10
collecting and studying literature	5

Student workload	**Hours** 77	**ECTS** 3.0
Workload involving teacher	**Hours** 37	**ECTS** 1.3
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	Course content	Activities

1.	1. The hydropower potential of the world, Europe and Poland. The importance of hydropower in the economy and its impact on the environment. 2. Legal regulations in Poland and in the European Union related to sustainable hydropower. 3. Hydrological conditions for energy needs: characteristic flows, flow measures, temporal and spatial variability flows. 4. Hydraulic models as well as tools and methods for assessing the potential of water resources and locations for the construction of hydropower installations. 5. Hydroelectric power plants in inland waters - flow, reservoir and pump. 6. Pumped storage power plants - clean water energy stores and power system regulators. 7. Hydrotechnical solutions of the power plant: friendly, dammed, with channel and pipe derivation. 8. Types and principles of operation of water turbines: action (Pelton) and reaction (Francis, Archimedes, Kaplan, Deriaz, tubular) turbines, mobile turbines, water turbine regulators and the method of transmission of the drive from the turbine to the generator. 9. Characteristics and selection of turbines, power and efficiency of hydropower plants. 10. Equipment of hydroelectric power plants and automation of their work. 11. Issues in the field of ecology and protection of ichthyofauna within water energy structures: technical, natural and active fish ladders, lifts, protective barriers, friendly turbines. 12. Profitability of hydropower and investment financing: national, regional and EU programs. 13. Ocean and sea wave power, tidal hydro power, sea current and diffusion energy. 14. Energy use of water systems: water supply networks, sewage treatment plants. 15. Ecological and natural conditions of sustainable hydropower (Natura 2000 areas, protected areas, fish passages) and criteria for issuing opinions on EW projects (technical, hydrological, hydrotechnical, environmental-natural and economic), barriers to the development of hydropower in Poland.	lecture
2.	Hydroelectric power plant project 1. Selection of the type of power plant and its concept - location. 2. Hydrological and hydraulic calculations. 3. Calculations of power plant parameters and selection of a turbine. 4. Drawings and project completion.	project classes

Course advanced

Teaching methods:

Blended learning, classes, lecture, discussion, teamwork

Activities	Examination methods	Percentage in subject assessment
lecture	written credit, participation in discussion	40.00%
project classes	project, observation of student’s work, active participation, participation in discussion	60.00%

Additional info

Part of the lectures and exercises on-line.

Entry requirements

hydraulics and fliu mechanics

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Artificial intelligence

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3421.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	exam **Activities and hours** lecture: 30, project classes: 30	4.0

Goals

C1	To familiarize the student with the mathematical foundations of selected methods of artificial intelligence.
C2	To familiarize the student with selected data processing methods in the field of artificial intelligence.
C3	To familiarize the student with the practical applications of artificial intelligence methods.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student knows and understands mathematical foundations and principles of operation of machine learning methods, their possibilities, limitations and areas of application in bioeconomics and supply chain planning.	IBE_P6S_WG02, IBE_P6S_WG12, IBE_P6S_WG18	written exam, oral exam, performing tasks
Skills – Student can:			
U1	The student is able to properly select, adjust and apply machine learning methods to the problem under consideration	IBE_P6S_UU01, IBE_P6S_UW04, IBE_P6S_UW05, IBE_P6S_UW06	observation of student's work, performing tasks
Social competences – Student is ready to:			
K1	The student is aware of the importance of artificial intelligence in applications related to bioeconomics	IBE_P6S_KK01, IBE_P6S_KO02	written exam, oral exam, observation of student's work

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
lesson preparation	10
exam / credit preparation	20
consultations	5
report preparation	20
exam participation	2

Student workload	**Hours** 117	**ECTS** 4.0
Workload involving teacher	**Hours** 67	**ECTS** 2.4
Practical workload	**Hours** 50	**ECTS** 2.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	Lecture 1-2 Machine learning as a part of artificial intelligence. The use of artificial intelligence in bioeconomy and supply chain design - examples. Lecture 3-4 Supervised and unsupervised methods in machine learning. Differences. Lecture 5-6 Regression: definition, applicability, notations. Interpolation and extrapolation problem; Lecture 7-8 Linear regression. Ordinary least squares. Cost function minimization. Lecture 9-12 Polynomial and multivariable regression: explanation with examples, the concept and intuitive explanation of overfitting and underfitting, qualitative and quantitative variables, regularization, feature selection. Lecture 13-14 Evaluation and visualization of the regression results. Logistic regression. Lecture 15-16 Classification: definition, applicability, notations. Lazy learners and eager learners. Binary, multi-class and multi-label classification. Lecture 17-20 Explanation of the selected classification models. Examples in bioeconomy and supply chain design. Lecture 21-22 Evaluation and visualization of classification results. Lecture 23-24 Clustering: definition, applicability, notations. Lecture 25-28 Examples of clustering methods. Applications in bioeconomy and supply chain design. Lecture 29-30 Evaluation and visualization of clustering results. A summary of the course content.	lecture
2.	Excercise 1-6 Python knowledge repetition:syntax, variables, conditions, loops, functions, data structures, objects, classes, machine learning packages Excercise 7-22 Implementation of the regression or classification using machine learning Python libraries. Experimenting with the model parameters, feature selection, validation and visualization of the results. Excercise 23-30 Implementation of the clustering using machine learning Python libraries. Experimenting with the model parameters, validation and visualization of the results.	project classes

Course advanced

Teaching methods:

classes, lecture

Activities	Examination methods	Percentage in subject assessment
lecture	written exam, oral exam	50.00%
project classes	observation of student’s work, performing tasks	50.00%

Entry requirements

mathematics and statistics, programming principles

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Biomaterials

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3422.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period Semester 5	**Examination** exam **Activities and hours** lecture: 30, laboratory classes: 30	**Number of ECTS points** 4.0

Goals

C1	The aim of the education is to present knowledge about biomaterials used in environmental applications, determine their potential, properties and directions of application.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the properties and possible directions of use of selected biomaterials used in environmental applications.	IBE_P6S_WG14	written exam
Skills – Student can:			

U1	to apply the methods and techniques necessary for the study of biomaterials and for solving simple environmental problems.	IBE_P6S_UW13	performing tasks
U2	to prepare and present presentation on selected biomaterials.	IBE_P6S_UW01	presentation
Social competences – Student is ready to:			
K1	to apply solutions that improve the quality of people's life and the condition of the natural environment.	IBE_P6S_KO04	presentation, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
laboratory classes	30
lesson preparation	25
exam / credit preparation	30
consultations	5

Student workload	**Hours** 120	**ECTS** 4.0
Workload involving teacher	**Hours** 65	**ECTS** 2.3
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Environment pollution. Circular economy. Sustainable development issues. Characteristics of polymers. Natural biomaterials. Biopolymers. Biocomposites. Physicochemical properties of selected biomaterials. Mechanisms of polymer degradation. Additives and modifiers for biopolymers. Biomaterials and their impact on the environment. Application of biomaterials and practical aspects of their applications. Principles and criteria for the selection of biomaterials for engineering solutions. The latest achievements and prospects.	lecture
2.	Organization of exercises. The rules of occupational health and safety in the laboratory. Laboratory exercises on the biodegradation of selected materials. Determining the degree and rate of biodegradation of selected materials. Determination of factors influencing the course of biodegradation. Presentations on selected biomaterials.	laboratory classes

Course advanced

Teaching methods:

discussion, classes, lecture, teamwork, presentation / demonstration

Activities	Examination methods	Percentage in subject assessment
lecture	written exam	50.00%
laboratory classes	presentation, performing tasks	50.00%

Entry requirements

Basic knowledge of physical and chemical sciences. The ability to think logically, obtain information from various sources and the ability to work in a team.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Biotransfomation principles

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3423.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period Semester 5	**Examination** exam **Activities and hours** lecture: 15, laboratory classes: 45	**Number of ECTS points** 4.0

Goals

C1	The aim of education is to provide knowledge and skills in the field of the basics of the biotransformation of biomass and bio-waste into high-quality products.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows and understands at an advanced level selected issues in the field of biotechnology and biotransformation of biomass and by-products	IBE_P6S_WG05	written exam, performing tasks
Skills – Student can:			

U1	The student knows and understands at an advanced level selected issues in the field of the kinetics of the process of biotransformation of biomass and by-products	IBE_P6S_UW04, IBE_P6S_UW06	written exam, test, performing tasks
U2	The student knows and understands at an advanced level selected issues in the field of modeling the processes of biotransformation of biomass and by-products	IBE_P6S_UW12	written exam, test, performing tasks
Social competences – Student is ready to:			
K1	The student is able to obtain information from literature, databases, and other sources; is able to integrate the obtained information, interpret it, as well as draw conclusions and formulate and justify opinions	IBE_P6S_KK01	presentation, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
laboratory classes	45
collecting and studying literature	20
exam / credit preparation	10
report preparation	30

Student workload	**Hours** 120	**ECTS** 4.0
Workload involving teacher	**Hours** 60	**ECTS** 2.0
Practical workload	**Hours** 75	**ECTS** 3.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	• Introduction, the concept of biotransformation of biomass and by-products • Basics of the kinetics of biological transformation of biomass and by-products • Factors influencing the kinetics of biomass and by-products biotransformation • Identification of groups and species of microorganisms used in the biotransformation of biomass and by-products • Basics of gu monitoring and control of biomass and by-products biotransformation processes • Basics of optimization of biomass and by-products biotransformation processes • Inventions and innovations in the field of biotransformation of biomass and by-products	lecture
2.	• Comparative studies of the kinetics of biomass biotransformation and by-products • Statistical analysis of experimental data, determination of kinetic parameters of biomass and by-products biotransformation • Mathematical modeling of biomass and by-products biotransformation • Determination of technological parameters of biomass and by-products biotransformation	laboratory classes

Course advanced

Teaching methods:

classes, lecture, participation in research, teamwork, presentation / demonstration

Activities	Examination methods	Percentage in subject assessment
lecture	written exam	35.00%
laboratory classes	presentation, test, performing tasks	65.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Semestral project 5

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3424.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	graded credit **Activities and hours** project classes: 45	4.0

Goals

C1	The aim is to creatively solve problems in the field of bioeconomy by students using design thinking, teamwork, and critical analysis of data and examples from both the literature on the subject and reported by the economy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows and understands the principles of creative problem solving in the field of bioeconomy from both the economy and the literature on the subject, based on teamwork, critical case analysis and problem solving through design thinking.	IBE_P6S_WK03	project

Skills – Student can:			
U1	The student has the ability to apply the principle of rational management of natural resources, to solve simple problems in the field of bioeconomy, both from the economy and from the literature on the subject.	IBE_P6S_UW18	project
Social competences – Student is ready to:			
K1	The student is ready to bear social, professional and ethical responsibility when solving simple problems in the field of bioeconomy coming from both the economy and the literature on the subject.	IBE_P6S_KO04	project

Balance of ECTS points

Activity form	Activity hours*	
project classes	45	
project preparation	45	
collecting and studying literature	15	
consultations	10	
Student workload	**Hours** 115	**ECTS** 4.0
Workload involving teacher	**Hours** 55	**ECTS** 2.0
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	The student works using the principles of project work and teamwork, solves advanced problems in the field of bioeconomy coming from both industry and the subject's leterature. Based on the collected information, group work and creative thinking, he prepares a project solving a technical, organizational and / or social problem in the field of bioeconomy.	project classes

Course advanced

Teaching methods:

teamwork, project-based learning (PBL), problem-solving method, brainstorming

Activities	Examination methods	Percentage in subject assessment
project classes	project	100.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

English exam

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10JO.3425.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	exam **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with the English educational contents required at the minimum B2 level for the purpose of achieving the relevant language competence enabling to pass the examination at the required level.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at the minimum B2 level; apply grammar rules at the minimum B2 level; understand statements related to the subject matter and specified for the minimum B2 level; prepare a written statement in accordance with the requirements at the minimum B2 level; comprehensively read general texts at the minimum B2 level; communicate in accordance with the requirements assigned to the minimum B2 level.	IBE_P6S_UW02	written exam, oral exam, observation of student's work, active participation, test, performing tasks

Balance of ECTS points

Activity form	**Activity hours***	
foreign language (course)	26	
e-learning	4	
consultations	4	
lesson preparation	24	
exam participation	2	
Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 36	**ECTS** 1.3
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents is available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	Examination methods	Percentage in subject assessment
foreign language (course)	written exam, oral exam, observation of student’s work, active participation, test	80.00%
e-learning	performing tasks	20.00%

Additional info

During the examination semester, the student prepares for the examination at the minimum B2 level.
The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).

LEVEL B2
The student, who commands a language at this level, understands the importance of main messages conveyed in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate fluently enough to have a conversation with a native speaker, without any particular effort for either party; can communicate smoothly and spontaneously enough to have a free conversation with a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehend not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=090000168045bc7d

Verification of learning outcomes
Learning outcomes are verified by means of grammatical and lexical tests, oral and written statements, reading and listening comprehension tests.
The final grade for the exam semester is the average based on the grade received as a credit for the course in semester 4 and the grade for the exam. The average is drawn only on the basis of two positive grades. The negative grade acquired for the exam results in failure to pass the entire semester.

