1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Analysis of plant channels current by patch clamp technique

Module code: 2BT_E_57

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_57_1	Defines and describes the processes responsible for the transport of ions through plant biological membranes	2BT_E_U02_P 2BT_E_U05_P 2BT_E_W03_P	5 5 5
2BT_E_57_2	Describes and distinguishes the types of plant membrane ion transport systems (pumps, ion channels, transporters).	2BT_E_U02_P 2BT_E_W01_P 2BT_E_W02_P	5 5 5
2BT_E_57_3	Identifies and describes configurations of measuring patch-clamp techniques and analyzes the data obtained during measurements.	2BT_E_U01_P 2BT_E_U03_P 2BT_E_U06_P 2BT_E_W01_P 2BT_E_W04_P	5 5 5 5 5
2BT_E_57_4	Conducts measurements by patch-clamp method in selected configurations and interprets the results.	2BT_E_K01_P 2BT_E_K02_P 2BT_E_U02_P 2BT_E_U03_P 2BT_E_U04_P 2BT_E_W01_P	4 4 4 4 5 4

3. Module description	
Description	The module enables to gain the specialized knowledge and skills, of the patch-clamp method in measurements of ion current through plant cells membranes. By this module the student will be acquainted with the physical fundamentals of transport through biological membranes, types of plant membrane ion transport systems (pumps, ion channels, transporters), patch-clamp configurations that serve to record currents flowing through biological membranes, analysis of currents flowing through ion channels. In addition, the student acquires the skills to carry out measurements using the patch-clamp technique.
Prerequisites	Knowledge of botany and plant physiology at the undergraduate level.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_57_w_1	Continuous assessment of practical skills	During practicals the following skills will be assessed: the use of laboratory equipment, proper experiment implementation, interpreting the results and conclusions drawing, preparing a written final report of the experiments performed.	2BT_E_57_3, 2BT_E_57_4
2BT_E_57_w_2	Final test	It covers issues discussed in lectures and information contained in recommended literature.	2BT_E_57_1, 2BT_E_57_2, 2BT_E_57_3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_57_fs_1	lecture	Lectures using multimedia devices.	5	Knowledge of the material from the lectures and work with the literature positions recommended by the tutors.	15	2BT_E_57_w_2
2BT_E_57_fs_2	laboratory classes	Working in the patch-clamp laboratory, the measurements using different patch-clamp configuration, discussion and analysis of obtained results.	20	Preparing for courses basing on the recommended literature. Preparing the final reports.	10	2BT_E_57_w_1

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Basics of microbial biotechnology

Module code: 2BT_E_55

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_55_1	Student has detailed knowledge and ability to assess the risks associated with microbiological processes of synthesis and degradation of various compounds as well as their application on an industrial scale.	2BT_E_U04_P 2BT_E_W02_P 2BT_E_W03_P 2BT_E_W08_P 2BT_E_W09_P	5 4 5 5 5
2BT_E_55_2	Student analyses mechanisms of transformation of exemplary recalcitrant xenobiotics in the environment	2BT_E_U02_P 2BT_E_W03_P 2BT_E_W05_P	5 4 3
2BT_E_55_3	Student knows and applies the principles of screening for microorganisms with desired properties.	2BT_E_U01_P 2BT_E_U03_P 2BT_E_W09_P	5 4 5
2BT_E_55_4	Student can perform biochemical and morphological characteristics of the microorganisms isolated from the environment.	2BT_E_U01_P 2BT_E_U03_P	4 3
2BT_E_55_5	Student induces and identifies the enzymes and metabolites of microbial origin and demonstrates their use in the industry and environmental protection.	2BT_E_U03_P	3
2BT_E_55_6	Student rates and evaluates methods and standards used in assessing the degradability of polymers and plastics in an environment	2BT_E_U04_P 2BT_E_U06_P	5 5
2BT_E_55_7	Student interprets, thinks analytically and evaluates critically the results of experimental work using current information and past	2BT_E_K01_P	5

	experiences.	2BT_E_U05_P 2BT_E_U06_P 2BT_E_W08_P	3 4 5
2BT_E_55_8	Student practices effective communication and cooperation with other people. Respect the safety rules when working with microorganisms.	2BT_E_K01_P 2BT_E_K02_P 2BT_E_K04_P	5 5 5

3. Module description	
Description	The course is designed to demonstrate methods and spark debate related to the basics of microbial biotechnology. It covers advanced techniques associated with microbial synthesis and degradation processes as well as their economics. Microbial screening for enzymes and metabolites-synthesizing microorganisms of potential use in various industries. During the course, the students will perform screening for microorganisms with desired properties and isolate commercially valuable metabolites. A part of degradation experiments emphasizes a variety of abiotic and biotic mechanisms involved in the conversion of persistent compounds in the environment. Special attention is paid to the synthesis, disposal, and degradation of plastic materials as an example of the most contemporary persistent xenobiotics. Students will examine the degradability of natural and synthetic polymeric materials under laboratory and field conditions in various environments. Additionally, basics related to the use of microorganisms in zero-waste economy will be discussed.
Prerequisites	Basic knowledge of chemistry, biochemistry, microbiology and enzymology.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_55_w_1	Continuous assessment of practical skills	Estimating the student skills when using the laboratory equipment, assessing behaviour, and compliance with safety rules. Evaluation of the basic understanding of the scientific methods and student's ability to draw conclusions based on various experimental data. Preparation for classes and active participation in debates.	2BT_E_55_3, 2BT_E_55_4, 2BT_E_55_5, 2BT_E_55_6, 2BT_E_55_7, 2BT_E_55_8
2BT_E_55_w_2	Laboratory report	Group of students prepares short oral presentation of the results and discussion of laboratory experiments.	2BT_E_55_1, 2BT_E_55_2, 2BT_E_55_3, 2BT_E_55_4, 2BT_E_55_5, 2BT_E_55_6, 2BT_E_55_7, 2BT_E_55_8
2BT_E_55_w_3	Final test	Single-choice test questions and short questions.	2BT_E_55_3, 2BT_E_55_4, 2BT_E_55_5, 2BT_E_55_6
2BT_E_55_w_4	The written exam	The exam consists of essay questions	2BT_E_55_1, 2BT_E_55_2, 2BT_E_55_3, 2BT_E_55_4, 2BT_E_55_5, 2BT_E_55_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_55_fs_1	lecture	Multimedia lecture.	10	Memorising and describing the material from the lectures, assessing basic sources of information and how to evaluate and use this information.	35	2BT_E_55_w_2, 2BT_E_55_w_4
2BT_E_55_fs_2	laboratory classes	Cooperative work in the biochemical and microbiological laboratory under the supervision of lecturer, performing experiments according to the instructions given to students, analysis of the results. Possibility of consultations: Clarification or discussion on material from the lectures and assistance in the preparation of the report.	35	Reading instructions, planning and basic understanding of the scientific method, preparation of report, recognition of the biodegradable plastics market.	40	2BT_E_55_w_1, 2BT_E_55_w_2, 2BT_E_55_w_3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Basics of plant biotechnology

Module code: 2BT_E_54

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_54_1	Student gets familiar with basic biotechnology methods applied in plant breeding and research on structure and function of plant genomes.	2BT_E_W01_P 2BT_E_W02_P	5 5
2BT_E_54_2	Student defines the goals, applications and environmental risk of the methods used in genetic modification of plant genomes.	2BT_E_W03_P	5
2BT_E_54_3	Student demonstrates the practical ability to apply the basic techniques to induce genetic variation in plants and gets familiar with the molecular analysis of transgenic plants.	2BT_E_U01_P 2BT_E_U03_P	5 5
2BT_E_54_4	Student applies modern biotechnology tools for understanding the structure and function of plant genomes.	2BT_E_U03_P	5
2BT_E_54_5	Students uses specialized electronic data bases and international services to update the reports on world wide status of genetically modified crops.	2BT_E_K01_P 2BT_E_U06_P	5 5
2BT_E_54_6	Student is able to plan the basic equipment for plant biotechnology laboratory.	2BT_E_W02_P	5
2BT_E_54_7	Student describes the experiment outcomes, analyzes the results, makes conclusions and present them in the report or presentation.	2BT_E_U03_P	5
2BT_E_54_8	Students follows the rules of safety work with the transgenic material and cares about laboratory equipment.	2BT_E_W04_P	5

3. Module description

Description	The module delivers the basic knowledge on plant biotechnology and prepares students theoretically and practically in terms of the methods used in plant biotechnology. Particular emphasis is placed on learning the key methods of plant biotechnology used in plant breeding, including the production and analysis of genetically modified plants and haploids. The usefulness of genetically modified plants in other industries as well as in the basic research is also presented. During self-made experiments, students learn to handle with the equipment of modern specialized plant biotechnology laboratory. The

	selected laboratory techniques used in biotechnology of the crops as well as and model plants is demonstrated . Student acquires practice in collecting and analysis of empirical data, interpretation of the results and formulation of the hypothesis and conclusions.
Prerequisites	Principles of molecular biology, basis of biotechnology and in vitro cultures of plants on undergraduate level.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_54_w_1	Final test	The written work to evaluate a knowledge and practical skills acquired during laboratory.	2BT_E_54_3, 2BT_E_54_5
2BT_E_54_w_2	Evaluation of practical skills	Verification of student's compliance with the rules of the work in specialized laboratory including handling with aseptic conditions of work and modern laboratory devises; evaluation of student's ability for conducting experiments; data collection and formulation of the conclusions..	2BT_E_54_3, 2BT_E_54_4, 2BT_E_54_5, 2BT_E_54_6, 2BT_E_54_7, 2BT_E_54_8
2BT_E_54_w_3	Written exam	Getting a credit on the laboratory work and report is obligatory to enter the exam which evaluate the knowledge on problems presented during the lectures.	2BT_E_54_1, 2BT_E_54_2, 2BT_E_54_5

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
1BT_54_fs_1	lecture	Lectures supported with computer presentations in Power Point to illustrate the problems discussed.	10	Acquisition of knowledge presented in lectures; textbooks and research papers related to the topics discussed.	40	2BT_E_54_w_3
1BT_54_fs_2	laboratory classes	Conducting of the experiments following the instructions, the analysis of the results – under teacher supervision.	35	Preparation for laboratory tasks based on the instructions and recommended literature	40	2BT_E_54_w_1, 2BT_E_54_w_2

1.	**Field of study**	**Biotechnology**
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Bioethics