Entry requirements

Adequate level of language is required
Group level Min. level
B2 --> B1, B2
C1 --> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

French exam

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10JO.3426.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	exam **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with the French educational contents required at the minimum B2 level for the purpose of achieving the relevant language competence enabling to pass the examination at the required level.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at the minimum B2 level; apply grammar rules at the minimum B2 level; understand statements related to the subject matter and specified for the minimum B2 level; prepare a written statement in accordance with the requirements at the minimum B2 level; comprehensively read general texts at the minimum B2 level; communicate in accordance with the requirements assigned to the minimum B2 level.	IBE_P6S_UW02	written exam, oral exam, observation of student's work, active participation, test, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
foreign language (course)	26
e-learning	4
consultations	4
lesson preparation	24
exam participation	2

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 36	**ECTS** 1.3
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	Examination methods	Percentage in subject assessment
foreign language (course)	written exam, oral exam, observation of student’s work, active participation, test	80.00%
e-learning	performing tasks	20.00%

Additional info

During the examination semester, the student prepares for the examination at the minimum B2 level.

The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).
LEVEL B2
The student, who commands a language at this level, understands the importance of main messages conveyed in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate fluently enough to have a conversation with a
native speaker, without any particular effort for either party;
can communicate smoothly and spontaneously enough to have a free conversation with a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.
LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehended not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of
topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.
http://www.sjo.agh.edu.pl/dane/ESOKJ.pdf

Verification of learning outcomes
Learning outcomes are verified by means of grammatical and lexical tests, oral and written statements, reading and listening comprehension tests.
The language course is completed with an exam.
The final grade for the exam semester is the average based on the grade received as a credit for the course in semester 4 and the grade for the exam. The average is drawn only on the basis of two positive grades. The negative grade acquired for the exam results in failure to pass the entire semester.

Entry requirements

Adequate level of language is required
Group level Min. level
B2 --> B1, B2
C1 --> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Chineese exam

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10JO.3427.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	exam **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with the Chinese educational contents required at the minimum B2 level for the purpose of achieving the relevant language competence enabling to pass the examination at the required level.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at the minimum B2 level; apply grammar rules at the minimum B2 level; understand statements related to the subject matter and specified for the minimum B2 level; prepare a written statement in accordance with the requirements at the minimum B2 level; comprehensively read general texts at the minimum B2 level; communicate in accordance with the requirements assigned to the minimum B2 level.	IBE_P6S_UW02	written exam, oral exam, observation of student's work, active participation, test, performing tasks

Balance of ECTS points

Activity form	**Activity hours***	
foreign language (course)	26	
e-learning	4	
consultations	2	
lesson preparation	26	
exam participation	2	
Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 34	**ECTS** 1.2
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	Examination methods	Percentage in subject assessment
foreign language (course)	written exam, oral exam, observation of student’s work, active participation, test	80.00%
e-learning	performing tasks	20.00%

Additional info

The student is taught the selected language for 4 semesters to take the written and oral exam at the minimum B2 level. The student can study the selected language at a level lower than B2 for 3 semesters, but during semester 4 he/she has to attend a course at the minimum B2 level.
The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).
LEVEL A1
The student, who commands a language at this level, can understand and use the learnt simple utterances for the purpose of communicating specific needs of everyday life.
The student can introduce himself/herself and others; can ask questions concerning private life, residence, friends and possessions as well as answer such questions; can have simple conversations provided that the interlocutor speaks slowly and clearly, and is ready to help,

LEVEL A2
The student, who commands a language at this level, can understand utterances, common at this level, related to the most important matters (e.g. basic information concerning his/her family, shopping, environment, work; can communicate in typical communication situations which only require direct exchanges of information about known and often repeated topics; can easily describe the direct environment as well as that of his/her origin; can speak in a very simple way about topics related to the most important needs.

LEVEL B1
The student, who commands a language at this level, can understand the importance of the main contents of communication and standard utterances referring to familiar matters as well as typical situations related to work, school, leisure time, etc.; can cope with typical travel situations to the country of the studied language; can create consistent oral and written statements on topics that are familiar or interesting to him/her; can describe events, personal experiences, plans, projects and future plans.

LEVEL B2
The student, who commands a language at this level, understands the importance of main messages contained in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate smoothly and spontaneously enough to have a free conversation with a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehended not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of
topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

http://www.sjo.agh.edu.pl/dane/ESOKJ.pdf

Entry requirements

Adequate level of language is required

Group level	Min. level
B2	--> B1, B2
C1	--> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Spanish exam

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10JO.3428.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 5	exam **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with the Spanish educational contents required at the minimum B2 level for the purpose of achieving the relevant language competence enabling to pass the examination at the required level.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at the minimum B2 level; apply grammar rules at the minimum B2 level; understand statements related to the subject matter and specified for the minimum B2 level; prepare a written statement in accordance with the requirements at the minimum B2 level; comprehensively read general texts at the minimum B2 level; communicate in accordance with the requirements assigned to the minimum B2 level.	IBE_P6S_UW02	observation of student's work, active participation, test, performing tasks, Egzamin

Balance of ECTS points

Activity form	**Activity hours***	
foreign language (course)	26	
e-learning	4	
lesson preparation	26	
consultations	4	
Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 34	**ECTS** 1.2
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	**Examination methods**	**Percentage in subject assessment**

Activities	Examination methods	Percentage in subject assessment
foreign language (course)	observation of student’s work, active participation, test, Egzamin	80.00%
e-learning	performing tasks	20.00%

Additional info

During the examination semester, the student prepares for the written and oral examination at the minimum B2 level.
The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).
LEVEL B2
The student, who commands a language at this level, understands the importance of main messages conveyed in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate fluently enough to have a conversation with a
native speaker, without any particular effort for either party;
can communicate smoothly and spontaneously enough to have a free conversation with a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehended not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of
topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

http://www.sjo.agh.edu.pl/dane/ESOKJ.pdf
Verification of learning outcomes
Learning outcomes are verified by means of grammatical and lexical tests, oral and written statements, reading and listening comprehension tests.
The language exam consists of 2 parts: the written part (constituting 50% of the final grade) and the oral one (another 50% of the final grade).
The final grade for the exam semester is the average based on the grade received as a credit for the course in semester 4 and the grade for the exam. The average is drawn only on the basis of two positive grades. The negative grade acquired for the exam results in failure to pass the entire semester.

Entry requirements

Adequate level of language is required
Group level Min. level
B2 --> B1, B2
C1 --> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Russian exam

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10JO.3429.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	exam **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with the Russian educational contents required at the minimum B2 level for the purpose of achieving the relevant language competence enabling to pass the examination at the required level.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at the minimum B2 level; apply grammar rules at the minimum B2 level; understand statements related to the subject matter and specified for the minimum B2 level; prepare a written statement in accordance with the requirements at the minimum B2 level; comprehensively read general texts at the minimum B2 level; communicate in accordance with the requirements assigned to the minimum B2 level.	IBE_P6S_UW02	written exam, oral exam, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
foreign language (course)	26
e-learning	4
exam / credit preparation	24
consultations	4
exam participation	2

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 36	**ECTS** 1.3
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	Examination methods	Percentage in subject assessment
foreign language (course)	written exam, oral exam	80.00%
e-learning	performing tasks	20.00%

Additional info

During the examination semester, the student prepares for the written and oral examination at the minimum B2 level. The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).

Entry requirements

Adequate level of language is required
Group level Min. level
B2 --> B1, B2
C1 --> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

German exam

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10JO.3430.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	exam **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with the English educational contents required at the minimum B2 level for the purpose of achieving the relevant language competence enabling to pass the examination at the required level.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at the minimum B2 level; apply grammar rules at the minimum B2 level; understand statements related to the subject matter and specified for the minimum B2 level; prepare a written statement in accordance with the requirements at the minimum B2 level; comprehensively read general texts at the minimum B2 level; communicate in accordance with the requirements assigned to the minimum B2 level.	IBE_P6S_UW02	written exam, oral credit, observation of student's work, active participation, test, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
foreign language (course)	26
e-learning	4
consultations	4
lesson preparation	24
exam participation	2

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 36	**ECTS** 1.3
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents is available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials.	e-learning

Course advanced

Teaching methods:

classes, foreign language (conversation classes)

Activities	Examination methods	Percentage in subject assessment
foreign language (course)	written exam, oral credit, observation of student’s work, active participation, test	80.00%
e-learning	performing tasks	20.00%

Additional info

During the examination semester, the student prepares for the examination at the minimum B2 level.
The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).

LEVEL B2
The student, who commands a language at this level, understands the importance of main messages conveyed in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics;
can communicate fluently enough to have a conversation with a native speaker, without any particular effort for either party; can communicate smoothly and spontaneously enough to have a free conversation with a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.

LEVEL C1
The student, who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehend not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

http://www.sjo.agh.edu.pl/dane/ESOKJ.pdf
Verification of learning outcomes
Learning outcomes are verified by means of grammatical and lexical tests, oral and written statements, reading and listening comprehension tests.
The language course is completed with an exam.
The final grade for the exam semester is the average based on the grade received as a credit for the course in semester 4 and the grade for the exam. The average is drawn only on the basis of two positive grades. The negative grade acquired for the exam results in failure to pass the entire semester.

Entry requirements

Adequate level of language is required
Group level Min. level
B2 --> B1, B2
C1 --> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Italian exam

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10JO.3431.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 5	exam **Activities and hours** foreign language (course): 26, e-learning: 4	2.0

Goals

C1	The student is made acquainted with the Italian educational contents required at the minimum B2 level for the purpose of achieving the relevant language competence enabling to pass the examination at the required level.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Skills – Student can:			

U1	The student can: make use of general vocabulary and idiomatic phrases required at the minimum B2 level; apply grammar rules at the minimum B2 level; understand statements related to the subject matter and specified for the minimum B2 level; prepare a written statement in accordance with the requirements at the minimum B2 level; comprehensively read general texts at the minimum B2 level; communicate in accordance with the requirements assigned to the minimum B2 level.	IBE_P6S_UW02	written exam, oral exam, observation of student's work, active participation, test, participation in discussion, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
foreign language (course)	26
e-learning	4
consultations	4
lesson preparation	24
exam participation	2

Student workload	**Hours** 60	**ECTS** 2.0
Workload involving teacher	**Hours** 36	**ECTS** 1.3
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The curriculum contents are realized on the basis of appropriate coursebooks at a given level. The detailed range of the curriculum contents are available on the SJOiNHS website.	foreign language (course)
2.	The curriculum contents are partly realized on the basis of appropriate e-learning materials	e-learning

Course advanced

Teaching methods:

classes, discussion, teamwork, situation-based learning, foreign language (conversation classes), text analysis

Activities	Examination methods	Percentage in subject assessment
foreign language (course)	written exam, oral exam, observation of student’s work, active participation, test, participation in discussion	80.00%
e-learning	performing tasks	20.00%

Additional info

During the examination semester, the student prepares for the written and oral examination at the minimum B2 level.

The reference for the language competence levels is in accordance with Common European Framework of Reference for Languages (CEFR).
LEVEL B2
The student who commands a language at this level, understands the importance of main messages conveyed in complex texts on specific and abstract topics; can understand and participate in discussion by use of the specialist language referring to professional topics; can communicate fluently enough to have a conversation with a native speaker, without any particular effort for either party; can communicate smoothly and spontaneously enough to have a free conversation with a native speaker, without any particular effort for either party; can formulate clear and detailed oral or written statements on many topics as well as express his/her viewpoint concerning the matters discussed along with advantages and disadvantages of different solutions.
LEVEL C1
The student who commands a language at this level, can understand extensive and advanced texts concerning various topics. While reading and listening the student can fully comprehend not only the gist of it, but also various overtones, implicit meanings and the author's attitude; can speak fluently by means of the extensive vocabulary; can use the language effectively in interpersonal, social, educational and professional contexts; can formulate clear, well-structured, detailed written statements on a wide range of topics by use of grammatical rules as well as language tools in accordance with the principles of oral and written statements in a manner indicating a very good mastery of the language.

https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=090000168045bc7d

Verification of learning outcomes
Learning outcomes are verified by means of grammatical and lexical tests, oral and written statements, reading and listening comprehension tests.
The final grade for the exam semester is the average based on the grade received as a credit for the course in semester 4 and the grade for the exam. The average is drawn only on the basis of two positive grades. The negative grade acquired for the exam results in failure to pass the entire semester.