Module code: 2BT_E_01

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_01_1	Student explains the state of knowledge about the functioning of the biosphere, describes the causes of the ecological crisis and presents the multilateral links between man and nature	2BT_E_W01_P 2BT_E_W03_P	4 4
2BT_E_01_2	Student justifies ethical important dimensions in modern biotechnology.	2BT_E_W01_P 2BT_E_W05_P	5 5
2BT_E_01_3	Student analyzes the assumptions of the main trends in bioethics and environmental ethics, knows its leading representatives and precursors	2BT_E_W01_P 2BT_E_W03_P	5 5
2BT_E_01_4	Student lists the most important ethical regulations contained in the applicable legal documents concerning the nature and living organisms.	2BT_E_W01_P 2BT_E_W03_P	4 4
2BT_E_01_5	Student proposes ethically conditioned solutions to diverse human activities which interact nature and living organisms.	2BT_E_U01_P 2BT_E_U04_P 2BT_E_U05_P	4 4 4
2BT_E_01_6	Student recognizes the motives of own decisions regarding behaviors affecting other life forms	2BT_E_U02_P 2BT_E_U04_P	5 5
2BT_E_01_7	Student selects and presents possible ways of exploitation of nature without destroying it	2BT_E_K01_P 2BT_E_U02_P 2BT_E_U05_P	5 5 5
2BT_E_01_8	selects and presents ways of exploiting nature without destroying it	2BT_E_K03_P	4

3. Module description

Description	The main aim of the Module "Bioethics" is to acquaint students and prepare them to evaluate various situations related to human interference in the phenomenon of life. The background and precursors of bioethics will be presented and various currents in this way of thinking will be analysed. Furthermore, the ethical aspects of legislation relating to living organisms and the natural environment, assumptions of animal liberation and humanitarian principles of experimental methodology will be presented and discussed. Human attitudes towards living organisms and wildlife, different solutions with respect to exemplary environmental situations of conflict and various aspects related to the use of genetically modified organisms will be critically analysed.
Prerequisites	general knowledge of biology at the undergraduate level

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_01_w_1	Test	Test at the last meeting, including the theoretical content of the lectures and exercises.	2BT_E_01_1, 2BT_E_01_2, 2BT_E_01_3, 2BT_E_01_4
2BT_E_01_w_2	Essay	Writing a multi-page essay on one of the selected list of topics.	2BT_E_01_3, 2BT_E_01_5, 2BT_E_01_7, 2BT_E_01_8
2BT_E_01_w_3	Continous assessement of student activity in classroom	Oral presentations, the ability to draw conclusions, the activity during the discussion are evaluated.	2BT_E_01_5, 2BT_E_01_6, 2BT_E_01_7, 2BT_E_01_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_01_fs_1	lecture	Lecture in the form of a multimedia presentation, using Internet resources: presentation of interviews, famous lectures and films.	15	Discussions of selected ethical dilemmas in biology; case study applied to specific environmental conflicts; educational games used to consolidate content from lectures and acquire complementary knowledge of the discussed issues.	10	2BT_E_01_w_1
2BT_E_01_fs_2	discussion classes	Discussions of selected ethical dilemmas in biology; case study applied to specific environmental conflicts; educational games used to consolidate content from lectures and acquire complementary knowledge of the issues discussed	15	Working with the textbooks, reading of supplementary materials (pdf-s articles, links to websites), writing of an essay	10	2BT_E_01_w_2, 2BT_E_01_w_3

1.	**Field of study**	**Biotechnology**
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Bioinformatics

Module code: 2BT_E_11

1. Number of the ECTS credits: 6

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_11_1	Student classifies and applies information technologies and statistical techniques in the analyses of DNA and protein sequences.	2BT_E_W01_P	4
2BT_E_11_2	Student applies informatics and bioinformatisc techniques to collect and describe data from the experiments on DNA, cDNA and protein sequencing and protein sequence and structure analyses.	2BT_E_W03_P	4
2BT_E_11_3	Student notices and analyses correlations in nature and applies the knowledge in the phylogenetic analyses and biodiversity analyses based on DNA and protein sequence.	2BT_E_W03_P	4
2BT_E_11_4	Chooses adequate bioinformatics and statistical methods to describe phenomena and to collect and analyse data from biological experiments.	2BT_E_U01_P	5
2BT_E_11_5	Student plans and preforms the bioinformatics analyses connected with the solving of research problem in biote	2BT_E_U01_P 2BT_E_U02_P	5 5
2BT_E_11_6	Student appreciates the significance of bioinformatics and statistical tools in the description of natural phenomena and processes and in the solving of research problem in biotechnology and biology.	2BT_E_K01_P 2BT_E_K03_P	5 5
2BT_E_11_7	Student demonstrates the creativity and self-reliance in bioinformatics analyses and is in a habit of updating of the knowledge in the studied subject.	2BT_E_K01_P	4

3. Module description

Description	Performed, without the tutor’s help, using a komputer, bioinformatics analyses, the recording of the results in an electronic form , checking the level of understanding and mastering of the knowledge and skills acquired during the classes.
Prerequisites	Mastering knowledge in the basics of computer science, genetics, molecular biology and biochemistry

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
2BT_E_11_w_1	Pass colloquium	Performed, without the tutor’s help, using a komputer, bioinformatics analyses, the recording of the results in an electronic form , checking the level of understanding and mastering of the knowledge and skills acquired during the classes.	2BT_E_11_1, 2BT_E_11_2, 2BT_E_11_3, 2BT_E_11_4, 2BT_E_11_5
2BT_E_11_w_2	Continuous assessment of practical skills	The assessment of the skills in the bioinformatics analyses and in the concluding.	2BT_E_11_4, 2BT_E_11_5, 2BT_E_11_6, 2BT_E_11_7
2BT_E_11_w_3	Practical test	Assessment of the ability to independently carry out bioinformatic analyzes and extraction applications: carried out independently, using a computer, analysis bioinformatics and record of obtained results in electronic form	2BT_E_11_5

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
2BT_E_11_fs_1	lecture	Multimedia lecture about selected issues – presentations.	15	Reading handbooks, supplementary reading.	35	2BT_E_11_w_1
2BT_E_11_fs_2	laboratory classes	Supervisioned works, performing the analyses based on the instructions, analyses of the results	45	Acquiring of the knowledge presented during the lectures, work on handbooks, supplementary reading	30	2BT_E_11_w_1, 2BT_E_11_w_2, 2BT_E_11_w_3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Biological bases for human and animal behavior

Module code: 2BT_E_52

1. Number of the ECTS credits: 6

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_52_E_01	Student knows the techniques and tool for acquiring biomedical and neurophysiological data and is able to interprete the results.	2BT_E_W01_P 2BT_E_W03_P	3 3
2BT_52_E_02	Student operates with physiological knowledge so that he/she understands biological bases for processes taking place in the nervous system.	2BT_E_U02_P 2BT_E_U06_P	3 3
2BT_52_E_03	Student knows the neurobiological vocabulary in English which enables him/her to acquire information from electronic sources and benefit from required experiments in virtual laboratory.	2BT_E_U05_P 2BT_E_U06_P	3 3
2BT_52_E_04	Student is able to analyze critically the information he/she acquired by themselves from electronic sources, is able to present scientific reports on neurobiology.	2BT_E_K01_P 2BT_E_U02_P 2BT_E_U06_P	3 3 3
2BT_52_E_05	Student is able to draw conclusions from the physiological observations and experiments, connect them with his/her konowledge of natural sciences and find adaptative role of structure and functions ofanimal nervous system.	2BT_E_U03_P 2BT_E_U06_P	3 3
2BT_52_E_06	Student is in a habit to use available sources of scientific information including newsletters and scientific portals and to apply the rules of critical concluding during the assessment of their reliability.	2BT_E_K01_P 2BT_E_U05_P	3 3

3. Module description

Description	THE AIM of the module is to acquire, by the students, the knowledge of biological mechanisms of human and animal behaviour and practical skills enabling the students to observe and interprete behaviour and to apply the knowledge in the future professional activity. LECTURES cover the fundamentals of neurobiology (functional neuroanatomy, cellular neurobiology, electrophysiology, neurochemistry and neuropharmacology, perception

	and motor mechanisms, maintaining of homeostasis, motivation, emotions, sensory physiology, behavioral genetics, consciousness behavioral sexual dimorphism, etology, sociobiology). PRACTICAL CLASSES tech students to observe and search for data, analysis of the data, calculate and reate models of neurobiological processes. STUDENT'S OWN WORK – with handbooks and electronic data sources, aimed at the preparation to the classes and creation of schemes and tables used during the classes.
Prerequisites	Knowledge and skills of biophysics, biochemistry, animal physiology and environmental issues and fundamentals of genetics and evolutionism acquired at the previous study stages, enabling the students to synthesize data and understanding of neurobiological processes.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_52_w01	written test	Written assay checking the level of understanding of the knowledge and skills acquired during the classes.	2BT_52_E_01, 2BT_52_E_02, 2BT_52_E_03, 2BT_52_E_04
2BT_E_52_w02	Current evaluation of practical skillls	Current evaluation of the task, models schemes, graphs and diagrams realization, including their correctness and connections with the main subject. Substantial and formal evaluation of the presented reports.	2BT_52_E_01, 2BT_52_E_02, 2BT_52_E_03, 2BT_52_E_04, 2BT_52_E_05, 2BT_52_E_06
2BT_E_52_w03	Final pass	Final written work (mini-assay or presentation) on biological bases of nervous system functions.	2BT_52_E_02, 2BT_52_E_03, 2BT_52_E_04, 2BT_52_E_05, 2BT_52_E_06

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_52_fs01	lecture	Lecture applying audiovisual equipment.	30	Preparation for colloquium, including student's own work in order to elaborate selected parts of material.	20	2BT_E_52_w01, 2BT_E_52_w03
2BT_E_52_fs02	practical classes	Analysis of selected problems of human and animal neurobiology. Projection of films on nervous and behavioral processes accompanied with comments. Computer modelling. Analysis of preserved parts of issues. Behavioural and psychological tests. Selected methods using measuring instruments.	30	Work with articles or films, searchiong for informations, preparation o fa mini-assay based on the data found without teacher's help.	40	2BT_E_52_w01, 2BT_E_52_w02, 2BT_E_52_w03

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: DNA markers

Module code: 2BT_E_18

1. Number of the ECTS credits: 6

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_18_1	Student possess a detailed knowledge in DNA markers methods applied for the fingerprinting, variation assessment or mapping.	2BT_E_W02_P 2BT_E_W09_P	5 5
2BT_E_18_2	Student classifies the DNA markers methods depending the type of the polymorphism they detect and the techniques of molecular biology they use.	2BT_E_W04_P 2BT_E_W09_P	5 5
2BT_E_18_3	Student compares various DNA markers methods and point out their advantages and disadvantages, as well as presents the examples of the applications of DNA markers in genetics, molecular biology and in plant breeding programmes.	2BT_E_W04_P 2BT_E_W05_P 2BT_E_W09_P	5 5 5
2BT_E_18_4	Student understands the aims and principles of conducting the analyzes with the use DNA markers.	2BT_E_U01_P 2BT_E_W09_P	5 5
2BT_E_18_5	Student can apply DNA markers methods to solve research problems which appear in plant breeding programmes and in basic research in the area of genetics and molecular biology.	2BT_E_U01_P 2BT_E_U03_P	5 5
2BT_E_18_6	Student correctly gathers the data from the performed experiments on DNA markers, critically evaluates their results and draws conclusions. Student, individually or in group of 2-3 persons, presents reports from the analyses performed.	2BT_E_U03_P 2BT_E_U04_P	5 5
2BT_E_18_7	Student assumes responsibility for laboratory equipment and follows safety rules in molecular biology laboratory.	2BT_E_K04_P	5

3. Module description

Description	

	The module is aimed at gaining knowledge in DNA markers methods, applied for the fingerprinting, variation assessment or mapping, and points out their practical applications. It provides students with a broad, detailed knowledge about basic and newest, advanced DNA markers techniques as well as presents the examples of their use in general research and application experiments, especially in plant breeding programmes. Students are acquainted with proper designing and performing of experiments with the use of DNA markers techniques, depending on the aim of research. During each practical students themselves carry out experiments with the use of DNA markers techniques, individually or in groups of 2-3 persons, and are taught how to analyze correctly the results and draw conclusions.
Prerequisites	Knowledge on general and molecular genetics, and on basic techniques in molecular biology.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_18_w_1	Colloquium	Written test, evaluating students' knowledge and skills acquired during practicals - performed after the accomplishment of each topic.	2BT_E_18_1, 2BT_E_18_2, 2BT_E_18_3, 2BT_E_18_4, 2BT_E_18_5
2BT_E_18_w_2	Practical skills continuous evaluation	Evaluation of practical skills and a theoretical knowledge related to the subject of each practical, evaluation of skills of the experiment conducting, analysis of the results and drawing of conclusions.	2BT_E_18_5, 2BT_E_18_6, 2BT_E_18_7
2BT_E_18_w_3	final test	Written final tesst checking up the knowledge acquainted during lectures and practicals.	2BT_E_18_1, 2BT_E_18_2, 2BT_E_18_3, 2BT_E_18_4, 2BT_E_18_5
2BT_E_18_w4	Report of the laboratory classes	Written reports, checking the student's skills as to presenting the results experiment, their analysis and formulation of conclusions	2BT_E_18_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_18_fs_1	lecture	Lectures illustrated with examples derived from own experiments and the newest scientific literature - in form of multimedia (PowerPoint) presentations.	15	- acquisition of knowledge from lectures - acquisition of knowledge from recommended supplementary literature	35	2BT_E_18_w_3
2BT_E_18_fs_2	laboratory classes	Students work under the supervision in the laboratory of molecular biology, individually or in groups of 2-3 persons – experiment performing, result analysis and conclusion drawing coordinated by the supervisor	45	- gathering knowledge and skills required for participation in lab classes. - acquaintance with issues presented during classes - acquaintance with literature recommended by the teacher	55	2BT_E_18_w4, 2BT_E_18_w_1, 2BT_E_18_w_2

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: English classes

Module code: 2BT_E_14

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_14_1	Student communicates in foreign language, using communication skills in foreign language at the advanced level.	2BT_E_U05_P	5
2BT_E_14_2	Student uses adequate linguistic competences in the frames of specialist vocabulary taking up complex linguistic actions	2BT_E_K03_P 2BT_E_U02_P	2 5
2BT_E_14_3	Student understands the need to continue of the learning of foreign language, verifies his/her own linguistic competences, is able to complete and improve the acquired knowledge and skills	2BT_E_U06_P	2

3. Module description

Description	The aim of the module is to develop the communication linguistic skills within such areas as: Reading, listening, speaking, writing, interaction using necessary linguistic strategies within the frames of specialist vocabulary typical for the field of study. The module improves the ability to communicate with specialists on biotechnology as well as with the recipients from outside of the specialists.
Prerequisites	Knowledge of English acquired at the previous stages of education.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_14_w_1	final test	Periodic and comprehensive, written and / or verbal checking of acquired language competences during classes and as part of his / her own work, taking into account class activity on a scale marks 2-5. Two written tests in the semester. To get a positive grade you must get at least 60% of the maximum number of points.	2BT_E_14_1, 2BT_E_14_2, 2BT_E_14_3

5. Forms of teaching						
code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_14_fs_1	practical classes	Exercices using communication metod, with the elements of discussion, with oral or written feedback, including student’s own work. Practical classes are conducted using activisation method as well as methods applied in e-learning, including TIK.	30	Work with handbook, dictionary, book of exercices, complementary materiale, electronic sources. Acquiring and strenghtening of linguistic competences. Preparation of oral or written forms (e.g. Project, presentation, dialog essay, letter). Work at the e-learning platform.	30	2BT_E_14_w_1

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Environmental biotechnology

Module code: 2BT_E_25

1. Number of the ECTS credits: 6

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_25_1	Student possesses wide knowledge of environmental biotechnology.	2BT_E_W02_P	5
2BT_E_25_2	Student names and describes plants and microorganisms that can be applied in the bioremediation of polluted environments.	2BT_E_W04_P 2BT_E_W09_P	5 5
2BT_E_25_3	Student names and describes the methods of improving of the organisms potentially applicable in environmental biotechnology.	2BT_E_W04_P 2BT_E_W09_P	4 5
2BT_E_25_4	Student applies advanced biotechnologiucal techniques to characterize and modify microorganismal strains.	2BT_E_U01_P	5
2BT_E_25_5	Student demonstrates the ability to critically analyze the results of the experiments.	2BT_E_U01_P 2BT_E_U03_P	5 4
2BT_E_25_6	Student understands the necessity to apply biological methods in environmental protection and to inform the socjety about new achievements in environmental biotechnology.	2BT_E_K01_P 2BT_E_K02_P	4 4
2BT_E_25_7	Student is able to work independently as well as in group, follows the rules of laboratory work.	2BT_E_K02_P 2BT_E_U04_P	5 4

3. Module description

Description	The module covers a detailed knowledge of environmental biotechnology. Student learns the different ways of application of microorganisms and plants in the treatment of environments contaminated with heavy metals and toxic organic compounds. Meets the microbial resistance mechanisms to heavy metal ions and the ability of microorganisms to degrade aromatic hydrocarbons. The module also provides the knowledge about the methods of genetic modification of microorganisms aimed at improving their catabolic activity, as well as the improvement of the enzymes used in the environment

	protection. Student ran onto the methods used in environmental biotechnology, lab activities develop abilities to independently carry out the experiments, as well as analyze and interpret the results.
Prerequisites	Principles of biotechnology, microbiology, molecular genetics and biochemistry at the undergraduate level.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_25_w_1	Colloquium	Written work checking the level of knowledge and skills acquired during the laboratory classes.	2BT_E_25_2, 2BT_E_25_3, 2BT_E_25_4, 2BT_E_25_6
2BT_E_25_w_2	Current evaluation of practical skills	Evaluation of the ability to perform experiments according to the protocol, analyses of the results, evaluation of the way of following of the rules of laboratory work by a student, evaluation of theoretical praparation to the laboratory classes.	2BT_E_25_3, 2BT_E_25_4, 2BT_E_25_5, 2BT_E_25_7
2BT_E_25_w_3	Report of the laboratory classes	Students, as a team, prepare a report, describing the experiment, results and interpretation of the results.	2BT_E_25_3, 2BT_E_25_5, 2BT_E_25_7
2BT_E_25_w_4	Final colloquium	Written work checking the level of understanding of the information acquired during the lectures.	2BT_E_25_1, 2BT_E_25_2, 2BT_E_25_3, 2BT_E_25_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_25_fs_1	lecture	Lecture illustrated by examples from lecturer's own researches and quoted from the literature, using audiovisual devices.	15	Student learns the knowledge from the lectures, reading of scientific literature and electronic sources connected with the issues taught.	35	2BT_E_25_w_4
2BT_E_25_fs_2	laboratory classes	Individual or group work under the tutor's supervision, performing of the experiments according to the instructions analysis of the results.	45	Preparation to the classes using recommended literature and instructions, report preparation.	55	2BT_E_25_w_1, 2BT_E_25_w_2, 2BT_E_25_w_3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Food microbiology and nutritional physiology

Module code: 2BT_E_29

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_29_1	Student knows and describes the evolution and diversity of animal alimentary tract. Student is able to notice correlations between the alimentary tract endocrine and neural systems and is able to describe the symptoms of homeostasis in nourishing physiology, including appestat.	2BT_E_K01_P 2BT_E_W01_P 2BT_E_W02_P	4 4 4
2BT_E_29_2	Student is able to Defie the nutritional and calorific value of food. Student is able to calculate calorific demand, understands the processing and supplementation processes of food and fodder. Student is able to assess reliably the benefits and potential risk of GMO in food. Knows the codes and descriptions of food additives and recognizes selected examples of “E” codes.	2BT_E_W01_P 2BT_E_W02_P 2BT_E_W03_P	3 4 4
2BT_E_29_3	Student has detailed knowledge about microorganisms present in food products, sees the positive and negative consequences of its occurrence. Student is able to assess the importance of functional foods.	2BT_E_W01_P 2BT_E_W02_P 2BT_E_W03_P	3 3 4
2BT_E_29_4	Demonstrates the knowledge of modern techniques of data collection and research tools used in microbiological food control. Knows and understands the regulations on food production and its control systems, including the techniques used in the microbiological analysis of food and its processed in accordance with the recommendations of the Polish Committee for Standardization. Understands and is able to draw up a scheme of research documentation.	2BT_E_U01_P 2BT_E_U02_P 2BT_E_W02_P	4 4 4
2BT_E_29_5	Student is able to construct correctly balanced diet based on tabula data. Knowi diet-dependent diseases. Student is able to describe selected examples of dietetic treatment in pathological states.	2BT_E_U01_P 2BT_E_U02_P 2BT_E_W02_P	3 3 3
2BT_E_29_6	Responsibly assess the risks resulting from the use of research techniques in microbial laboratory and complies with the conditions of safe operation.	2BT_E_K01_P 2BT_E_K02_P	4 4

2BT_E_29_7	Student is able to assess critically the information and dietetic recommendation propagated in media and is able to find reliable and trustful information, knows the most important nutritional portals.	2BT_E_K01_P 2BT_E_K02_P	4 4