Entry requirements

Adequate level of language is required
Group level Min. level
B2 --> B1, B2
C1 --> B2, C1

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Recovery of critical earth elements

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3433.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	Providing knowledge of the properties of critical and precious elements, their occurrence and extraction technology.
C2	Providing knowledge of the possibilities and technologies of recovering critical and precious elements from selected groups of polymetallic waste.
C3	Acquiring the ability to make quantitative and qualitative balances for the suggested type of polymetallic waste with an indication of potential raw materials that can be recovered.
C4	Acquiring the ability to select effective processing technologies for the indicated type of polymetallic waste in relation to the applicable formal and legal requirements and to determine the quantitative and qualitative characteristics of the recovered raw materials and potential post-process waste.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	physicochemical properties of critical and precious elements, their importance for the economy and methods of obtaining them from natural sources.	IBE_P6S_WG04	written credit
W2	currently used and new methods and technologies of polymetallic waste recycling and their importance in the context of sustainable resource management.	IBE_P6S_WG_03	written credit
Skills – Student can:			
U1	characterize and make a quantitative and qualitative balance of the stream of the suggested types of polymetallic waste.	IBE_P6S_UW18	project, active participation
U2	select the appropriate material recovery technology for the indicated groups of polymetallic waste together with an indication of the potential waste remaining for management.	IBE_P6S_UW08	project, active participation
Social competences – Student is ready to:			
K1	formulate and provide the public with information and opinions on achievements in the field of engineering and environmental protection, and make the public aware of threats to the environment and human health resulting from inadequate management of polymetallic waste.	IBE_P6S_KO04	written credit, project, active participation

Balance of ECTS points

Activity form	Activity hours*
lecture	15
project classes	15
exam / credit preparation	5
project preparation	40
consultations	4
exam participation	2

Student workload	**Hours** 81	**ECTS** 3.0
Workload involving teacher	**Hours** 36	**ECTS** 1.3
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Characteristics of critical and precious elements - their properties and application. Polymetallic waste management - characteristics of selected groups of waste, quantitative and qualitative analysis of their stream. Possibilities of recovering critical and precious elements - technologies used in industrial practice. Prospects for the development of technology for the recovery of critical and precious elements - a review of the latest laboratory research.	lecture
2.	Characterization and preparation of quantitative and qualitative balances of polymetallic waste covered by the project topic. Selection of the optimal recycling technology - analysis of raw materials that can be recovered in the selected processing process and the characteristics of the potential waste stream.	project classes

Course advanced

Teaching methods:

lecture, discussion, project-based learning (PBL), text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	project, active participation	50.00%

Entry requirements

Basic knowledge of waste management and chemistry.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Quality of recources

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3434.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	graded credit **Activities and hours** lecture: 15, laboratory classes: 15	3.0

Goals

C1	The aim of the course is to learn the basic properties of solid resources and the analytical methods used in their assessment.
C2	The aim of the practical classes is to acquire the ability to perform selected analyzes.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	at advanced level the analytical procedures, methods of investigating and evaluating solid resources.	IBE_P6S_WG14	written credit

Skills – Student can:			
U1	apply analytical methods and laboratory techniques to assess the physical, chemical and biological properties of raw materials and products produced and used by the bioeconomy	IBE_P6S_UW17	performing tasks
Social competences – Student is ready to:			
K1	taking actions related to the protection of resources	IBE_P6S_KO04	performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
laboratory classes	15
lesson preparation	15
exam / credit preparation	15
report preparation	15
consultations	15

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 45	**ECTS** 1.7
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	1. Resources classification and characterization. 2. Methods of separation of mixture components as the basis of sieve and morphological analysis. 3. Analysis of the basic physicochemical properties of soil and waste 4. Assessment of biodegradability / biomass content 5. Fertilizing properties 6. Fuel properties 7. Forms of heavy metals occurrence. Analysis of the speciation of metals in solids.	lecture

2.	Introduction, presentation of the scope of exercises and health and safety rules in a chemical laboratory. Granulometric and morphological analysis of waste samples. Analysis of selected physicochemical properties in raw and dried waste. Analysis of selected fertilizing properties. Analysis of selected fuel properties. Summary and interpretation of analytical results. Assessment of fertilizing and fuel properties of waste, presentation of group results. Development of group reports - selection of the recovery / management method.	laboratory classes

Course advanced

Teaching methods:

practical simulation training, lecture, teamwork, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
laboratory classes	performing tasks	50.00%

Entry requirements

1. Basic knowledge of inorganic and organic chemistry.
2. Has basic skills related to working in an analytical laboratory.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Packages management

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3435.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	graded credit **Activities and hours** lecture: 15, laboratory classes: 15	3.0

Goals

C1	Gaining knowledge of the materials used in the production of modern packaging and the technology of their production
C2	Getting to know the recycling technology of various packaging groups
C3	Gaining knowledge on packaging properties measurements

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student knows and understands the modern materials and technologies used in the packaging production	IBE_P6S_WG01	test
W2	The student knows and understands the types of materials and the possibility of their reuse	IBE_P6S_WG04	test
Skills – Student can:			
U1	The student is able to prepare packaging for reprocessing	IBE_P6S_UW11	report, performing tasks
U2	The student knows and is able to produce foils and other packaging	IBE_P6S_UW14	report, performing tasks
U3	The student is able to prepare a written report and present the test results	IBE_P6S_UW03	report

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
laboratory classes	15
class preparation	10
collecting and studying literature	15
conducting research	20
exam / credit preparation	15

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 35	**ECTS** 1.2

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Packaging market in Poland and Europe. Current legal acts regarding packaging, placing on the market and their disposal 2. Modern materials and technologies used in the production of packaging 3. Glass packaging, manufacturing, re-processing 4. Types of metal packaging, technological cycle, methods of recovery 5. Paper packaging, manufacturing methods, the possibility of reprocessing 6. Plastics used for the production of packaging, manufacturing methods, recycling, compostable packaging 7. Methods of testing the properties of packaging materials, e.g. strength properties, barrier properties, migration and resistance to chemicals 8. Final test	lecture
2.	1. Introduction, discussion of the scope of exercises and health and safety rules in the laboratory 2. Preparation of materials for re-processing - grinding used packaging, granulation 3. Production of foil and packaging from waste materials 4. Manufacturing of films and packaging from virgin materials 5. Production of foil packaging from compostable materials 6. Preparation and production of samples for tensile tests 7. Performing mechanical tests, comparing the results for various materials 8. Presentation of research results	laboratory classes

Course advanced

Teaching methods:

classes, lecture, participation in research, teamwork, presentation / demonstration

Activities	Examination methods	Percentage in subject assessment
lecture	test	50.00%
laboratory classes	report, performing tasks	50.00%

Entry requirements

The student has a basic knowledge of chemistry

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Recykling

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3436.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	graded credit **Activities and hours** lecture: 15, laboratory classes: 15	3.0

Goals

C1	Gaining knowledge in the field of recycling of plastic packaging
C2	Gaining knowledge on waste sorting
C3	Gaining knowledge of the type of waste and requirements for its management
C4	Understanding the waste collection systems

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student knows and understands selected waste groups and quantitative requirements for recovery	IBE_P6S_WG_03	test
W2	The student knows and understands waste collection systems	IBE_P6S_WG17	test
Skills – Student can:			
U1	The student is able to carry out waste qualitative analysis	IBE_P6S_UW14	report, performing tasks
U2	The student is able to perform plastic waste recycling process	IBE_P6S_UW18	report, performing tasks
Social competences – Student is ready to:			
K1	The student is ready to assess the threats to the natural environment resulting from incorrect waste management	IBE_P6S_KO02	report

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
laboratory classes	15
lesson preparation	5
conducting research	20
collecting and studying literature	15
report preparation	20

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 55	**ECTS** 2.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	The amount and range of waste in Europe, especially in Poland, waste legislation Waste collection systems Waste sorting technologies Basic technologies for the recovery of various groups of waste Recycling of aluminum Plastics recycling technologies Mechanical recycling of plastics Final test	lecture

2.	1. Introduction. Course overwiew. Work safety regulations in the laboratory of recycling and plastics processing 2. Identification of specific plastics 3. Waste separation 4. Mechanical recycling of selected plastics 5. Samples preparation via thermal processing 6. Mechanical and processing properties measurements 7. Presentation of obtained results	laboratory classes

Course advanced

Teaching methods:

lecture, participation in research, discussion, presentation / demonstration

Activities	Examination methods	Percentage in subject assessment
lecture	test	50.00%
laboratory classes	report, performing tasks	50.00%

Entry requirements

Basic knowledge of chemistry

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Pirolysis and gasification

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3438.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 5	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	The aim of the training is to present knowledge and transfer skills and competencies covering the implementation and development of pyrolysis and gasification technologies of biomass and by-products in order to valorize them as high-quality products and fuels.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Knows and understands at an advanced level selected issues in the field of application of pyrolysis and gasification processes for the production of biofuels and the use of biomass and by-products generated in the bioeconomy	IBE_P6S_WG_03, IBE_P6S_WG10	written credit
Skills – Student can:			
U1	Can solve, based on standard engineering activities, production and operational problems in the field of pyrolysis and gasification of biomass and by-products, while taking into account the requirements related to the care for the natural environment	IBE_P6S_UW12, IBE_P6S_UW14	project, performing tasks
U2	Is able to independently and in a team plan and perform design tasks in the area of pyrolysis from gasification of biomass and by-products	IBE_P6S_UW15	project, performing tasks
Social competences – Student is ready to:			
K1	Is ready to accept responsibility for own work and to submit to the principles of teamwork and responsibility for jointly performed tasks	IBE_P6S_KO01, IBE_P6S_KO04	project, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
class preparation	10
project preparation	30
collecting and studying literature	20

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	• Characteristics of thermochemical valorization processes of biomass and by-products • Detailed characteristics of pyrolysis processes: types of pyrolysis, technological parameters, technical requirements • Detailed characteristics of pyrolysis processes: types of pyrolysis reactors, pre-treatment of biomass, and by-products • Detailed characteristics of pyrolysis processes: management of pyrolysis products, security systems • Detailed characteristics of gasification processes: types of gasification, technological parameters, technical requirements • Detailed characteristics of gasification processes: types of gasification reactors, pre-treatment of biomass and by-products • Detailed characteristics of gasification processes: management of gasification products, safety systems • Technical supporting infrastructure • Basics of monitoring and control • Synergy of pyrolysis and gasification processes	lecture
2.	• Case study: mathematical modeling of the pyrolysis process of a selected type of biomass or by-product • Case study: mathematical modeling of the gasification process of a selected type of biomass or by-product • Group work: development of a PFD of an integrated pyrolysis and gasification system for a selected type of biomass or by-product	project classes

Course advanced

Teaching methods:

classes, lecture, teamwork, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	project, performing tasks	50.00%

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Thermal utilisation of biomass

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3439.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 5	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	To acquaint students with the possibilities and methods of thermal processing and the use of biomass.
C2	Making the audience aware of the effects of a given thermal process on the physicochemical properties and types of final products.
C3	Transfer of knowledge in the field of biomass valorization by thermal methods.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	He has knowledge in thermal biomass processes, including waste biomass from forestry, agricultural and animal.	IBE_P6S_WG05, IBE_P6S_WG09	written credit, active participation, performing tasks
W2	Has a general knowledge of systems, technologies, techniques, devices and tools used in thermal processing and use of biomass.	IBE_P6S_WG09, IBE_P6S_WG10	written credit, active participation, presentation
Skills – Student can:			
U1	He can use basic technologies for thermal processing of biomass and its effective use in practice.	IBE_P6S_UW12, IBE_P6S_UW14	written credit, project
U2	Can propose the initial technology of the thermal biomass process for the assumed effects and properties of the final products.	IBE_P6S_UW12, IBE_P6S_UW14	written credit, project, observation of student's work, presentation
Social competences – Student is ready to:			
K1	The student is aware of the need for continuous improvement and care for the natural environment.	IBE_P6S_KK01	project, observation of student's work, active participation, presentation, performing tasks
K2	The student is ready to work in a team and is aware of the responsibility for his work.	IBE_P6S_KO02	project, observation of student's work, active participation, presentation, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
consultations	2
presentation/report preparation	10
lesson preparation	5
exam / credit preparation	10
exam participation	1
class preparation	2
collecting and studying literature	6
report preparation	12
project preparation	8

Student workload	**Hours** 86	**ECTS** 3.0
Workload involving teacher	**Hours** 33	**ECTS** 1.1
Practical workload	**Hours** 27	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Biomass as a renewable fuel and its role in the bioeconomy, including the closed cycle. Problems of thermal use of biomass. Thermal processes used in the conversion of solid biomass. Thermal processes as a way to generate electricity, heat and products for energy, agricultural, chemical and other applications. Valorization of solid biomass by thermal methods. Characteristics of thermal processes such as: drying, torrefaction, pyrolysis, gasification and combustion. Energy equipment used in thermal biomass processing. Combustion and co-combustion of biomass in energy devices/installations. The use of biomass for the production of heat and electricity in commercial and individual power engineering. EcoDesign low-power heating boilers. The influence of thermal processes on the properties of end products derived from solid biomass. Advantages and disadvantages of individual biomass thermal processing technologies. Environmental aspects resulting from the application of a given thermal process to the conversion of solid biomass.	lecture
2.	The demand for biomass for the production of heat and electricity. Lower and higher heating value. The emission of pollutants during biomass combustion. Indicative method of estimation of pollutants emission into the atmosphere in the process of heat and electricity generation. Analysis of the torrefaction process and its impact on physical-chemical properties. The combustion of biomass in a low-power boiler.	project classes

Course advanced

Teaching methods:

classes, lecture, participation in research, discussion, teamwork, presentation / demonstration, text analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit, observation of student’s work	50.00%
project classes	project, observation of student’s work, active participation, presentation, performing tasks	50.00%

Additional info

Accounting exercises and laboratory tests.