3. Module description	
Description	The aim of the course is to obtain knowledge of food microbiology and widely understood physiology of nutrition. The module allows to gain skills for isolating of microorganisms from food products and their identification, according to the Polish Committee for Standardization. The student learns factors that cause food poisoning, and take note of the HACCP system as a tool for the production of safe food.
Prerequisites	Basic knowledge of microbiology, animal physiology and biochemistry.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_29_w_1	Laboratory report	Student prepares laboratory report which allows for the estimation of the student's knowledge and skills acquired on laboratory classes.	2BT_E_29_2, 2BT_E_29_3, 2BT_E_29_4, 2BT_E_29_5
2BT_E_29_w_2	continuous assessment of practical skills	Practical skills and logical reasoning assessed on all practical classes - evaluation of the student in the use of microbiological methods, laboratory equipment, evaluation of the correctness of the calculations array of experience and skills and interpretation of the results.	2BT_E_29_2, 2BT_E_29_3, 2BT_E_29_4, 2BT_E_29_5, 2BT_E_29_6
2BT_E_29_w_3	Final examination	It encompass the preparation of a short oral presentation (in groups of 2 -, 3-person) on topic chosen by the student in the field of food microbiology and physiology, nutrition and final test which will verify the student’s level of knowledge passed on the lectures.	2BT_E_29_1, 2BT_E_29_2, 2BT_E_29_3, 2BT_E_29_4, 2BT_E_29_5, 2BT_E_29_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_29_fs_1	lecture	Lectures on selected topics in the field of food microbiology and physiology of nourishment with audiovisual means - computer presentations illustrating the issues.	10	Expanding knowledge through self-complementary reading scientific articles (including English language) in the field indicated by the teacher.	40	2BT_E_29_w_3
2BT_E_29_fs_2	laboratory classes	Working under the supervision of the lecturer - perform experiments and calculations, discussion and documentation of observations, interpretation of the results. Discussion about the student’s presentation preceded by a lecture.	20	Preparation for the laboratory classes on the basis of literature recommended by the lecturer. Preparation of a multimedia presentation on the topic chosen by the student.	30	2BT_E_29_w_1, 2BT_E_29_w_2

1.	**Field of study**	**Biotechnology**
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: GMO – benefits and threats

Module code: 2BT_E_36

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_36_1	Student describes deploying of genetically modified plants (GMP) in agriculture, taking into account food production, pharmaceuticals and biofuels.	2BT_E_W02_P	5
2BT_E_36_2	Student presents data regarding current status of GMP production in the world. Characterizes transgenic plants of new generation.	2BT_E_W05_P 2BT_E_W09_P	5 5
2BT_E_36_3	Student presents legal regulations regaring release of GMO to the environment and trade of goods containing GMO products.	2BT_E_U02_P	5
2BT_E_36_4	Student identifies and discusses problems and potential threats related with GMP for the environment and consumers.	2BT_E_U02_P	5
2BT_E_36_5	Student critically evaluates pros and cons of GMP release to the environment and their use in food production, taking into account biological, economical and ethical aspects.	2BT_E_K01_P	5
2BT_E_36_6	Student acquires and improves skills of application of molecular biology methods aimed at GMO identification and improves capabilities of data analysis and interpretation.	2BT_E_U01_P 2BT_E_U02_P	5 5
2BT_E_36_7	Student acquaints oneself with safety protocols for GMO handling.	2BT_E_K02_P 2BT_E_K04_P	5 5

3. Module description

Description	The module is aimed at broadening of students' knowledge on current status of cultivation of GMP in the world. Identifies problems and potential threats associated with GMP for the environment and consumers. Discusses such issues as: GMP and famines in the world, GMP and diminishing of fertilizers application in agriculture, vertical and horizontal gene transfer, ethics of GMO products and food safety, GMO as private and social value. The module acquaints students with legal regulations regarding registration and release of new GMO crop cultivars in the USA and European Union. During the classes students acquaint themself with molecular methods of GMO detection in food products and with the safety procedures of GMO handling.

Prerequisites	Knowledge on basic issues of biotechnology.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_36_w_1	Final test	Written test evaluating students' knowledge and skills acquired during lectures and lab classes.	2BT_E_36_1, 2BT_E_36_2, 2BT_E_36_3, 2BT_E_36_4, 2BT_E_36_5
2BT_E_36_w_2	Practical skills evaluation	Evaluation of proper implementation of safety procedures during work in laboratory, evaluation of skills of experiment conducting, observation and drawing counclusions.	2BT_E_36_6, 2BT_E_36_7
2BT_E_36_w_3	Report on the lab work	Group report describing methods, effects and conclusion of the perfomed experiments.	2BT_E_36_6, 2BT_E_36_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_36_fs_1	lecture	Lectures illustrated with results derived from own experiments and scientific literature with the application of Power Point presentations.	20	Acquiring knowledge derived from lectures, books and supplementary literature.	55	2BT_E_36_w_1
2BT_E_36_fs_2	practical classes	Student's individual work coordinated by supervisor.	10	Gathering knowledge and skills required for participation in lab classes . Acquaintance with issues discussed during classes and suggested literature.	15	2BT_E_36_w_1, 2BT_E_36_w_2, 2BT_E_36_w_3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Histochemical and immunohistochemical techniques

Module code: 2BT_E_24

1. Number of the ECTS credits: 6

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_24_01	Good knowledge concerning histochemical techniques used in plant and animal tissues analysis.	2BT_E_U01_P 2BT_E_W01_P 2BT_E_W02_P 2BT_E_W04_P 2BT_E_W09_P	4 4 4 4 4
2BT_E_24_02	Knowledge of the advanced techniques in tissues analysis.	2BT_E_W02_P 2BT_E_W04_P 2BT_E_W09_P	5 5 5
2BT_E_24_03	Classification and collection of data during carrying the histo- and immunihistochemical reactions.	2BT_E_U02_P 2BT_E_U03_P	4 4
2BT_E_24_04	Use the advanced techniques in plant and animal tissues analysis.	2BT_E_U01_P 2BT_E_W04_P	4 4
2BT_E_24_05	Abilities to carry out histo- and immunohistochemical staining.	2BT_E_U01_P 2BT_E_U03_P	3 3
2BT_E_24_06	Handling experimental observation and data Interpretation of obtained data and reactions.	2BT_E_K02_P 2BT_E_U03_P 2BT_E_U06_P	3 3 3

2BT_E_24_07	Present reasoned explanation of phenomena and problems, concerned tissues analysis.	2BT_E_K02_P 2BT_E_U06_P	4 4
2BT_E_24_08	Skils in practical use of presented histochemical techniques.	2BT_E_U06_P	3

3. Module description	
Description	Detailed classification of histo- and immunohistological methods used in laboratories; introduction to terminology, characteristic of methods and the theoretical principles of methods including principles of fixation, dehydratation, embeddind and sectioning for plant and animal tissues; skils in carrying out histo- and immunohistological reactions, recognition of analysed structures; improvement in interpretation of obtained results; student get the advanced knowledge in fluorescence and transmission electron microscopy techniques.
Prerequisites	Knowledge of plant and animal histology, cell biology.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_24_w01	Written report	Written report by each of student after each of laboratory: description of histochemical and /or immunohistochemical techniques used for tissues analysis, expected effects, detection capabilities of analyzed structures, photo-documentation of reactions.	2BT_E_24_01, 2BT_E_24_02, 2BT_E_24_03, 2BT_E_24_06, 2BT_E_24_07
2BT_E_24_w02	Test of practical skills	Student's experimental skills will be evaluated on each laboratory by lecturel – know how to use apparatus, techniques according to protocols, principles of microscope, analysis and identification tissue structure, the quality of speciemens, interpretation and evaluation of obtainet results, evaluation of the ability to discuss problems raised during the laboratory work.	2BT_E_24_03, 2BT_E_24_04, 2BT_E_24_05, 2BT_E_24_06, 2BT_E_24_08
2BT_E_24_w03	Written pass test	Final completion of laboratory – completion of each laboratory and theory from lectures.	2BT_E_24_01, 2BT_E_24_02, 2BT_E_24_04, 2BT_E_24_08

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_24_fs01	lecture	Lectrure choosen problems with the use of audiovisual methods; computer presentation ilustrating the discussed issues.	10	Work with manuals and suplementarny material.	40	2BT_E_24_w03
2BT_E_24_fs02	laboratory classes	Work under supervision of teacher – carrying out histochemical and immunohistochemical reactions to analyse plant and animal tissues following carefully a sequence of instruction provides by teacher; microscopical observation of specimens produced during classes (notes, drawings) discussion.	50	Knowledge with understanding of the topics solved during laboratory; writing report, work with the manuals.	50	2BT_E_24_w01, 2BT_E_24_w02

		Laboratory with the use of bright field and fluorescence microscopy, and transmission electron microscopy.				

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Industrial microbiology

Module code: 2BT_E_31

1. Number of the ECTS credits: 6

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_31_1	Student describes and understands the importance and application of microorganisms in various areas of industrial microbiology.	2BT_E_W05_P	5
2BT_E_31_2	Student has detailed knowledge about the synthesis of various compounds on an industrial scale.	2BT_E_W02_P	4
2BT_E_31_3	Student plans research on screening and improvement of microorganisms with desired properties and demonstrates knowledge of modern techniques used in food, pharmaceutical and cosmetic industries.	2BT_E_W09_P	5
2BT_E_31_4	Student uses advanced research techniques to conduct experiments related to industrially important microorganisms.	2BT_E_U01_P	5
2BT_E_31_5	Student uses the knowledge gained in lectures and laboratory classes for proper and correct interpretation of the results obtained in the experimental work.	2BT_E_U02_P	4
2BT_E_31_6	Student systematically updates and completes the knowledge of the latest developments in the field of industrial microbiology. Student is able to properly assess the practical application of obtained knowledge.	2BT_E_U06_P	5
2BT_E_31_7	Student responsible interprets the risks arising from the use of research techniques and respects the conditions of safe work in laboratories.	2BT_E_W08_P	5

3. Module description

Description	The course focuses on the specialist knowledge in the field of industrial microbiology. Acquaints the student with the use of microorganisms for the production of food products as well and non-food materials, cosmetic and pharmaceutical products. Gives knowledge on the biosynthesis of biologically active compounds on an industrial scale and the technological and microbiological basics for ethanol and organic acids production. The course describes the possibilities of microbiological process problems and damage of different industrial products. Students will learn the characteristics of industrially important microorganisms, will conduct experiments for obtaining organic acids using industrial methods. Through the analysis, comparison and discussion of the results student will verify existing knowledge, skills and competences.