Entry requirements

Basics of chemistry, thermodynamics, heat and mass transfer.

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Biochar and biohydrogen

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3440.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period Semester 5	**Examination** graded credit **Activities and hours** lecture: 15, project classes: 15	**Number of ECTS points** 3.0

Goals

C1	The aim of the training is to present knowledge and transfer skills and competencies covering the implementation and development of technologies of biochar and biohydrogen production from biomass and by-products and utilization of biochar and biohydrogen in the industry.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Knows and understands at an advanced level selected issues in the field of application of biochar and biohydrogen production and utilization	IBE_P6S_WG_03, IBE_P6S_WG09	written credit

Skills – Student can:			
U1	Can solve, based on standard engineering activities, production, and operational problems in the field of biochar and biohydrogen production from biomass and by-products and their utilization in the industry, while taking into account the requirements related to the care for the natural environment	IBE_P6S_UW12, IBE_P6S_UW14	project, performing tasks
U2	Is able to independently and in a team plan and perform design tasks in the area of biochar and biohydrogen production from biomass and by-products and their utilization in the industry	IBE_P6S_UW15	project, performing tasks
Social competences – Student is ready to:			
K1	Is ready to accept responsibility for own work and to submit to the principles of teamwork and responsibility for jointly performed tasks	IBE_P6S_KK01, IBE_P6S_KO04	project, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
lesson preparation	10
project preparation	30
collecting and studying literature	20

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	• Characteristics of thermochemical valorization processes of biomass and by-products • Detailed characterization of biochar production processes: torrefaction • Detailed characterization of biochar production processes: pyrolysis • Properties of biochar • Directions for using biochar in the bioeconomy • Quality requirements for the use of biochar • Detailed characterization of the biohydrogen production processes: biological processes • Detailed characterization of biohydrogen production processes: thermochemical processes • Detailed characterization of biohydrogen production processes: other processes • Directions of biohydrogen use in bioeconomy • Quality requirements for the use of biohydrogen • Synergy of biohydrogen and biochar	lecture
2.	• Case study: mathematical modeling of the torrefaction/pyrolysis process of a selected type of biomass or by-product and prediction of biochar yield and quality • Case study: mathematical modeling of the gasification process of a selected type of biomass or by-product and prediction of biohydrogen yield and quality • Group work: development of a PFD of an integrated system utilizing the biochar and biohydrogen	project classes

Course advanced

Teaching methods:

classes, lecture, teamwork, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	project, performing tasks	50.00%

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Energy passive systems

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I10BO.3441.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 5	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	Transfer of knowledge in the field of passive energy acquisition solutions.
C2	To acquaint students with the principles of passive and low-emission building.
C3	Making the audience aware of the importance of passive energy solutions for the bioeconomy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student knows the rules of passive construction and understands their importance for the natural environment.	IBE_P6S_WG09, IBE_P6S_WK03	written credit, observation of student's work, presentation, performing tasks
W2	The student knows the possibilities/measures of reducing primary energy consumption by passive solutions.	IBE_P6S_WG10, IBE_P6S_WK03	written credit, observation of student's work, presentation, performing tasks
Skills – Student can:			
U1	The student is able to propose passive low-energy solutions.	IBE_P6S_UW05, IBE_P6S_UW15, IBE_P6S_UW18	active participation, participation in discussion, performing tasks
U2	The student is able to identify barriers and possibilities of local potential to be used in construction or technological processes.	IBE_P6S_UW16, IBE_P6S_UW18	active participation, participation in discussion, performing tasks
Social competences – Student is ready to:			
K1	The student is aware of the need to raise his knowledge and his responsibility for the environment.	IBE_P6S_KK01, IBE_P6S_KO04	observation of student's work, active participation, presentation, participation in discussion, performing tasks
K2	The student is ready to work in a group and be responsible for his work.	IBE_P6S_KO02	observation of student's work, active participation, presentation, participation in discussion

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
presentation/report preparation	15
consultations	2
exam / credit preparation	10
class preparation	6
collecting and studying literature	5
lesson preparation	7

Student workload	**Hours** 75	**ECTS** 3.0
Workload involving teacher	**Hours** 32	**ECTS** 1.1
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Formal and legal issues, rules and materials in the field of low-emission and passive building. The importance of passive energy systems for the bioeconomy. Passive systems in energy-saving construction. Heat balance of the object/building. Ventilation, recuperators, heat exchangers and low-emission heating. Designing passive buildings. Energetic efficiency. Automation in an intelligent passive building. Economic and environmental aspects in passive construction.	lecture
2.	Comparison of the impact of traditional and passive solutions used in the economy on the environment. Assessment of the possibility of implementing passive solutions for a given facility (group work).	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, presentation / demonstration, project-based learning (PBL), problem-solving method, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	observation of student’s work, active participation, presentation, participation in discussion, performing tasks	50.00%

Additional info

In the exercises to do the case study.

Entry requirements

None

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Design thinking

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3442.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period Semester 6	**Examination** graded credit **Activities and hours** lecture: 15, laboratory classes: 30	**Number of ECTS points** 4.0

Goals

C1	The course aim at the
C2	acquiring the ability to construct and implement projects in accordance with the Design Thinking methodology
C3	gaining the ability to cooperate in a team

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	knows basic rules and methods of Design Thinking	IBE_P6S_WK03	project, presentation
Skills – Student can:			

U1	critically evaluate and apply the tools used in the Design Thinking methodology	IBE_P6S_UU01, IBE_P6S_UW01, IBE_P6S_UW05, IBE_P6S_UW07	participation in discussion
U2	to design next steps in the Design Thinking process	IBE_P6S_UW05, IBE_P6S_UW07, IBE_P6S_UW11, IBE_P6S_UW14	project, presentation
U3	works in a group on the preparation of subsequent parts of the project	IBE_P6S_UW07, IBE_P6S_UW10	project
U4	has an ability to use a specific terminology	IBE_P6S_UW02	project, presentation
Social competences – Student is ready to:			
K1	create an innovative solution to the problem, taking into account group work	IBE_P6S_KK01, IBE_P6S_KO01, IBE_P6S_KO02, IBE_P6S_KO03	project, presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
laboratory classes	30
lesson preparation	10
project preparation	50

Student workload	**Hours** 105	**ECTS** 4.0
Workload involving teacher	**Hours** 45	**ECTS** 1.7
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	• basics of Design Thinking methodology • defining target groups for research problems • trend analysis • alternative research techniques in Design Thinking • prototyping	lecture

2.	• defining target groups for research problems (empathy map, stakeholder map) • generating ideas • prototyping: tools and techniques • testing prototypes • presentation of the project results	laboratory classes

Course advanced

Teaching methods:

Blended learning, teamwork, project-based learning (PBL), problem-solving method, brainstorming, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	participation in discussion	20.00%
laboratory classes	project, presentation	80.00%

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Bioreactors technology

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3443.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 6	exam **Activities and hours** lecture: 30, project classes: 30	4.0

Goals

C1	The aim of the course is to present knowledge and transfer skills and competencies covering the implementation, development, and design of bioreactors used in the bioeconomy for the biological conversion of biomass and by-products in order to valorize them into high-quality products and fuels.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Knows and understands advanced-level issues in the field of design and operation of bioreactors	IBE_P6S_WG11	written exam, project

W2	Knows and understands at an advanced level the issues of bioreactor design and its application in the bioeconomy	IBE_P6S_WG05	written exam, project
Skills – Student can:			
U1	Can solve, based on standard engineering activities, production and operational problems regarding the design and operation of bioreactors, while taking into account the requirements related to the care for the natural environment	IBE_P6S_UW12, IBE_P6S_UW14	project
U2	Is able to independently and in a team plan and perform design tasks in the area of bioreactors dedicated to biomass and by-products biological treatment	IBE_P6S_UW15	project, presentation
Social competences – Student is ready to:			
K1	Is ready to accept responsibility for own work and to submit to the principles of teamwork and responsibility for jointly performed tasks	IBE_P6S_KK01, IBE_P6S_KO04	project, presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
exam / credit preparation	10
collecting and studying literature	10
project preparation	30
class preparation	10

Student workload	**Hours** 120	**ECTS** 4.0
Workload involving teacher	**Hours** 60	**ECTS** 2.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	• Bioreactors, definitions, classification, importance in bioeconomy • The theory of bioreactors • Processes of biological processing of biomass and by-products in the bioeconomy • Technological parameters of bioreactors • Temperature • Pressure • Oxidation and reduction potential • Temperature control • Pressure control • Control of the oxidation-reduction potential • Substrate and product control • Control of physical and chemical properties during the process • Mixing systems and filling degree control • Scaling of bioreactors • Technical infrastructure of bioreactors • Safety systems, failure risk assessment • Inventions and innovations in the field of bioreactors	lecture
2.	Semester project: Concept design of a bioreactor for the processing of given biomass and by-product for the production of specific high-value products, including the development of a Technical Concept Note (TOK), operating modes, mass, and energy balances, benchmarking of bioreactor devices, and components. On the basis of the prepared documentation, the bioreactor will be built and tested using the 3D printing technique. The bioreactor presentation will be the semester project. The public session will be held during the exam session where the team students will present the bioreactor.	project classes

Course advanced

Teaching methods:

classes, lecture, teamwork, problem-solving method, brainstorming

Activities	Examination methods	Percentage in subject assessment
lecture	written exam	40.00%
project classes	project, presentation	60.00%

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Semestral project 6

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3444.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 6	graded credit **Activities and hours** project classes: 45	4.0

Goals

C1	Acquiring the skills of conceptual work aimed at developing proposals for solutions to current challenges in the field of bioeconomy

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	rules for analyzing the technologies used and innovations in the bioeconomy.	IBE_P6S_WG13	project
Skills – Student can:			

U1	solve interdisciplinary engineering tasks, also working in a group, using analytical, simulation and experimental methods in the field of bioeconomy	IBE_P6S_UW05	project, presentation
Social competences – Student is ready to:			
K1	start cooperation in a group to carry out tasks, specified either by oneself or by others, and to ensure that they are performed on time	IBE_P6S_KO02	project

Balance of ECTS points

Activity form	**Activity hours***
project classes	45
lesson preparation	10
project preparation	30
literature study	20
consultations	10

Student workload	**Hours** 115	**ECTS** 4.0
Workload involving teacher	**Hours** 55	**ECTS** 2.0
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Students receive an engineering task to be solved, requiring interdisciplinary knowledge and competences related to the bioeconomy. The task will include the analysis of the current state, identification of problems, collection of information on technological solutions applied so far, analysis of quantitative and qualitative data and elaborating of a concept for solving the specified engineering task. It will involve a group work, including understanding of the problem and its background, presenting it to members of other groups, developing a solution and presenting it. Members of the remaining groups take an active part in the discussion and evaluation of the presented issues and solutions.	project classes

Course advanced

Teaching methods:

discussion, teamwork, problem-solving method, brainstorming, case analysis

Activities	Examination methods	Percentage in subject assessment
project classes	project, presentation	100.00%

Entry requirements

Knowledge in the field of biology, chemistry and related sciences useful for understanding and interpreting processes related to the bioeconomy

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Industrial practice

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3445.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 6	graded credit **Activities and hours** practical training: 160	6.0

Goals

C1	The aim of the course is to familiarize students with the organizational structure of research units and departments industrial, laboratories and local government units, their production profile and production process, circulation documents, raw material and material needs, elements used in the field of bioeconomy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	knows the technological instructions, rules for collecting and preparing samples for analyzes, methods and devices used in analyzes, parameters in the production process, technological process diagrams, apparatus diagrams with the description of machines and devices / observation of work in the plant, verification of the practice diary, evaluation of information about the organization the plant and the scope of its activities.	IBE_P6S_WG04, IBE_P6S_WG09, IBE_P6S_WG10, IBE_P6S_WG13, IBE_P6S_WG14, IBE_P6S_WG16	oral credit
W2	knows the organization of the plant, organizational units and their interrelationships, circulation of documents as well as about the quality management systems in force / observation of work in the plant / office, verification of the practice diary, evaluation of information about the organization of the plant and the scope of its activities	IBE_P6S_WK01	oral credit
W3	knows the rules of data protection regarding the technology used in the plant and the introduction of new products into production, as well as the observance of professional secrecy / observation of work in the plant, verification of the practice diary, evaluation of information about the organization of the plant and the scope of its activities	IBE_P6S_WK02	oral credit
Skills – Student can:			
U1	is able to use basic control and measurement devices / observation of work in the plant, verification of the practice diary, assessment of information about the organization of the plant and the scope of its activities	IBE_P6S_UW01, IBE_P6S_UW14	oral credit
U2	is able to perform chemical and microbiological analysis with the use of appropriate devices and interpret the obtained results of laboratory analyzes / observation of work in the plant, verification of the practice diary, evaluation of information about the organization of the plant and the scope of its activities	IBE_P6S_UW13	oral credit
U3	is able to carry out an economic assessment of the raw material balance and estimate the costs associated with the production process / observation of work in the plant, verification of the practice diary, evaluation of information on the organization of the plant and the scope of its activities	IBE_P6S_UW08, IBE_P6S_UW16	oral credit
U4	is able to work in a group, is aware of the responsibility for tasks carried out jointly in the team / observation of work in the plant, verification of the practice diary, assessment of information about the organization of the plant and the scope of its activities	IBE_P6S_UW05	oral credit
Social competences – Student is ready to:			
K1	is ready to critically assess own knowledge and update knowledge about new achievements in the field of bioeconomy / observation of work in the plant, verification of the practice diary	IBE_P6S_KO02	oral credit
K2	is ready to think and act in an entrepreneurial manner / observation of work in the plant, verification of the practice diary	IBE_P6S_KO03	oral credit

Balance of ECTS points

Activity form	Activity hours*
practical training	160
report preparation	10
collecting and studying literature	10

Student workload	**Hours** 180	**ECTS** 6.0
Workload involving teacher	**Hours** 160	**ECTS** 6.0
Practical workload	**Hours** 170	**ECTS** 6.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	The organizational structure of the plant, production and service profile, circulation of documents regarding production or service activities, raw material and material needs, waste management, technologies used in the field of bioeconomy, water, sewage and energy management of the plant. Production schedule for individual products, diagrams of technological processes, technological instructions, applicable parameters in the production process, development and introduction to production of new products and services, sampling and preparation of samples, basics of interpretation of analysis results, applicable regulations and orders, rules of documentation, accounting and reporting. Principles of document circulation.	practical training

Course advanced

Teaching methods:

practical simulation training, teamwork, case analysis

Activities	Examination methods	Percentage in subject assessment
practical training	oral credit	100.00%

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Suistainable cities

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3447.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 6	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	The aim of the course is focus on sustainable development activities which can be applied in city management. Students will learn about contemporary challenges in urban scale and actions that local stakeholders can undertake to implement the concept of sustainable development. As a result of the course, student is able to propose local activities that can be implemented in selected city.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Student has knowledge of contemporary problems related to urban management in the context of sustainable development.	IBE_P6S_WG17	written credit

Skills – Student can:			
U1	The student is able to identify local problems in the functioning of the city and propose actions that relates to municipal sustainable development.	IBE_P6S_UW18	presentation, case study
Social competences – Student is ready to:			
K1	Students is be able to debate on the proposed concepts of local action.	IBE_P6S_KR_01	presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
lesson preparation	20
exam / credit preparation	10
presentation/report preparation	10
consultations	5
collecting and studying literature	10
exam participation	1

Student workload	**Hours** 86	**ECTS** 3.0
Workload involving teacher	**Hours** 36	**ECTS** 1.3
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Introduction to the concept of sustainable development - identification of interconnections. Ideological assumptions and general principles of the concept of sustainable development. Sustainable development in development policies around the world. Indicators of development measurement. The concept of planetary limits. Urban closed-loop economy. Overview of sustainable actions in urban management. Nature-based solutions in urban management. Urban adaptation to climate change. Certification of sustainable urban actions.	lecture
2.	Diagnosis of a selected city's sustainability challenges. Review of best practices applied in the world in order to minimize or solve urban problems. Developing the concept of local actions implementing the idea of sustainable development in the city.	project classes

Course advanced

Teaching methods:

lecture, discussion, problem-solving method, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	30.00%
project classes	presentation, case study	70.00%

Additional info

Some of the learning activities may take place online.

Entry requirements

None

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Environment evaluation

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3448.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 6	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	The aim of the course is to raise student's awareness of the complex interrelationships in the socio-ecological system. The purpose of educating environmental valuation is to make students aware of the problems related to degradation of the environment seen from the perspective of reducing the benefits that society and the economy derive from the environment.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	different environemntal valuation methods	IBE_P6S_WG02, IBE_P6S_WG04	report

Skills – Student can:			
U1	practice three methods of different types	IBE_P6S_UW01, IBE_P6S_UW08, IBE_P6S_UW10, IBE_P6S_UW18	performing tasks
Social competences – Student is ready to:			
K1	discuss the role and importance of of natural environment and natural resources for socio-economic development and improvement quality of human life	IBE_P6S_KO04	performing tasks
K2	work in groups as well as giving and receiving feedback	IBE_P6S_KO01	performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
presentation/report preparation	30
class preparation	15

Student workload	**Hours** 75	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Neoclassical Economics vs Ecological Economics 2. Different approaches to achieve sustainability 3. Ecosystem service concept, assessment and valuation methods 4. Why and what do we value when valuing nature 5. Environmental valuation methods 1. market proce 2. travel cost 3. contingent valuation method 4. hedonic pricing 6. System of Environmetnal Economic Accounting 7. Data sources for valuation	lecture
2.	Students are introduced to and individually complete tasks related to the selected three methods for the described case studies: 1. Market price method 2. Travel cost method 3. Contingent valuation	project classes

Course advanced

Teaching methods:

educational game, educational film, brainstorming, text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	report	50.00%
project classes	performing tasks	50.00%

Entry requirements

None

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Life cycle assessment

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3449.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 6	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	To familiarize students with the method of life cycle assessment according to ISO requirements and implementation of LCA with the help of GaBi Education software.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	issues in the field of key issues in the field of environmental protection, including the sustainable use of natural resources, the principles of sustainable development and product life cycle assessment	IBE_P6S_WG04, IBE_P6S_WG17	written credit, test

Skills – Student can:			
U1	use selected computer programs to perform a life cycle assessment (GaBi Education)	IBE_P6S_UW04, IBE_P6S_UW05, IBE_P6S_UW07, IBE_P6S_UW16, IBE_P6S_UW18	project, performing tasks, case study
Social competences – Student is ready to:			
K1	act to minimize the impact on the environment	IBE_P6S_KK01, IBE_P6S_KO04	project, presentation, performing tasks, case study

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
literature study	5
project preparation	15
exam / credit preparation	8
presentation/report preparation	5
report preparation	10
consultations	5
class preparation	12

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 35	**ECTS** 1.2
Practical workload	**Hours** 25	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Introduction 2. LCA according to ISO 14040 3. Purpose and scope of LCA 4. Functional unit 5. LCA collection analysis 6. LCA impact assessment 7. LCA interpretation 8. LCA modeling 9. Allocation of environmental impacts 10. Biomaterials and bio-waste at LCA 11. LCC: Life Cycle Costing	lecture
2.	1. GaBi: simple product modeling: paperclip 2. GaBi: simple product modeling: binder, processes, streams, plans 3. GaBi: simple product modeling: paper clip, parameters 4. GaBi: simple product modeling: paperclip, results 5. Comparison of systems in GaBi: process, product or system of choice from in the field of bioeconomy 6. System comparison in GaBi: consultation 7. Comparison of systems in GaBi: presentation	project classes

Course advanced

Teaching methods:

classes, practical simulation training, lecture, computer lab/laboratory, teamwork, presentation / demonstration, project-based learning (PBL), educational film, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit, test	50.00%
project classes	project, presentation, performing tasks, case study	50.00%

Entry requirements

None.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Environmental impact assessment

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3450.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 6	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	The aim of education is to provide knowledge and skills in the field of legal and administrative aspects of environmental conditions of a project related to bioeconmy, stages of investment implementation: construction, operation, liquidation, description of elements of the natural environment, estimation of emissions, multi-variant analysis of the investment impact on the environment, methods of reducing emissions and investment impact on the environment, constructing an impact matrix, the impact of the investment on the level of environmental pollution, environmental compensation, social conflicts.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Has expanded knowledge in the field of production in bioeconomy, quality, and running a business, including individual entrepreneurship.	IBE_P6S_WK01	written credit, project
W2	Has structured and theoretically founded knowledge of systems, technologies, techniques, devices, and tools used in bioeconomy.	IBE_P6S_WG10	written credit, project
W3	Has the knowledge to assess the impact of bioeconomy on the environment.	IBE_P6S_WG04	written credit, project
Skills – Student can:			
U1	Has the ability to search, understand, analyze and creatively use information from literature, databases and other sources; is able to integrate the information obtained, interpret it, as well as draw conclusions and formulate and substantiate opinions	IBE_P6S_UW01, IBE_P6S_UW16	project
U2	Is able to assess technical solutions and analyze factors affecting the quality of life and health of humans and animals and the state of the environment.	IBE_P6S_UW01, IBE_P6S_UW10	project, participation in discussion
U3	Is able to solve production and operational problems based on standard engineering activities in the field of bioeconomy, while taking into account the requirements related to care for the natural environment.	IBE_P6S_UW03	project
Social competences – Student is ready to:			
K1	Is aware of the importance of social, professional, and ethical responsibility for actions taken affecting the formation and condition of the natural environment.	IBE_P6S_KO04	written credit, project, active participation, participation in discussion
K2	Is aware of the risk and is able to assess the social effects of activities carried out in the field of location, assembly, and operation of systems and technologies for bioeconomy, taking into account its impact on the environment, as well as responsibility for decisions made.	IBE_P6S_KR_01	written credit, project, active participation, participation in discussion

Balance of ECTS points

Activity form	**Activity hours***	
lecture	15	
project classes	15	
lesson preparation	15	
report preparation	30	
collecting and studying literature	15	
Student workload	**Hours** 90	**ECTS** 3.0

Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 45	**ECTS** 1.7

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	• Introduction. Legal basis of the EIA system • Screening and scoping rules • Process card • Emissions, types of emitters • Reference levels for pollution in the environment • Principles for a description of natural conditions • Ecological research • Principles for describing data on the state of the environment • Types of interactions, interaction matrix, ways of limiting interactions • Analysis of location and technology variants • Investment phases for the EIA • Modeling of the spread of pollution • Reference documents, installation monitoring • Graphic documentation • Appeal procedures, social conflicts	lecture
2.	• Explanation of the rules during exercises, creating working groups, assigning topics - projects of environmental impact assessment reports • Discussion of the scope of the project, group presentations on the prepared elements of the project, teamwork on the SWOT analysis of the installation • Classes on solving problems of environmental impact assessment using the problem-based learning method (investor's approach, FILA table, Ishikawa chart) • Classes on solving problems of environmental impact assessment using the problem-based learning method (social side, analysis of the project environment - stakeholder register, stakeholder management strategies, actions taken within these strategies, stakeholder matrix) • Classes on solving problems of environmental impact assessment using the problem-based learning method (final presentations by teams) • Settlement of EIA reports	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, project-based learning (PBL), problem-solving method, educational game, brainstorming, text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	project, active participation, participation in discussion	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Metorology and climatology

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3452.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 6	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	Transfer of knowledge on interpretation of: physical processes taking place in the Earth's atmosphere and at its contact with the Earth's surface; components of heat and water balance; climatic factors; climate of Europe and Poland; resources of the Polish climate.
C2	The practical classes includes the methods of measurements of selected meteorological elements and methods of processing the obtained data; climate and weather characteristics based on the data obtained from the available databases, using the basic indices and classifications.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Student knows and understands processes and relationships occurring in the Earth's atmosphere and at its contact with the Earth's surface; understands the processes of heat and water circulation, and general atmospheric circulation; knows the methods of measuring basic meteorological elements;	IBE_P6S_WG06, IBE_P6S_WG17	written credit, test
W2	Student knows and understands the major climatic factors and describes the major weather phenomena.	IBE_P6S_WG06	written credit, test
Skills – Student can:			
U1	Student can interpret the phenomena and processes occurring in the atmosphere and at its contact with the Earth's surface.	IBE_P6S_UW01	project, performing tasks
U2	Student is able to determine basic characteristics and perform calculations in the field of meteorology and climatology.	IBE_P6S_UW01, IBE_P6S_UW14	project, performing tasks

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
class preparation	15
exam / credit preparation	15
project preparation	15

Student workload	**Hours** 75	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	Introduction to meteorology and climatology. Weather and climate. Solar and earth radiation, shortwave and longwave radiation balance, total radiation balance. Sunshine (real, possible, relative). Heat balance of active surface. Thermal processes in soil and water bodies. Heat exchange between active surface and atmosphere. Daily and yearly air temperature course. The physical parameters characterizing the air humidity. Daily and yearly air humidity course. Water processes: evaporation, condensation, precipitation, climatic water balance. Pressure systems and fronts. Wind types. Weather phenomena in low and high pressure systems. Weather forecasting. Climatic factors. Classification of climates. Main features of Europe's climate. Variability, temporality and contrast of Poland's climate. Climatic regionalization of Poland. Local climate formation. Contemporary climate change and its consequences. Extreme weather phenomena.	lecture
2.	Organization of meteorological service. Types of observations. Types of meteorological stations. Meteorological garden. Instruction for the observer. Principles of correctness of meteorological observations. Observation times. Calculation of short-wave radiation balance. Calculation of average and daily amplitude of air temperature. Diurnal course graph. Calculations of hourly values of relative humidity and humidity deficit. Diurnal course graph. Calculating monthly sums of index evaporation for various locations in Poland. Calculating monthly sums of evapotranspiration and climatic and agro-climatic water balances for various locations in Poland. Wind roses for various locations in Poland. Analysis of synoptic maps. Characteristics of spatial differentiation of basic climate elements on the selected area. Characteristics of weather conditions for selected locations in Poland in different years.	project classes