Prerequisites	Basic knowledge of microbiology, chemistry, biochemistry and biotechnology.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_31_w_1	Written tests after each laboratory thematic block	The written work which verify the level of understanding, knowledge and skills acquired during each thematic block.	2BT_E_31_1, 2BT_E_31_2, 2BT_E_31_3
2BT_E_31_w_2	Continuous assessment of practical skills	Assessment of student's behaviour respecting the safety rules for the laboratory, maintain the sterility of work. Evaluation of the basics in conducting experiments and observations and student's ability to draw conclusions.	2BT_E_31_5, 2BT_E_31_7
2BT_E_31_w_3	Laboratory report	Student prepares laboratory report after each thematic block, the report contains the description of methods, results and conclusions from conducted experiments.	2BT_E_31_5, 2BT_E_31_6, 2BT_E_31_7
2BT_E_31_w_4	The written exam	A written work which verify the knowledge and skills acquired during lectures and laboratory classes. The condition for accession the final exam is to pass the laboratory classes.	2BT_E_31_1, 2BT_E_31_2, 2BT_E_31_3, 2BT_E_31_4, 2BT_E_31_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_31_fs_1	lecture	Lectures on selected topics with audiovisual means - computer presentations illustrating the issues discussed.	15	Working with textbooks and supplementary literature and generally available supplementary sources of electronic information.	35	2BT_E_31_w_4
2BT_E_31_fs_2	laboratory classes	Independent and cooperative work under the supervision of lecturer - perform experiments according to the instructions given to students, analysis of the results Possibility of consultations: Individual work with the student on the preparation of laboratory report from conducted experiments. Clarification or discussion on material from the lectures and assistance in the preparation of the report.	45	Acquiring knowledge from lectures and textbooks, drawn up notes and drawings from observation of microscopic preparations, an explanation of the results from the microbial analyzes. Discussion of the issue proposed by the student.	55	2BT_E_31_w_1, 2BT_E_31_w_2, 2BT_E_31_w_3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Mechanisms of evolution

Module code: 2BT_E_51

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_51_1	She/he acquired basic knowledge on the origin of organisms and their evolution on Earth.	2BT_E_W01_P	4
2BT_E_51_2	Understands the evolutionary processes in populations, both at the phenotypic and genic levels, driven by natural selection and/ or genetic drift.	2BT_E_W03_P	4
2BT_E_51_3	Explains the molecular processes underlying origin of new genes and species.	2BT_E_W02_P	4
2BT_E_51_4	Student is able to apply molecular analytical tools in the studies on evolution.	2BT_E_W04_P	4
2BT_E_51_5	She/he explains the biological diversity resulting from adaptation and speciation.	2BT_E_K02_P	4
2BT_E_51_6	Student is able to critically evaluate results published in evolutionary biology papers.	2BT_E_U02_P	4
2BT_E_51_7	Developed the habit of using scientific information resources and using critical inference when faced with alternative concepts and explanations.	2BT_E_K01_P	4
2BT_E_51_8	Understands the need of updating knowledge in her/his special field critically looking at the acquired information.	2BT_E_K01_P 2BT_E_U06_P	4 4

3. Module description

Description	The module provides current knowledge on evolution of life forms. Focuses on mechanisms of evolution, i.e. processes changing phenotypic and/or genetic composition of populations, theoretical models of natural selection and genetic drift. These along with principle of uniformitarianism and empirical testing of hypotheses are used then to present contemporary examples of experiments illustrating various processes leading to evolutionary change. Natural selection as a process resulting in adaptation. Mystery of sexual reproduction, sexual selection and genetic conflicts. Students will be familiarized with principles of molecular evolution, changes affecting genes and genomes. Basics of molecular phylogenetics and molecular clocks allowing dating of

	lineage divergence. Speciation, origin of reproductive barriers and role of hybridization in diversification are discussed next. Genome studies illuminating the past history of the human family close the module.
Prerequisites	Basic knowledge of biology, botany, zoology and genetics on the BSc level allowing comprehension of the presented topics.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_51_w_1	Exam	Test covering seminar content in the form of a mixed test.	2BT_E_51_1, 2BT_E_51_2, 2BT_E_51_3, 2BT_E_51_4, 2BT_E_51_5, 2BT_E_51_6, 2BT_E_51_7, 2BT_E_51_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_51_fs_1	discussion classes	seminar on selected issues using multimedia presentations and discussions.	30	Student self study based on a handbook, and internet resources.	55	2BT_E_51_w_1

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Microbial biotechnology

Module code: 2BT_E_13

1. Number of the ECTS credits: 7

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_13_1	Student has detailed knowledge and ability to assess the risks associated with microbiological processes of synthesis and degradation of various compounds as well as their application on an industrial scale.	2BT_E_U04_P 2BT_E_W02_P 2BT_E_W03_P 2BT_E_W08_P 2BT_E_W09_P	5 4 5 5 5
2BT_E_13_2	Student classifies the xenobiotic. Describes the mechanisms of their microbial transformation in the environment.	2BT_E_U02_P 2BT_E_W03_P 2BT_E_W05_P	5 5 3
2BT_E_13_3	Student knows and applies the principles of screening for microorganisms with desired properties.	2BT_E_U01_P 2BT_E_U03_P 2BT_E_W09_P	5 4 5
2BT_E_13_4	Student can perform biochemical and morphological characteristics of the microorganisms isolated from the environment.	2BT_E_U01_P 2BT_E_U03_P	4 3
2BT_E_13_5	Student induces and identifies the enzymes and metabolites of microbial origin and demonstrates their use in the industry and environmental protection.	2BT_E_U03_P	3
2BT_E_13_6	Student rates and evaluates methods used in assessing the biodegradability of polymeric waste.	2BT_E_U04_P 2BT_E_U06_P	5 5
2BT_E_13_7	Student interprets, thinks analytically and evaluates critically the results of experimental work using current information and past	2BT_E_K01_P	5

	experiences.	2BT_E_U05_P 2BT_E_U06_P 2BT_E_W08_P	3 4 5
2BT_E_13_8	Students will gain experience in effective communication skills by practicing, listening and speaking clearly. Respect the safety rules when working with microorganisms.	2BT_E_K01_P 2BT_E_K02_P 2BT_E_K04_P	5 5 5

3. Module description	
Description	The course focuses on the vast array of applications of microorganisms in microbial biotechnology. The course will cover an advanced methods associated with microbial synthesis and degradation processes as well as their economics. The emphasis will be placed upon variety of abiotic and biotic mechanisms involved in the conversion of persistent compounds in the environment. Special attention will be paid to synthesis, disposal and biodegradation of plastic materials and microbial screening for enzymes and metabolites synthesising microorganisms of potential use in various industries. During the course the students will perform screening for microorganisms with desired properties and isolate commercially useful metabolites. Isolated microorganisms will be tested for the degradation activity of petroleum hydrocarbons and emulsification activity. The capability of commercially used strain Leuconostoc mesenteroides to produce dextran will be estimated. Moreover, students will examine degradability of natural and synthetic polymeric materials in various environments. The estimation of susceptibility of plastics to filamentous fungi and white rot fungi as well as fungal enzymes involved in the degradation will be tested. Through the analysis, interpretation and discussion of the results students integrate knowledge, skills and competence.
Prerequisites	Basic knowledge of chemistry, biochemistry, microbiology and enzymology.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_13_w_1	Continuous assessment of practical skills	Estimation of the student's skills when using the laboratory equipment, assessment of behaviour and respecting the safety rules for the entire laboratory. Evaluation of the basic understanding of the scientific methods and observation of performance of the experiment and student’s ability to draw conclusions.	2BT_E_13_3, 2BT_E_13_4, 2BT_E_13_5, 2BT_E_13_6, 2BT_E_13_7, 2BT_E_13_8
2BT_E_13_w_2	Laboratory report	Student along with group of collaborators prepares short oral presentation of 15 minutes presenting the results and discussion of laboratory experiments.	2BT_E_13_1, 2BT_E_13_2, 2BT_E_13_3, 2BT_E_13_4, 2BT_E_13_5, 2BT_E_13_6, 2BT_E_13_7, 2BT_E_13_8
2BT_E_13_w_3	Final test	Single-choice test questions and short questions.	2BT_E_13_3, 2BT_E_13_4, 2BT_E_13_5, 2BT_E_13_6
2BT_E_13_w_4	The written exam	The exam consisted of essay questions will be given at the end of the semester.	2BT_E_13_1, 2BT_E_13_2, 2BT_E_13_3, 2BT_E_13_4, 2BT_E_13_5, 2BT_E_13_6

5. Forms of teaching						
code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_13_fs_1	lecture	Multimedia lecture.	30	Memorising and describing the material from the lectures, assessing basic sources of information and how to evaluate and use this information.	45	2BT_E_13_w_2, 2BT_E_13_w_4
2BT_E_13_fs_2	laboratory classes	Cooperative work in the biochemical and microbiological laboratory under the supervision of lecturer, performing experiments according to the instructions given to students, analysis of the results. Possibility of consultation: Clarification or discussion on material from the lectures and assistance in the preparation of the report.	60	Reading instructions, planning and basic understanding of the scientific method, preparation of report, recognition of the biodegradable plastics market	40	2BT_E_13_w_1, 2BT_E_13_w_2, 2BT_E_13_w_3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Modelling of plant organ growth

Module code: 2BT_E_19

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_19_1	Student realizes significance of biotechnology and utility of computer modelling as a research tool.	2BT_E_W01_P	3
2BT_E_19_2	Student organizes data, selects and specifies computer programs appropriate for growth modelling.	2BT_E_U01_P	4
2BT_E_19_3	Student applies knowledge about mechanisms and molecular basis of growth and plant morphogenesis.	2BT_E_W03_P	3
2BT_E_19_4	Student projects modelling and performs growth simulations in application to exemplary plant organs.	2BT_E_W02_P	3
2BT_E_19_5	Student visualizes results in the form of growth sequences and performs their critical analysis taking limitation of the modelling into account.	2BT_E_U01_P 2BT_E_U02_P 2BT_E_W02_P	4 3 4

3. Module description

Description	The objective of the unit is to present growth of plant organs, methods of its studied, overall description and computer modelling. The growth is considered as accompanied with cell divisions. Its description Includes tensor bases and biomechanical aspects related to stresses in cell wall system.
Prerequisites	Basic knowledge of plant biology, mathematics, physics and computer using from the first level of studies.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_19_w_1	Continuous assessment of practical skills	Participation in discussion on the considered problems.	2BT_E_19_2, 2BT_E_19_3, 2BT_E_19_4