Course advanced

Teaching methods:

Blended learning, classes, lecture, project-based learning (PBL)

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	40.00%
project classes	project, test, performing tasks	60.00%

Entry requirements

Mathematics and statistics

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Pollution transport modelling

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3453.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 6	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	To acquaint participants with the basics of numerical modeling of water flow with a free water table on a two-dimensional model.
C2	Ability to: prepare a model, prepare a mesh and define boundary conditions.
C3	The ability to carry out research on a two-dimensional model and the interpretation of the calculation results.
C4	Ability to model point source of water pollutants and carry out calculations and analysis of the results of pollutant transport in a flow with free water table.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods

Knowledge – Student knows and understands:			
W1	The participant understands the basics of numerical modeling of flow in a two-dimensional space	IBE_P6S_WG07	written credit, test
W2	The student obtains knowledge about the transport of pollutants in natural watercourses from point anthropological sources	IBE_P6S_WG_03	written credit, test
W3	The participant obtains knowledge about the sensitivity of mathematical modeling to boundary conditions and the accuracy of the mapping of the studied phenomenon.	IBE_P6S_WG07	written credit, test
Skills – Student can:			
U1	The student is able to assess the usefulness of the selected mathematical model for the numerical analysis of the studied phenomenon.	IBE_P6S_UW05	project
U2	The student is able to prepare a numerical model to calculate the flow and propagation of pollutants in a two-dimensional space.	IBE_P6S_UW04	project
U3	The student is able to carry out and interpret the results of numerical flow calculations and assess the sensitivity of the results to the quality of the designed model.	IBE_P6S_UW16	project
Social competences – Student is ready to:			
K1	Understanding social contact - the ability to resolve conflicts caused by pollution of surface waters	IBE_P6S_KO01	oral credit
K2	Empathy - the ability to take various social roles and look for optimal solutions on the example of a community affected by surface water pollution.	IBE_P6S_KO04	oral credit

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
lesson preparation	8
project preparation	20
consultations	1
exam / credit preparation	10
conducting research	10

Student workload	**Hours** 79	**ECTS** 3.0
Workload involving teacher	**Hours** 31	**ECTS** 1.0

Practical workload	Hours 25	ECTS 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Presentation of the basic equation used in hydrodynamic models that describe the movement of water with a free water table, i.e. with the Navier-Stokes equations. Description of water flow in natural watercourses using averaged turbulent flow. Empirical models of turbulence describing the properties of turbulent stresses. Interpretation of the watercourse surface and flood plains in terms of description of flow resistance with the use of roughness. Boundary and initial conditions in calculations. Methods of taring the numerical model. Mathematical modeling of pollutant dispersion in a flow of water with a free water table. Methods of assessing the impact of model quality on the representation of the studied phenomenon.	lecture
2.	Acquainting with software for one two and three dimensional modeling of fluid flow. Preparation and installation of the Iber program on the participants' equipment. Preparation and development of cross-sections of the selected watercourse. Preparation of the watercourse surface model. Interpretation and roughing selected model elements. Selection of model elements to densify the calculation mesh. Preparation of a computational mesh in three densities. Giving boundary and initial conditions. Carrying out calculations. Preparation, modification of the model to introduce the source of pollution. Interpretation of modeling results. Preparation of the report and preparation of conclusions.	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, computer lab/laboratory, situation-based learning, project-based learning (PBL), problem-solving method, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit, test	50.00%
project classes	oral credit, project	50.00%

Entry requirements

Participation in the course requires knowledge of the following subjects:
"Fluid Mechanics" or "Hydraulics and Hydrology" or "Hydraulics"

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Monitoring of environment

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3454.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 6	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	Acquiring knowledge of European and national legal bases constituting the basis for monitoring activities, basic pollutants monitored in individual components of the natural environment and knowledge of measurement and research methods used in environmental quality monitoring.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student understands the need to monitor the quality of individual elements of the natural environment; knows the measurement and research methods used in environmental quality monitoring.	IBE_P6S_WG04, IBE_P6S_WG06, IBE_P6S_WG17	written credit, test

Skills – Student can:			
U1	Can find and understand European and national legal acts constituting the basis of monitoring activities; is able to estimate the threats to the environment resulting from the emission of pollutants.	IBE_P6S_UU01, IBE_P6S_UW01, IBE_P6S_UW10, IBE_P6S_UW18	performing tasks

Balance of ECTS points

Activity form	Activity hours*
lecture	15
project classes	15
lesson preparation	8
consultations	8
exam / credit preparation	5
class preparation	8
project preparation	10
report preparation	10

Student workload	**Hours** 79	**ECTS** 3.0
Workload involving teacher	**Hours** 38	**ECTS** 1.4
Practical workload	**Hours** 25	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities

1.	1. Environmental monitoring - European and national monitoring programs; 2. Design and implementation of experimental field studies necessary for the implementation of monitoring tasks; 3. Air quality monitoring on the example of Wrocław, remedial programs; 4. Monitoring of surface and groundwater quality; 5. Monitoring of soil and land quality; 6. Monitoring of nature, biological and landscape diversity; 7. Monitoring of electromagnetic fields and ionizing radiation; 8. Monitoring of the urban environment quality; 9-10. Current problems related to environmental quality monitoring; 11-12. Satellite remote sensing; 13-14. Spectral analyses and indicators; 15. Application of satellite remote sensing in environmental research.	lecture
2.	1. Determining the load of biogenic pollutants in the lake, selection of remedial measures reducing the risk of eutrophication. 2. Identification of threats, analysis of ongoing monitoring activities and a proposal to implement new measures for a selected urban area based on the Problem Based Learning methodology. 3. Assessment of changes in vegetation condition with the use of spectral satellite remote sensing.	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, problem-solving method, brainstorming

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	test, performing tasks	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Ecological engineering

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I20BO.3455.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 6	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	The main aim of the course is to introduce the students with the methods and activities aimed to solving problems of ecological engineering including water protection against pollution and reducing environmental pressure with the use of wastewater treatment systems in local/non-urbanized areas; the design of selected systems of wastewater treatment plants with using alternative methods of wastewater treatment; reuse of gray wastewater, water recovery;

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	student knows the technologies used in wastewater collection, treatment and safely entering to the environment in local/non-urbanized areas; knows the solutions that can be applied to reduce the risk associated with the wastewater entering to the environment; understands the biochemical processes of pollutants transformations in wastewater treated in hydrophyte technology;	IBE_P6S_WG04	written credit, presentation, participation in discussion
Skills – Student can:			
U1	student is able to estimate the risk associated with the production and accumulation of wastewater in local/non-urbanized areas; student takes decisions related to wastewater treatment method; selects the devices and design procedures;	IBE_P6S_UW05, IBE_P6S_UW17	project, test

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
presentation/report preparation	20
lesson preparation	10
project preparation	25
consultations	5

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 35	**ECTS** 1.2
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	Block 1: Closing the circulation of matter and water through the soil environment. The applied solutions for the disposal of wastewater in the natural environment in accordance with the principles of sustainable development. Block 2: Biochemical processes of transformations of carbon, nitrogen and phosphorus compounds in wetland systems; Plant functions in wetlands systems; Types of wetlands systems, configurations used, hybrid systems; Basics of designing wetlands systems. Block 3: Wastewater separation systems vs methods of water recovery from wastewater. Recycling of sewage. Case study using the PBL method. Block 4: Satellite remote sensing in monitoring of the natural environment.	lecture
2.	Exercise 1: Technological project of wastewater treatment system in the non-urbanized area with using of hydrophyte method with the reuse of treated sewage / gray sewage Exercise 2: Assessment of eutrophication of water reservoirs with the use of satellite remote sensing.	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, problem-solving method

Activities	Examination methods	Percentage in subject assessment
lecture	written credit, presentation, participation in discussion	50.00%
project classes	project, test	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Biorefineries design

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I40BO.3529.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 7	exam **Activities and hours** lecture: 30, project classes: 30	5.0

Goals

C1	The aim of the training is to present knowledge and transfer skills and competencies covering the implementation and development of integrated biorefinery technologies of biomass and by-products in order to valorize them as high-quality products and fuels.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Knows and understands at an advanced level the issues of biorefining and the use of biomass and by-products in the bioeconomy	IBE_P6S_WG05	written exam

W2	Knows and understands at advanced level issues in the field of design and operation of biorefineries	IBE_P6S_WG11	written exam
Skills – Student can:			
U1	Can solve, based on standard engineering activities, production and operational problems in the field of biorefining of biomass and by-products, while taking into account the requirements related to the care for the natural environment	IBE_P6S_UW12, IBE_P6S_UW14	project
U2	Is able to independently and in a team plan and perform design tasks in the area of biorefining of biomass and by-products	IBE_P6S_UW15	project, presentation
Social competences – Student is ready to:			
K1	Is ready to accept responsibility for own work and to submit to the principles of teamwork and responsibility for jointly performed tasks	IBE_P6S_KK01, IBE_P6S_KO04	project, presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	30
project classes	30
collecting and studying literature	20
exam / credit preparation	10
project preparation	50
class preparation	10

Student workload	**Hours** 150	**ECTS** 5.0
Workload involving teacher	**Hours** 60	**ECTS** 2.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	• Biorefineries: purpose, classification, creation, importance in the bioeconomy • The importance of multidisciplinarity, interdisciplinarity, and transdisciplinarity in creating advanced biorefinery systems, taking into account the challenges of the circular economy • Bio-refineries as a method of upcycling • Biomass and by-products as a source of renewable energy necessary for the functioning of biorefinery systems • Biomass and by-products as a substrate for the acquisition and production of valuable products and fuels in integrated biorefinery systems • Physical processes of processing biomass and by-products in biorefinery systems • Chemical processes of biomass and by-products processing in biorefinery systems • Biological processes of biomass and by-products processing in biorefinery systems • Thermochemical processes of biomass and by-products processing in biorefinery systems • The importance of hydrogen in modern biorefinery systems • Product quality as a factor in the development of biorefineries • Ways of creating scenarios and development paths of selected technologies in the field of biorefineries • Integration of biomass and by-products conversion systems in energy self-sufficient bio-refinery systems • Bio-refineries - technology forecasting • Inventions and innovations in the field of biorefineries	lecture
2.	Semester project: The conceptual project of biorefinery designed for the treatment of given biomass and by-product for production of specific high vales products, including the development of a PFD of integrated processes, mass, and energy balances for individual processes and whole biorefinery, economical evaluation of the designed concept (CAPEX, OPEX, IRR), benchmarking of devices, reactors, and machines for individual processes. The semester project will be either a poster or paper summarizing the conceptual project of the biorefinery. A public poster session will be held during the final examination period at which time students will present the poster as a team.	project classes

Course advanced

Teaching methods:

classes, lecture, teamwork, problem-solving method, brainstorming

Activities	Examination methods	Percentage in subject assessment
lecture	written exam	40.00%
project classes	project, presentation	60.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Comercialization

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I40HSO.3457.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 7	graded credit **Activities and hours** project classes: 30	3.0

Goals

C1	The aim is to familiarize students with the types and process of commercialization and the basics of intellectual property protection.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	types and processes of commercialization and protection of intellectual property.	IBE_P6S_WK02	project
Skills – Student can:			

U1	pre-prepare the commercialization process, including the protection of intellectual property.	IBE_P6S_UU01	project
Social competences – Student is ready to:			
K1	undertake economic ventures, including commercialization of research results.	IBE_P6S_KO03	project

Balance of ECTS points

Activity form	**Activity hours***
project classes	30
project preparation	40
lesson preparation	20

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	a	project classes

Course advanced

Teaching methods:

classes, problem-solving method, brainstorming, text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
project classes	project	100.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Diploma seminar

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I40BO.3467.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 7	graded credit **Activities and hours** seminar: 24	2.0

Goals

C1	The aim of the education is to present students with the tools and techniques necessary to prepare an engineering thesis and a discussion on the relevance of the undertaken engineering problems, taking into account their applicative and innovative nature.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Knows and understands the methods of acquiring knowledge and analytical thinking techniques necessary for its verification and use to solve the indicated engineering problems	IBE_P6S_WG15	presentation, performing tasks

Skills – Student can:			
U1	Can acquire knowledge, formulate a research or engineering problem, plan a design or research process, carry out a project or research, interpret the results and draw conclusions indicating technical or research recommendations.	IBE_P6S_UW01, IBE_P6S_UW06	observation of student's work, performing tasks
Social competences – Student is ready to:			
K1	Is ready to plan engineering or research tasks, carry them out, take responsibility for actions taken, and analyze the effects of actions taken	IBE_P6S_KO01, IBE_P6S_KO02, IBE_P6S_KR_01	presentation, performing tasks

Balance of ECTS points

Activity form	**Activity hours***	
seminar	24	
collecting and studying literature	5	
literature study	10	
class preparation	5	
consultations	15	
Student workload	**Hours** 59	**ECTS** 2.0
Workload involving teacher	**Hours** 39	**ECTS** 1.4

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**
1.	Databases of literature source materials, innovative nature and importance of the undertaken topics of engineering theses, formulation of a research/engineering problem, the genesis and aim of the thesis, planning - work packages and tasks - Gantt chart, milestones and configuration of the project, tools for managing literature sources and bibliography, the quality of literature sources, techniques of writing a thesis - literature review, materials and methods, design assumptions, results and rules of interpretation, forms of presenting the results, conclusions, summary, recommendations, introduction, summary, how to write a scientific paper on the basis of an engineering thesis? Preparation for the exam, presentation. Students presentations on written engineering theses.	seminar

Course advanced

Teaching methods:

discussion, case analysis

Activities	Examination methods	Percentage in subject assessment
seminar	observation of student’s work, presentation, performing tasks	100.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Academic entrepreneurship

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I40HSO.3468.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 7	graded credit **Activities and hours** project classes: 15	2.0

Goals

C1	Practical classes of a project character are to prepare students to start, run or develop their own business. The project should relate to broadly defined academic entrepreneurship in the area of study or an anticipated/planned area of economic activity in Poland or abroad. The tutors are exclusively practitioners - entrepreneurs and academic teachers with business experience.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	relations between the field of study and business activity	IBE_P6S_WK01	project

W2	the essence of product demand and supply	IBE_P6S_WK01	project
W3	the concept of intellectual property protection	IBE_P6S_WK02	project
W4	cost and revenue structure in a company	IBE_P6S_WK01	project
W5	basic issues of Industry 4.0	IBE_P6S_WK01	project
W6	the concept of profitability and economic viability of a planned undertaking	IBE_P6S_WK01	project
Skills – Student can:			
U1	prepare a subject of his/her own economic/business activity	IBE_P6S_UW10	presentation
U2	define data relevant for the considered business issue, select sources appropriately and interpret information coming from them	IBE_P6S_UW01	presentation
U3	determine the cost and revenue structure, determine the project's profitability threshold	IBE_P6S_UW08	presentation
U4	conduct a SWOT analysis of the planned business undertaking	IBE_P6S_UW08	presentation
U5	present and defend own business ideas	IBE_P6S_UW03	presentation
U6	organize and plan individual and team work	IBE_P6S_UW05	presentation
U7	make a self-presentation	IBE_P6S_UW03	presentation
U8	prepare a presentation of their idea and present it to a group	IBE_P6S_UW03	presentation
Social competences – Student is ready to:			
K1	think and act in an entrepreneurial way	IBE_P6S_KO03	observation of student’s work, active participation
K2	individual and group searching for directions of economic development	IBE_P6S_KK01	observation of student’s work, active participation
K3	to locate own ideas in development megatrends	IBE_P6S_KO02	observation of student’s work, active participation
K4	to implement projects taking into account social responsibility of business	IBE_P6S_KO03	observation of student’s work, active participation
K5	to take up a leadership role in a group	IBE_P6S_KO02	observation of student’s work, active participation

Balance of ECTS points

Activity form	**Activity hours***
project classes	15
project preparation	25
presentation/report preparation	10

Student workload	**Hours**	**ECTS**
	50	2.0

Workload involving teacher	**Hours** 15	**ECTS** 0.6
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	The student carries out his own or commissioned, e.g. from a company, project in the field of entrepreneurship using the possessed substantive knowledge from the area of studies as well as expert knowledge of the tutor(s). Session 1 (4h): searching for own and/or new direction of activity also with the use of group work methods. Definition of important parameters and resources for the implementation of the project. Learning of self-presentation and 'public speech' - presenting one's strengths to the group, arguing one's ideas. Task 1: to clearly define the nature of the project, the product, the production process and the resources needed for the project. Session 2 (4h): Recognising opportunities and risks of a project: market segmentation, evaluation of opportunities and threats, strengths and weaknesses - SWOT analysis. Forecast of demand and market price. Task II: SWOT analysis, demand forecast, product price forecast, work breakdown structure (WBS), fixed, variable and total costs for an accepted project. Session 3 (4h): Determination of project costs with a breakdown into fixed and variable costs, determination of unit price of a product or service, feasible level of activity (production capacity); determination of the project break-even point (BEP), assessment of project feasibility, analysis of risk of project feasibility using the method of break-even point sensitivity analysis to cost and price changes. Task III: to determine the fixed cost and the unit variable cost of the product. Determine the maximum level of activity (production capacity). Calculate the quantitative and qualitative break-even point (BEP), prepare a graphical interpretation, assess the feasibility of the project, study the sensitivity of BEP to changes in costs and price. Session 4 (3h): Presentation and defence of the prepared project in the group, evaluation of the project presentation by the group and by the tutor.	project classes

Course advanced

Teaching methods:

Blended learning, teamwork

Activities	Examination methods	Percentage in subject assessment
project classes	project, observation of student’s work, active participation, presentation	100.00%

Additional info

The classes may be conducted by more than one teacher also in the formula "on line".
Supporting materials and videos "Academic Entrepreneurship" and "University 4.0" have been prepared for the subject.

Entry requirements

The student has preliminary ideas about the direction he will study at the second degree and about his professional career after graduation.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Supply chain

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I40BO.3458.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 7	graded credit **Activities and hours** lecture: 15	2.0

Goals

C1	The aim of the course is to provide information on supply chains, their impact on company management and reducing the generation of waste and by-products. Implementation the supply chain to create closed production loops.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	[IBE_P6S_WG04] the graduate knows and understands at an advanced level issues in the field of key issues in the field of environmental protection, including the sustainable use of natural resources	IBE_P6S_WG04	written credit

W2	[IBE_P6S_WG09] the graduate knows and understands at an advanced level issues in the field of sustainable production processes, processing and use of raw materials in the bioeconomy	IBE_P6S_WG09	written credit
W3	[IBE_P6S_WG18] the graduate knows and understands the basic methods of supply chain design, including the use of artificial intelligence methods	IBE_P6S_WG18	written credit
Skills – Student can:			
U1	[IBE_P6S_UW01] the graduate has the ability to search, understand, analyze and use information on bioeconomy in a creative way	IBE_P6S_UW01	written credit
U2	[IBE_P6S_UW08] the graduate has the ability to make a preliminary economic analysis of engineering activities undertaken and the profitability of simple production processes	IBE_P6S_UW08	written credit
U3	[IBE_P6S_UW15] the graduate has the ability to design and optimize technological processes and supply chains used in the bioeconomy, taking into account the principles of process safety	IBE_P6S_UW15	written credit
Social competences – Student is ready to:			
K1	[IBE_P6S_KK01] the graduate understands the need for development, updating his knowledge, knows the possibilities of developing professional and interpersonal competences and consulting experts	IBE_P6S_KK01	written credit
K2	[IBE_P6S_KO04] the graduate is ready to bear social, professional and ethical responsibility for the state of the environment	IBE_P6S_KO04	written credit

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
exam / credit preparation	15
exam participation	2
consultations	10
lesson preparation	13

Student workload	**Hours** 55	**ECTS** 2.0
Workload involving teacher	**Hours** 27	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	1. Profitability of transport of goods and waste and their optimization in the supply chain. 2. Managing the supply of goods, dynamic supply chains. 3. Production management to eliminate product errors and rain-free production. 4. Managing raw material selection for production to create low-rain or precipitation-free processes. 5. Human resource management in the supply chain - elimination of errors and production downtime. 6. Artificial intelligence methods in supply chain management. 7. Methods of introducing innovations in the supply chain. 8. The role of Life Cycle Management (LCA) in the supply chain.	lecture

Course advanced

Teaching methods:

lecture, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	100.00%

Entry requirements

Information on process management and the course of production processes. Information on waste management, water and sewage management and environmental protection.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

BSc Thesis

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I40BO.3604.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** mandatory
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Subject related to scientific research** Yes
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 7	exam **Activities and hours** test assignments and project assignments: 5	10.0

Goals

C1	Familiarizing students with the basics of copyright, the layout, method and principles of preparing an BSc thesis. Conducting the student through the process of implementing an BSc thesis on a selected topic, its effect is the development and editing by the student of a written work that meets the requirements of the engineering diploma thesis in the field of Bioeconomy.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The student knows and understands at an advanced level issues in the field of: biology, chemistry, microbiology and related sciences useful for understanding and interpreting processes related to bioeconomy, issues in the field of mathematics, statistics used in the formulation and solving of simple tasks in the field of bioeconomy, issues in the field of economy water and sewage, waste management and non-waste management, issues covering key issues in the field of environmental protection, including sustainable use of natural resources, issues in the field of biotransformation, biorefining, bioconversion and the use of biomass and by-products in bioeconomy, meteorology and climatology, protection and atmospheric pollution, process engineering, including fluid mechanics, thermodynamics, rheology, methods, techniques, tools and materials used for purification, identification and characterization of bioproducts, sustainable production processes, brewing and use of raw materials in bioeconomy, construction, functions, use of technical devices and systems used in production processes, design and operation of bioreactors and biorefineries, information technology, enzymatic, microbiological, physical, chemical and biological processes used in bioeconomy, design and programming basics , rules for predicting the development of technology, innovations in the bioeconomy, research methods, methods of use and evaluation of biomaterials and bio-products, sources of scientific and technical-engineering information, new techniques and technologies used in bioeconomy; principles, methods and technologies of environmental monitoring, adaptation to climate change, the principles of sustainable development and product life cycle assessment, the student knows the rules of writing diploma theses, including the use of works by other authors and the preparation of multimedia presentations and public speeches, knows specialist terminology in Polish and a stranger.	IBE_P6S_WG01, IBE_P6S_WG02, IBE_P6S_WG_03, IBE_P6S_WG04, IBE_P6S_WG05, IBE_P6S_WG06, IBE_P6S_WG07, IBE_P6S_WG08, IBE_P6S_WG09, IBE_P6S_WG10, IBE_P6S_WG11, IBE_P6S_WG12, IBE_P6S_WG13, IBE_P6S_WG14, IBE_P6S_WG15, IBE_P6S_WG16, IBE_P6S_WG17	oral exam, observation of student’s work, report, presentation, diploma paper
Skills – Student can:			

U1	The student is able to: define the directions of further learning in order to improve professional competences, skillfully search, understand, analyze and creatively use information about the bioeconomy, skillfully search, understand, analyze and creatively use information about the bioeconomy, skillfully communicate using various techniques in the professional environment in the field of bioeconomy also in the language at the B2 level of the European Language Education Description System, skillfully prepare an engineering study (along with a presentation) in the field of bioeconomy, use selected computer programs for design, data processing, analysis and graphic presentation, solve interdisciplinary engineering tasks, also working in a group, using analytical, simulation and experimental methods in the field of bioeconomy, test hypotheses related to simple research problems related to bioeconomy, skillfully interpret The obtained results and formulate conclusions, assess the usefulness and possibilities of using new achievements in the field of bioeconomy, make a preliminary economic analysis of the engineering activities undertaken and the profitability of simple production processes, identify threats both theoretical and practical processes taking place in the bioeconomy and have the preparation necessary to work in an industrial environment , recognize non-technical aspects, including environmental, organizational, social, economic and legal aspects, when formulating and solving engineering tasks, skillfully assess the suitability of appropriate analytical methods and laboratory techniques to assess the physical, chemical and biological properties of raw materials and products produced and used by the bioeconomy, skillfully choose the conditions for conducting typical unit processes related to the processing of bioproducts and estimate the demand for energy and raw materials in these processes, skilfully apply basic measurement methods to control the course of processes characteristic of the bioeconomy, skillfully select typical devices and apparatus used in the bioeconomy, skillfully design and optimize technological processes and supply chains used in the bioeconomy, taking into account the principles of process safety, skillfully make a critical analysis of the functioning of existing technical solutions, systems, processes, services, devices and facilities in particular, skilfully select water treatment and renewal technologies, wastewater treatment, use of sludge and residual materials, skilfully apply the principles of rational management of natural resources.	IBE_P6S_UU01, IBE_P6S_UW01, IBE_P6S_UW02, IBE_P6S_UW03, IBE_P6S_UW04, IBE_P6S_UW05, IBE_P6S_UW06, IBE_P6S_UW07, IBE_P6S_UW08, IBE_P6S_UW09, IBE_P6S_UW10, IBE_P6S_UW11, IBE_P6S_UW12, IBE_P6S_UW13, IBE_P6S_UW14, IBE_P6S_UW15, IBE_P6S_UW16, IBE_P6S_UW17, IBE_P6S_UW18	oral exam, observation of student’s work, report, presentation, diploma paper
Social competences – Student is ready to:			