2BT_E_19_w_2	Laboratory report	Ability to work with a compute, use modelling and discuss obtained results.	2BT_E_19_2, 2BT_E_19_4, 2BT_E_19_5
2BT_E_19_w_3	Tests of the lecture	Written test verifying a knowledge gained during lectures and seminar.	2BT_E_19_1, 2BT_E_19_3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
BT_E_19_fs_1	lecture	Presentation of selected problems related to growth, its description and modelling with the use of audiovisual tools.	10	Individual study, work with the recommended literature to increase and systematize student’s knowledge.	15	2BT_E_19_w_3
BT_E_19_fs_2	discussion classes	Discussion on specific methods and programming tools used in growth modelling.	15	Work with the literature that broadens and systematizes knowledge recommended in the syllabus.	10	2BT_E_19_w_1
BT_E_19_fs_3	laboratory classes	Work with a computer and simulation model applied to generate growth	20	Self-preparation to modelling in practice, reports and tests	55	2BT_E_19_w_2

1.	**Field of study**	**Biotechnology**
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Molecular cytogenetics

Module code: 2BT_E_15

1. Number of the ECTS credits: 6

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_15_01	Student develops the knowledge about the nuclear genome organizatio	2BT_E_W02_P 2BT_E_W03_P	4 4
2BT_E_15_02	Student is familiar with the basic and advanced techniques of molecular cytogenetics.	2BT_E_U01_P	5
2BT_E_15_03	Student knows how to plan the experiments in the field of molecular cytogenetics	2BT_E_U03_P	5
2BT_E_15_04	Student is competent to perform an experiment using FISH method	2BT_E_U03_P	5
2BT_E_15_05	Student possesses skills to interpret and discus the results of his experiments based on the scientific knowledge	2BT_E_K02_P 2BT_E_U02_P 2BT_E_U06_P	5 5 5
2BT_E_15_06	Student improves his skills in operating fluorescence microscope	2BT_E_U03_P	4
2BT_E_15_07	Student takes the responsibility for his work and the laboratory equipment he is using	2BT_E_K04_P	5

3. Module description

Description	In this module student becomes acquainted with detailed knowledge in the area of the molecular cytogenetic. Student becomes familiar with the basic method of the molecular cytogenetics – fluorescence in situ hybridization (FISH) and its modifications, he becomes acquainted with the confocal microscopy, flow cytometry and image cytometry. Student develops his knowledge in the field of comparative genome analyses, the importance of chromosomal rearrangements in species evolution, and genome's polyploidization and diploidization. Student becomes familiar with practical exploitation of the molecular cytogenetics in medicine and plant breeding. During laboratory classes student develops the skills in planning and performing the experiments using FISH method and in interpreting his experiments' results.

Prerequisites	Knowledge from the field of basic genetics and plant cytogenetics.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_15_w01	Written test	Written test in order to evaluate the knowledge and skills acquires during laboratory activity.	2BT_E_15_01, 2BT_E_15_02, 2BT_E_15_05
2BT_E_15_w02	Practical skills evaluation	Practical skills are examined in each laboratory class – the evaluation of efficiency in laboratory work, evaluation of the results' quality, and results interpretation ability.	2BT_E_15_03, 2BT_E_15_04, 2BT_E_15_06, 2BT_E_15_07

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_15_fs01	lecture	Lecture presenting the chosen topics of the molecular cytogenetics – computer presentation with audio-visual aids.	15	Working with textbooks, reading of the supplementary scientific articles	35	2BT_E_15_w01
2BT_E_15_fs02	laboratory classes	Individual work in the molecular cytogenetic laboratory, realization of the experiments according to the instructions, interpretation of the results.	45	Preparation to laboratory tasks on the basis of the recommended data sources.	35	2BT_E_15_w01, 2BT_E_15_w02
2BT_E_15_fs03	discussion classes	Discussion on issues learned in lectures and observations during laboratory classes	10	Working with the textbook, fixing material from lectures and laboratories	15	2BT_E_15_w02

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: MSc laboratory I

Module code: 2BT_E_05

1. Number of the ECTS credits: 17

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_05_1	Student identifies and selects proper research methods according to the specificity of the Department or Institute and uses the knowledge during his/her MSc Project.	2BT_E_U01_P 2BT_E_U03_P 2BT_E_W04_P	5 5 5
2BT_E_05_2	Independently, or as a part of research team, a student plans simple experimental models, plans and realizes the measurements, assessments and also is ready to be involved in a team work.	2BT_E_K03_P 2BT_E_U01_P 2BT_E_U03_P 2BT_E_U04_P	5 5 5 5
2BT_E_05_3	Using advanced statistical techniques and graphic editors a student analyses the results obtained during the realization of their MSc project.	2BT_E_U02_P 2BT_E_U06_P 2BT_E_W01_P	5 5 4
2BT_E_05_4	Student constantly updates his/her database containing source materials and, concerning the intellectual property law./copyrights writes his/her reports and master thesis.	2BT_E_K04_P 2BT_E_U02_P 2BT_E_W07_P	5 5 5
2BT_E_05_5	During the realization of his/her MSc Project a student solves bioethical dilemmas concerning biotechnological experiments as well as constructively criticizes own activities as well as the activity of other participants.	2BT_E_K04_P 2BT_E_U04_P 2BT_E_W08_P	5 5 5
2BT_E_05_6	Student explains the necessity to follow the rules of cooperation, schedules and work plans in the laboratory, interprets the assumption of Good Laboratory Practice, occupational safety and health and first aid as well as is introduced to the responsibility	2BT_E_K04_P	5

	for material and equipment during their preparation to the realization of their master projects.	2BT_E_U04_P	5

3. Module description	
Description	The main assumption of the module is to lead the activities connected with the realisation of the MSc project. Students leads the works aimed at the verification of hypotheses and finding reliable conclusions dunder the supervision of the tutor. Student id introduced into the operation of advanced equipment and measurement apparatuses as well as the supplies of materials and equipment. Student systematically collects and archives the results of the investigations and analyses them statistically and graphically according to the rules specific for their discipline. Constantly completes his/her database and collects scientific literature on the MSc subject. An important element of the module is the preparation of the plan of the MSc thesis – discussion on its contents, structure and formal correctness. The final effect of the module is the presentation of working conclusions and clear definition of the areas of his/her own work in the laboratory/field that needs verification (completing, repeating or omission).
Prerequisites	Knowledge eanbling the student to understand and join the research led in the chosen Departament or Institute. Ability to operate with advanced equipment in a biological laboratory. General knowledge on statistical and graphical elaboration of the data. Ability to use text editors, spreadsheets and graphical editors. .Knowledge of English sufficient to cope with the chosen discipline.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_05_w_1	Continuous assessment of practical skills	Assessed are: - creativity during the solving of scientific problems, ability to operate with advanced equipment, inquisitiveness, discernment, caution in concluding as well as reliability in the laboratory - reliability and correctness of the measurements, assessments and observations, correctness and completeness of statistical analyses and graphical elaborations - substantial value of the source materials and the degree of their elaboration - substantial and formal correctness of a plan (or fragments) of the MSc thesis	2BT_E_05_1, 2BT_E_05_2, 2BT_E_05_3, 2BT_E_05_4, 2BT_E_05_5, 2BT_E_05_6
2BT_E_05_w_2	Laboratory report	Assessed are the correctness and completeness of the reports from the experiments (observations, measurements), precision and accuracy of the calculations, correctness of the conclusions, quality of the documentary materials.	2BT_E_05_1, 2BT_E_05_2, 2BT_E_05_3, 2BT_E_05_4
2BT_E_05_w_3	Final past/report/MSc plan	Presentation of the preliminary results, as the element of the future MSc thesis. Plan and introduction to the MSc thesis. Assessed are: creative attempt to the process of realization of the MSc thesis as well as the correctness of the analyses of obtained results and conclusions.	2BT_E_05_1, 2BT_E_05_2, 2BT_E_05_3, 2BT_E_05_4

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_05_fs_1	laboratory classes	Experiments, observations and measurements necessary to realize the assumption of the MSc thesis - systematic collection and elaboration of data (own or acquired from other sources)	180	-queries to complete the collection of literature - systematic studies on the subject based on the recent literature - completing the calculations, protocols,	240	2BT_E_05_w_1, 2BT_E_05_w_2, 2BT_E_05_w_3

		- statistical and graphical analyses of the results - verification of research hypotheses - rearing or culturing of plants or animals (optionally) - preparation of reports		reports from the laboratory works Completing the documentation from the laboratory (rearing/planting, optionally) - preparation of the plan or the fragment (introduction) of the MSCc thesis.		

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: MSc laboratory II

Module code: 2BT_E_06

1. Number of the ECTS credits: 17

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_06_1	Student proficiently identifies and chooses research methods coherent with the research profile of teh Department/Institute in order to solve a specific problem and applies the skills to prepare their own Msc project.	2BT_E_U01_P 2BT_E_U03_P 2BT_E_W04_P	5 5 5
2BT_E_06_2	Student designs experimental models, plans and conducts measurements, assessments and analyses on their own or in teams, (according to the Department's/Institute's research profile) using advanced lab equipment as well as he/she is ready to take the initiative among the students.	2BT_E_K03_P 2BT_E_U01_P 2BT_E_U02_P 2BT_E_U04_P	5 5 5 5
2BT_E_06_3	Using advanced statistical techniques student finally analyses their results without the tutor's help.	2BT_E_U02_P 2BT_E_U06_P 2BT_E_W01_P	5 5 4
2BT_E_06_4	Applying collected source materials (including those in English) and their own results student writes the MSc thesis.	2BT_E_K04_P 2BT_E_U02_P 2BT_E_W07_P	5 5 5
2BT_E_06_5	Student presents the abilities to apply the acquired knowledge, skills and competences in their professional activity; is prepared to plan their own career and be a team leader.	2BT_E_K01_P 2BT_E_K03_P 2BT_E_U02_P 2BT_E_U06_P 2BT_E_W06_P	5 5 5 5 5

		2BT_E_W07_P 2BT_E_W09_P	5 5
2BT_E_06_6	Student presents the abilities to apply the acquired knowledge, skills and competences in their professional activity; is prepared to plan their own career and be a team leader.	2BT_E_K01_P 2BT_E_U02_P 2BT_E_U04_P 2BT_E_W08_P	5 5 5 5
2BT_E_06_7	Student follows the assumptions of Good Laboratory Practices and occupational safety and health, is able to assess the risk for health and life during laboratory work is able to give first aid; is responsible for his workplace and equipment.	2BT_E_K04_P 2BT_E_U04_P	5 5