K1	The student is ready to: develop and update his knowledge, knows the possibilities of developing professional and interpersonal competences and consulting experts, taking responsibility for his own work and the consequences of decisions made, correctly defining priorities for the implementation of specific, by himself or other tasks, and ensure their timeliness. implementation, undertaking economic undertakings, bearing social, professional and ethical responsibility for the state of the environment, correct identification and resolution of dilemmas related to the performance of the profession of an engineer; is aware that the result of the engineer's activity depends on the correct recognition of the problem; adheres to the principles of professional ethics and personal culture and requires it from others.	IBE_P6S_KK01, IBE_P6S_KO01, IBE_P6S_KO02, IBE_P6S_KO03, IBE_P6S_KO04, IBE_P6S_KR_01	oral exam, observation of student’s work, presentation

Balance of ECTS points

Activity form	**Activity hours***
test assignments and project assignments	5
collecting and studying literature	30
presentation/report preparation	5
conducting research	80
consultations on diploma paper	80
preparation of diploma paper	70
exam / credit preparation	20
exam participation	1

Student workload	**Hours** 291	**ECTS** 10.0
Workload involving teacher	**Hours** 86	**ECTS** 3.0
Practical workload	**Hours** 80	**ECTS** 3.0

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	Acquainting the student with the basic rules of observing copyrights, the layout of the engineering thesis. Review of professional literature and collected starting materials related to the implementation of the selected topic of engineering thesis. Presentation by the student of topics related to the subject matter of the work being implemented. Defining the scope, purpose of work, methodology and implementation schedule. Performing the necessary analyzes, tests and calculations related to the engineering work being carried out. Analysis and processing of the results of analyzes, tests and calculations. Preparation of the necessary elements of the study, such as drawings, etc. Preparation of appropriate forms of presentation illustrating the solved / developed topic of the engineering thesis. Final preparation of the final version of the engineering thesis to be submitted for review and defense.	test assignments and project assignments

Course advanced

Teaching methods:

participation in research, discussion, computer lab/laboratory, presentation / demonstration, situation-based learning, project-based learning (PBL), problem-solving method, text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
test assignments and project assignments	oral exam, observation of student’s work, report, presentation, diploma paper	100.00%

Entry requirements

Implementation of the first-cycle study program in Bioeconomy.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Logistics

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I40HSO.3461.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 7	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	Acquainting students with the basic concepts of logistics.
C2	Acquainting with the integration of production and management systems, and the role and tasks of logistics.
C3	Acquisition skills in the field of logistics management and optimization of logistics systems.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Knows and can describe basic logistics issues.	IBE_P6S_WG18, IBE_P6S_WK01	project, test
W2	Can characterize the logistics system of an enterprise.	IBE_P6S_WG18, IBE_P6S_WK01	project, test
W3	Can identify cooperation and integration processes in a part of the supply chain.	IBE_P6S_WG18, IBE_P6S_WK01	project, test
W4	Is able to identify basic aspects of customer service.	IBE_P6S_WG18, IBE_P6S_WK01	project, test
Skills – Student can:			
U1	Can obtain information from literature, databases, and other sources.	IBE_P6S_UW01	project
U2	Can critically analyze, interpret and evaluate logistic support and processes on various scales inside the organization.	IBE_P6S_UW15	project
Social competences – Student is ready to:			
K1	Can interact and work in a group.	IBE_P6S_KK01, IBE_P6S_KO01	project
K2	Can properly define priorities for the implementation of specific tasks and problems.	IBE_P6S_KK01, IBE_P6S_KO01	project
K3	Can think and act creatively.	IBE_P6S_KK01, IBE_P6S_KO01	project

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
lesson preparation	30
project preparation	30

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Fundamentals and objects of logistics. Basic concepts, basic definitions, aspects, goals, tasks of logistics. 2. Introduction to logistics and logistic management in an enterprise: scope of the enterprise's functioning, logistic processes, logistics engineering. 3. Supply chain management and logistics networks. Designing and managing the supply chain. 4. Identification of logistic processes in transportation processes and material delivery. 5. Methods of warehouse management presentation in the logistic operations system of organizations. 6. The role of information and IT systems in supply chain management. Basic tools supporting the work of logistics. 7. Risk management in supply chains. The main logistic problems in distribution. 8. Final test.	lecture
2.	1. Introduction to project classes. Discussion of forms of class organization and the principles of the passing project. Organizational issues. 2. Selection and design of the production process. Planning of distribution needs. Presentation of a selected case study. 3. Designing a logistic network. Assessment and selection of suppliers. 4. Selection of purchase options and storage process, cost-effectiveness analysis. 5. Building a decision tree for a given example. Choosing the optimal logistics strategy. 6. Assessment of the effectiveness of supply systems. Directions and concepts for the improvement of supply chain management. 7. Discussion of completed projects, a summary of project activities. Pass the course.	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, teamwork, presentation / demonstration, situation-based learning, project-based learning (PBL), problem-solving method, text analysis, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	test	50.00%
project classes	project	50.00%

Entry requirements

Has basic knowledge of statistical analysis (description and interpretation of the results).
Can interpret simple economic phenomena.
Basic skills of spreadsheet software, such as Excel.

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Suistainable water management

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I40HSO.3462.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills No

Period	**Examination**	**Number of ECTS points**
Semester 7	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	Gaining the knowledge into water quality and factors influencing on water quality.
C2	Gaining the knowledge into fundaments of water treatment technology
C3	Gaining knowledge into a problem of water scarcity and possible solutions of solving this problem

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the compounds and factors forming the water quality.	IBE_P6S_WG01	written credit

W2	the fundaments of water treatment technology	IBE_P6S_WG_03	written credit
W3	the problem of water scarcity and alternative water sources which allow decreasing this problem	IBE_P6S_WG04	written credit
Skills – Student can:			
U1	propose the methods of rainwater and greywater management	IBE_P6S_UW18	project, observation of student’s work
U2	estimate the approximate water consumption and assess the water quality.	IBE_P6S_UW01, IBE_P6S_UW08	project, observation of student’s work
Social competences – Student is ready to:			
K1	creative operation.	IBE_P6S_KO01	project, observation of student’s work
K2	work in a team.	IBE_P6S_KK01	project, observation of student’s work

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
exam / credit preparation	7
consultations	5
project preparation	40
lesson preparation	5

Student workload	**Hours** 87	**ECTS** 3.0
Workload involving teacher	**Hours** 35	**ECTS** 1.2
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Introduction. Classification and amount of water resources. 2. Water quality parameters. 3. Water quality monitoring. 4. Legislation regulations in water quality management. 5. Processes in water treatment technology: coagulation, filtration, sedimentation. 6. Processes in water treatment technology: disinfection, ion exchange, membrane processes. 7. Alternative sources of water and rational management of water resources. 8. Final test.	lecture
2.	1. Introduction to project, conditions of passing. 2. Assessment of water quality and amount. 3. The proposition of rainwater management. 4. The proposition of greywater management (water reclamation). 5. Estimation of general costs and water saving. 6. Advantages and disadvantages of assumed conception. 7. Other propositions of reduction of water usage and ecofriendly solutions. 8. Final project delivery and crediting.	project classes

Course advanced

Teaching methods:

lecture, discussion, teamwork, brainstorming

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
project classes	project, observation of student’s work	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Quality management and auditing

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I40HSO.3463.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 7	graded credit **Activities and hours** lecture: 15, seminar: 15	3.0

Goals

C1	Gaining knowledge of the processes taking place in the environment in terms of the use of quality management systems in the context of environmental protection.
C2	Gaining skills in the field of developing environmental management systems in the enterprise.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	the scope of creating and functioning of quality management systems, including environmental management.	IBE_P6S_WG04	written credit
W2	the scope of certification and implementation of environmental management systems.	IBE_P6S_WG04, IBE_P6S_WG17	written credit
Skills – Student can:			
U1	to develop an exemplary environmental management system for the enterprise.	IBE_P6S_UW01, IBE_P6S_UW07, IBE_P6S_UW09	report, presentation
U2	to assess the environmental effects in the environmental management system in the enterprise.	IBE_P6S_UW13, IBE_P6S_UW16	report, presentation
Social competences – Student is ready to:			
K1	to work in a team and implement joint projects.	IBE_P6S_KO01, IBE_P6S_KO02	presentation

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
exam participation	2
exam / credit preparation	10
presentation/report preparation	13
report preparation	12
collecting and studying literature	8
lesson preparation	15
seminar	15

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 32	**ECTS** 1.1
Practical workload	**Hours** 12	**ECTS** 0.4

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	Introductory lecture. Quality management - basic concepts and terminology. Environmental Management - the essence and general model. General information about environmental management. Benefits of operating an EMS. History and review of environmental management systems. Environmental threats in the enterprise. Environmental management system compliant with the PN-EN ISO 14001 standard. Management system compliant with EMAS. Energy management system compliant with the PN-EN ISO 50001 standard. Stages and methodology of implementing the environmental management system. Management of waste and water-sewage management in the enterprise. Management of emissions and odors in the enterprise. Environmental Management System certification methodology. Audit of the environmental management system in the enterprise.	lecture
2.	Introduction. Division of presentation topics. Selected environmental management procedures in an enterprise based on the ISO 14001 standard. Environmental management system in an enterprise. Eco-balancing - purpose and principles as well as possible application in the enterprise. Methods of assessing the environmental effects of implementing the environmental management system in the enterprise. Summary of the presentation - discussion.	seminar

Course advanced

Teaching methods:

lecture, discussion, teamwork, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	written credit	50.00%
seminar	report, presentation	50.00%

UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Environmental data analysis

Educational subject description sheet

Basic information

Field of study bioeconomy	**Education cycle** 2022/23
Speciality -	**Subject code** WIKSiGIBE-AMS.I40HSO.3464.22
Department The Faculty of Environmental Engineering and Geodesy	**Lecture languages** English
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** Przedmioty humanistyczno-społeczne prowadzone w językach obcych
Education profile General academic	**Subject related to scientific research** No
	Subject shaping practical skills Yes

Period	**Examination**	**Number of ECTS points**
Semester 7	graded credit **Activities and hours** lecture: 15, project classes: 15	3.0

Goals

C1	Acquainting students with the basic issues in the area of statistical data analysis.
C2	Learning about the tools for analysis of environmental data.
C3	Acquisition skills in the application of mathematical methods to the analysis of observation series.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Knows and can describe the methods of field research used in the analysis of environmental problems.	IBE_P6S_WG02, IBE_P6S_WG04	project, test
W2	Student can identify the main forms for analysis, interpreting the collected data, drawing conclusions.	IBE_P6S_WG02, IBE_P6S_WG04	project, test
W3	Knows the basic methods of verification statistical hypotheses concerning the significance of differences in the data structure.	IBE_P6S_WG02, IBE_P6S_WG04	project, test
Skills – Student can:			
U1	Can obtain information from literature, databases and other properly selected sources.	IBE_P6S_UW01, IBE_P6S_UW04	project
U2	Can interpret the results obtained from measurements and apply the methods of statistical inference in relation to the examined processes.	IBE_P6S_UW01, IBE_P6S_UW04	project
U3	Can critically analyze and evaluate results of scientific research.	IBE_P6S_UW01, IBE_P6S_UW04	project
Social competences – Student is ready to:			
K1	Can interact and work in a group, assuming various roles.	IBE_P6S_KK01, IBE_P6S_KO04	project
K2	Can properly define priorities for the implementation of specific tasks and problems.	IBE_P6S_KK01, IBE_P6S_KO04	project
K3	Can think and act creatively.	IBE_P6S_KK01	project

Balance of ECTS points

Activity form	**Activity hours***
lecture	15
project classes	15
lesson preparation	30
project preparation	30

Student workload	**Hours** 90	**ECTS** 3.0
Workload involving teacher	**Hours** 30	**ECTS** 1.0
Practical workload	**Hours** 15	**ECTS** 0.6

* hour means 45 minutes

Study content

No.	**Course content**	**Activities**

1.	1. Variety of environmental data. Basic methods of data presentation. 2. Data analysis as a process. Methods of preparing data for analysis. 3. Methods of analyzing data from questionnaire surveys. 4. Descriptive statistics. Elements of descriptive statistics. 5. Statistical inference. Determining the minimum sample size. 6. Checking statistical hypotheses. Selected statistical tests. 7. Analysis of the dependence of two quantitative variables. Correlation. Regression equation. Regression methods. 8. Final test.	lecture
2.	1. Presentation and discussion of the subject of the project. Requirements for project development. Organizational issues. 2. Implementation of projects divided into teams: area selection, data analysis and calculations based on selected examples. 3. Surveys. Methods of survey research analysis. 4. Introduction to descriptive statistics for the sample and general population. 5. Methods of statistical inference. Diagram of significance test, Student's t-test, and its modifications. 6. Introduction to the analysis of variance, linear ANOVA models and graphical presentation of results from different studies. 7. Preparation and presentation of prepared projects. Pass the course.	project classes

Course advanced

Teaching methods:

classes, lecture, discussion, computer lab/laboratory, teamwork, presentation / demonstration, project-based learning (PBL), problem-solving method, case analysis

Activities	Examination methods	Percentage in subject assessment
lecture	test	50.00%
project classes	project	50.00%

Entry requirements

Has basic knowledge of environmental indicators and environmental protection problems.
Can perform simple statistical calculations (description and interpretation of the results).
Basic skills in statistical packages, such as Excel.