3. Module description

Description	The module is the continuation of the activities aimed at the preparation and defense Master thesis. Student , after the verification of hitherto achievments effects can perform the complementary analyses, observations and measurements. A deep analysis of results is performed, the results are analyzed statistically and graphically, and the final version of presentation is prepared, including reports, tables, figures, maps, graphs, diagrams and photographs. Under the tutor’s supervision student learns to apply the source materials for the explanation of their own results (comparisons, discussions), synthesizes the information and concludes based on their own results and source materials. The final element of the module is the submission of substantially and formally correct master thesis, being the crucial condition to take a diploma exam.
Prerequisites	Knowledge that enable the student to join the researches performer by the scientists of the Department/Institute. The ability to operate with advanced apparatuses and equipment of biotechnological laboratory. Good knowledge of the rules of statistical and graphical analyses of data. The ability to use text and graphic editors and spreadsheets. Knowledge of English, fluent enough to cope with the subject.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_06_w_1	Continuous assessment of practical skills	Assessed are the reliability and meticulousness of research activities and documentation, correctness and accuracy of statistical analyses and graphical presentations, the extent of source material usage, substantial and formal correctness of the MSc dissertation.	2BT_E_06_1, 2BT_E_06_2, 2BT_E_06_3, 2BT_E_06_4, 2BT_E_06_5, 2BT_E_06_6, 2BT_E_06_7
2BT_E_06_w_2	Laboratory reports	Assessed are: the correctness and completeness of the protocols of the measurements (observations, assessments), accuracy in the calculations, correctness of the conclusions, quality of the collected and recorded documentary materials.	2BT_E_06_1, 2BT_E_06_2, 2BT_E_06_3, 2BT_E_06_6
2BT_E_06_w_3	Final pass/MSc dissertation	Assessed are: the creative attempt to the activities aimed at the completing of MSc dissertation, substantial and formal correctness of the MSc manuscript.	2BT_E_06_1, 2BT_E_06_2, 2BT_E_06_3, 2BT_E_06_4, 2BT_E_06_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_06_fs	laboratory classes	-continuation of experiments, observations	180	- completing the literature collection	245	

_1		and measurements necessary to complete the MCs project - systematic data collection and processing - statistical and graphical elaboration of the results -continuation of laboratory works -MSc disseration preparation Possibility of consultations: -discussion on the way of processing and analysis of the results - -discussion on the contents, structure and formal correctness of the MSc manuscript		- systematical studies on the subject basing in the recent scientific literature - completing of the calculations and graphical presentation of the results -preparation of the documentation form the laboratory works - preparation of the MSc dissertation		2BT_E_06_w_1, 2BT_E_06_w_2, 2BT_E_06_w_3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: MSc seminar I

Module code: 2BT_E_09

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_09_1	Student describes and explains complex issues of the natural sciences in a mature way.	2BT_E_U02_P 2BT_E_U03_P 2BT_E_W01_P 2BT_E_W02_P 2BT_E_W03_P 2BT_E_W05_P	5 5 5 5 5 5
2BT_E_09_2	Student presents and discussess recent discoveries in plant and microbial biotechnlogy, including the review of literature quoted in his/her own MSc thesis.	2BT_E_K01_P 2BT_E_U02_P 2BT_E_U05_P 2BT_E_W09_P	5 5 5 5
2BT_E_09_3	Forms and improves the skills at the scientific presentation and discussion on chosen subject.	2BT_E_K01_P 2BT_E_K02_P 2BT_E_K03_P 2BT_E_K04_P	5 5 5 5
2BT_E_09_4	Student searches for and interpretes scientific literature according to the needs of his/her MSc thesis.	2BT_E_U02_P 2BT_E_U05_P	5 5
2BT_E_09_5	Student demonstrates the need to update his/Her knowledge of biotechnology and similar science.	2BT_E_K02_P 2BT_E_U02_P	5 5

		2BT_E_U06_P 2BT_E_W09_P	5 5
2BT_E_09_6	Student understands the significance of research in the context of intellectual property law, respects the work done by themselves and other students.	2BT_E_W07_P	5
2BT_E_09_7	Student is aware of the costs of the experimental studies and knows the basic mechanisms of the financing.	2BT_E_K04_P 2BT_E_W06_P 2BT_E_W07_P	5 5 5

3. Module description

Description	The module continues and widens the activities realized during the specialization seminars I and II. The aims of the module: advanced improvement of the student in his/her independence in elaboration of scientific issues connected with the researches realized in the chosen Department or Institute, especially in order to prepare, present and discuss a report of the literature collected for the needs of his/her MSc thesis; elaboration, without the tutor's help, a chosen issue and its Power Point presentation, improvement of the skills to present and discuss scientific questions in English.
Prerequisites	Completing the specialization seminar II in a selected Department or Institute. The knowledge that enables student to join the main stream of researches realized in the Department or Institute. Knowledge of English in the extend enabling student to use scientific literature in English and to lead scientific discussion in English. Initiated MSc project.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_09_w_1	Test of the autopresentation abilities	Ability to prepare and clear presentation of a scientific report or poster about a selected issue. The assessment of substantial and technical value of the poster, ability to synthesize the data as well as the ability to choose appropriate literature, including this written in English.	2BT_E_09_1, 2BT_E_09_2, 2BT_E_09_3, 2BT_E_09_4, 2BT_E_09_5, 2BT_E_09_6, 2BT_E_09_7
2BT_E_09_w_2	Continous assessment	Activity in discussion and attitude to the classes.	2BT_E_09_1, 2BT_E_09_2, 2BT_E_09_3, 2BT_E_09_4, 2BT_E_09_5, 2BT_E_09_6, 2BT_E_09_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_09_fs_1	seminar	Presentation and discussion on the presented report or poster. Possibility of consultations: Works with the supervisor's help, selection and analyses of the literature.	30	Query and analysis of literature, presentation of report or poster.	45	2BT_E_09_w_1, 2BT_E_09_w_2

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: MSc seminar II

Module code: 2BT_E_10

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_10_1	Student, in a mature way, describes and explains complex problems of natural science, with special stress on plant and microbial biotechnology, including all parts of his/Her MSc thesis.	2BT_E_U02_P 2BT_E_U03_P 2BT_E_W01_P 2BT_E_W02_P 2BT_E_W05_P	5 5 5 5 5
2BT_E_10_2	Student practices and improves the ability to present and discuss selected issues in English.	2BT_E_K01_P 2BT_E_K02_P 2BT_E_U02_P 2BT_E_U05_P	5 5 5 5
2BT_E_10_3	Student searches for and interpreter scientific literature, including this in English, in order to complete their MSc thesis.	2BT_E_U02_P 2BT_E_U05_P	5 5
2BT_E_10_4	Student demonstrates the need of constant update of their knowledge of biotechnology and similar science.	2BT_E_K02_P 2BT_E_U02_P 2BT_E_U06_P 2BT_E_W09_P	5 5 5 5
2BT_E_10_5	Student understands the significance of scientific research in the context of intellectual property law; respects their own work as well as of other persons' work.	2BT_E_W07_P	5
2BT_E_10_6	Student is aware of the costs of the researches in experimental science and knows the Basic mechanisms of their financing.	2BT_E_K04_P	5

		2BT_E_W06_P 2BT_E_W07_P	5 5

3. Module description	
Description	The module is the continuation and browning of the activities realized during the specialisation seminars I and II and MSc seminar I. The aims of the module: advanced improvement of the student in his/her independence in elaboration of scientific issues connected with the research profile of the Department/Institute, with a special stress on the preparation, presentation and discussion of the report on the methods, results, discussion part and conclusions of the MSc thesis; presentation of the author's abstract of the MSc thesis; deepening of the theoretical knowledge of the problems and research methods connected with the completing of the MSc project, the preparation of a selected seminar issue and its Power Point presentation in English; practicing and improvement in the abilities to present and discuss scientific issues in English.
Prerequisites	Final pass of MSc seminar I in a selected Department/Institute. Advanced knowledge of the research profile of the Department/Institute. Knowledge of English at the level that enables the student to read and apply scientific literature in English and to actively participate in the scientific discussions in English. Advanced realization of the MSc project.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_10_w1	Test of the autopresentation abilities	Ability to prepare and clear presentation of a scientific report or poster about a selected issue, including an abstract of all parts of the own MSc thesis as a Power Point presentation. The assessment of substantial and technical value of the poster, ability to synthetize the data as well as the ability to choose appropriate literature, including this written in English.	2BT_E_10_1, 2BT_E_10_2, 2BT_E_10_3, 2BT_E_10_4, 2BT_E_10_5, 2BT_E_10_6
2BT_E_10_w2	Continuous assessment	Activity in discussion and attitude to the classes.	2BT_E_10_1, 2BT_E_10_2, 2BT_E_10_3, 2BT_E_10_4, 2BT_E_10_5, 2BT_E_10_6
2BT_E_10_w3	Presentation of MSc dissertation	Assessed are: the creative attempt to the activities aimed at the completing of MSc dissertation, substantial and formal correctness of the MSc manuscript.	2BT_E_10_1, 2BT_E_10_2, 2BT_E_10_3, 2BT_E_10_4, 2BT_E_10_5, 2BT_E_10_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_10_fs1	seminar	Presentation and discussion on the report (abstract) in English. Possibility of consultations: Work under the tutor's supervision, selection and analysis of the literature.	30	Searching for and analysis of scientific literature in English, presentation or poster preparation.	45	2BT_E_10_w1, 2BT_E_10_w2, 2BT_E_10_w3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Nutrigenomics and nutrigenetics

Module code: 2BT_E_58

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_58_01	Students acquire detailed knowledge on the structure and function of human genomes and knows the ways of its implementation in nutrigenomic and nutrigenetics consulting	2BT_E_W02_P	5
2BT_E_58_02	Students understand the relationship between nutrients metabolism and gene expression regulation	2BT_E_W03_P	5
2BT_E_58_03	Students understand the methods of experimental design in nutrigenomic and nutrigenetics	2BT_E_W04_P	5
2BT_E_58_04	Students know basic and advanced techniques of genome, epigenome, transcriptome, proteome and metabolome analysis.	2BT_E_W09_P	5
2BT_E_58_05	Students analyze and critically evaluate results of studies published in the area of nutrigenomic and nutrigenetics	2BT_E_U02_P	5
2BT_E_58_06	Students evaluate the potential threats related to experimental methods and comply with rules of labor ethics	2BT_E_K04_P	5
2BT_E_58_07	Students routinely use the resources of scientific information and employ the rules of critical deduction for problem solving	2BT_E_K01_P	5

3. Module description

Description	The module is aimed to provide knowledge of nutrigenomic and nutrigenetics to the students. It systemizes the knowledge of human genome structure and introduces to the students the methods of the analysis of its structure, function and gene expression regulation. It provides the information on high throughput methods of transcriptome, proteome and metabolome analysis. It introduces the knowledge of genome sequencing strategies and the methods of genetic variation analysis in human population. It provides the information on the relationship between single nucleotide polymorphism and gene-environmental interactions, in the context of diet and nutrition. It introduces the concept of personalized diet. In provides the knowledge of the genetic basis of metabolic disorders. It gives the information on gene expression regulation by selected nutrients. It introduces the term of functional food – nutrients that play role in cancer and metabolic disorders prevention. It provides the knowledge of relationship between diet, nutrients metabolism, gene expression regulation and the occurrence of diseases. It provides the information on molecular mechanisms of longevity regulation and their relationship to nutrients supply. It gives the knowledge on the epigenetics and the association between DNA methylation and diet – factors that modulate the genetic

	predisposition to metabolic disorders. It points to the role of maternal nutrition and maternal effect to the epigenetic changes and gene expression regulation during early stages of embryonic development. It provides the information on the ethical norms related to human genome studies, collecting human genome data and their use in nutritional consulting. The above issues provided by lectures are broaden during discussion sessions, and are analyzed, interpreted, discussed and evaluated based on the data from scientific literature.
Prerequisites	The knowledge and skills on the basics of genetics, genetic analysis and molecular biology.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_58_w_1	Partial written tests	Partial written tests evaluating students' knowledge of the tasks learned during discussion sessions	2BT_E_58_01, 2BT_E_58_02, 2BT_E_58_03, 2BT_E_58_04
2BT_E_58_w_2	Student's presentation	Students' presentation on selected subject form nutrigenomic and nutrigenetics field, evaluating the skills of data interpretation and their critical evaluation.	2BT_E_58_01, 2BT_E_58_02, 2BT_E_58_03, 2BT_E_58_04, 2BT_E_58_05, 2BT_E_58_07
2BT_E_58_w_3	Skills evaluation during discussion sessions	Skills evaluated during every meeting of discussion sessions – verifying the ability to discuss scientific problems and interpretation of the scientific results	2BT_E_58_05, 2BT_E_58_06, 2BT_E_58_07
2BT_E_58_w_4	Final written test	Positive mark of discussion sessions is the prerequisite to join to the final exam. The exam encompasses tasks covered by lectures	2BT_E_58_01, 2BT_E_58_02, 2BT_E_58_03, 2BT_E_58_04

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_58_fs_1	lecture	Lectures illustrated using the PowerPoint presentations, covering data and results derived from up-to-date scientific literature on nutrigenomic and nutrigenetics	25	Acquiring knowledge derived from lectures, books and supplementary literature	25	2BT_E_58_w_4
2BT_E_58_fs_2	discussion classes	Presentation of selected problems of nutrigenomic and nutrigenetics prepared by the students and discussions on scientific results of the field of study	20	Gathering knowledge and skills required for participation in discussion session classes. Preparation of presentation on selected subject from the field of study	45	2BT_E_58_w_1, 2BT_E_58_w_2, 2BT_E_58_w_3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Organisms under environmental stress

Module code: 2BT_E_43

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_43_1	Student knows the techniques and tools for the acquiring data about physiological processess in animals as potential biotechnological processes.	2BT_E_W01_P 2BT_E_W04_P	5 5
2BT_E_43_2	Student operates with the acquired knowledge so that he/she understands and notices the correlations between physiological processes o fan animal and extreme parameters of its habitat.	2BT_E_W01_P	5
2BT_E_43_3	Student knows the recent information about the concepts of animal adaptations to extreme environmental conditions. Student is able to regard the physiological processes as processes potentially applicable in biotechnology.	2BT_E_K02_P 2BT_E_W02_P	5 5
2BT_E_43_4	Student is able to analyze critically the information acquired without tutor’s help, from the electronic sources and analyze functional adaptations of animals to their habitats and adaptations for avoiding or minimizing of the stressing situations.	2BT_E_U02_P 2BT_E_U05_P	4 4
2BT_E_43_5	Student is able to widen and update the knowledge of physiology of adaptation to the living dunder stressing factor action, including humans, also in a popular scientific form.	2BT_E_U02_P 2BT_E_U06_P	5 5

3. Module description

Description	The aim of the classes is the acquiring by the student of the knowledge on the changes in the animal organism functioning in extreme environmental conditions, under prolonged stress conditions and practical skills to describe adequately the correlations between physiological processess rate and the environment as well as to acquire experimental data. Lectures cover the issues of physiological changes in animal organism as a reaction to environmental stress of both anthropogenic and natural origin. Laboratory classes teach the students to observe and search for data, analyze the data in order to differentiate the functions of an adapter organism and an organism beyond the range of its natural tolerance, expose to a strong natural or unnatural stress. Student’s own work – with handbooks and electronic sources of information is aimed at the preparation for laboratory classes and at the creating of schemes, tables used during the classes and enabling the studentt to assess extreme conditions that can be tolerated.

Prerequisites	Knowledge and skills of animal physiology and environmental issues, acquired during the previous educational stages, enabling the students to synthesise data and to notice the correlations between animals and extreme habitat conditions.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_43_w_1	Colloquium	The written work to evaluate a knowledge and practical skills acquired during laboratory classes and lectures.	2BT_E_43_2, 2BT_E_43_3, 2BT_E_43_4, 2BT_E_43_5
2BT_E_43_w_2	Current evaluation of practical skills	Current evaluation of the task, models schemes, graphs and diagrams realization, including their correctness and connections with the main subject. Substantial and formal evaluation of the presented reports.	2BT_E_43_1, 2BT_E_43_2, 2BT_E_43_3, 2BT_E_43_4, 2BT_E_43_5
2BT_E_43_w_3	Final pass	Final work (mini-essay) on the species or group of animals including survival strategies adopted in extreme environmental conditions.	2BT_E_43_4, 2BT_E_43_5

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
1BT_43_fs_1	lecture	Lecture applying audiovisual equipment, projection of film fragments supplemented with comments on the strategies of survival rate under extreme environmental stress.	10	Preparation for colloquium, and including student's own work in order to elaborate the parts of material, indicated by the lecturer, that have been omitted by the lecturer.	5	2BT_E_43_w_1, 2BT_E_43_w_3
1BT_43_fs_2	laboratory classes	The analyses of selected problems of survival rate strategies under extreme environmental conditions at the organismal, organ or molecular level. Constructing and analyses of diagrams and nomograms of the correlations between the survival rate and environmental factors.	20	Work on an article or popular science film, searching for data, preparation of presentation based on data acquired without tutor's help.	30	2BT_E_43_w_1, 2BT_E_43_w_2

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Physiological bases for medicament effects

Module code: 2BT_E_22

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_22_1	Student demonstrates the knowledge of techniques and tools applied in pharmacology, is able to find connections between physiological and pharmacological data, considering the challenges of biotechnological medicaments.	2BT_E_W02_P 2BT_E_W04_P	4 4
2BT_E_22_2	Student operates with the acquired knowledge joining pharmacology and physiology, is able to process and analyze data and present them in an assessable way.	2BT_E_W05_P	4
2BT_E_22_3	Student demonstrates the knowledge of English pharmacological and physiological pharmacology that enables them to acquire information from electronic sources, medical databases including molecular targets and mechanisms of action.	2BT_E_U05_P 2BT_E_W09_P	3 3
2BT_E_22_4	Student is able to analyze critically the information about medicaments, found without tutor's help; is able to differentiate between commercial and scientific description.	2BT_E_K04_P 2BT_E_U02_P	4 4
2BT_E_22_5	Student can present scientific articles and reports on physiology, pathology and pharmacology.	2BT_E_U06_P	4
2BT_E_22_6	Student is able to draw conclusions from available metaanalyses and clinical researches, connect them with his/her knowledge and appreciate the significance of the data obtained from the studies on large, randomized groups by means of adequate statistical tools.	2BT_E_K01_P 2BT_E_U01_P	4 4
2BT_E_22_7	Student is in a habit to use various sources of scientific information, including newsletters and scientific portals and to apply the rulet of critical concluding during the assessment of their reliability and credibility. Student independently, of their own initiative, searches for medicament information and share it with other students during the classes.	2BT_E_K01_P 2BT_E_K02_P	3 4

3. Module description

Description	The aim of the classes is to acquire the knowledge of molecular targets and mechanisms of medicament action, including physiological causation (homeostasis) and practical skills enabling the student to use the data from medicament decscriptions, including biotechnological medicaments. The

	lectures cover the review of physiological and pathophysiological bases of pharmacology (medicament receptors, cascades of induced or inhibited reactions) and elements of pharmacokinetics and pharmacoeconomics. Practical trainings teach students how to use virtual pharmacokinetical models, dose-effect correlations and how to search for data in medicament bases and how to analyze them. Student's own work with handbooks and electronic sources of data is aimed at the preparation for the classes and creating of schemes and reports used during the classes.
Prerequisites	Knowledge and skills in animal physiology, biochemistry, molecular biology and cell biology acquired during the previous study stages, enabling the students to understand the language of pharmacology and pathophysiological attempt to the medicament description. It is recommended, though not necessary to possess elementary knowledge of patophysiology.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_22_w_1	Colloquium	Written work checking the level of knowledge and skills acquired during the laboratory classes.	2BT_E_22_1, 2BT_E_22_2, 2BT_E_22_3, 2BT_E_22_4, 2BT_E_22_6
2BT_E_22_w_2	Current evaluation of practical skills	Current substantial evaluation of the realization of tasks, models, schemes, graphs and diagrams. The evaluation of abilities to collect and interpret data from reference medical databases. Substantial and formal evaluation of presented scientific reports.	2BT_E_22_1, 2BT_E_22_2, 2BT_E_22_3, 2BT_E_22_4, 2BT_E_22_5, 2BT_E_22_6, 2BT_E_22_7
2BT_E_22_w_3	Final colloquium	Final work (presentation) on the molecular target and mechanism of action of a chosen medicament.	2BT_E_22_2, 2BT_E_22_4, 2BT_E_22_5, 2BT_E_22_6, 2BT_E_22_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_22_fs_1	lecture	Lecture supported by audiovisual devices, including schemes demonstrating molecular targets and mechanisms of medicament action.	15	Preparation fo colloquia and final pass, including individual learning of the parts of material, indicated by the lecturer, that have been omitted during the lectures.	35	2BT_E_22_w_3
2BT_E_22_fs_2	practical classes	Analyses of the structure and ability to acquire information from the reference databases about the medicaments. Pharmacikinetic and pharmacodynamic models. Construction of schemes demonstrating the mechanisms of medicament action. Experiments in virtual laboratory.	20	Searching for information in the databases used during the classes, preparation of a mini-presentation based on the data collected without the tutor's help.	45	2BT_E_22_w_1, 2BT_E_22_w_2
2BT_E_22_fs_3	discussion classes	Discuss the presented mini-presentation, analysis and finding solutions to emerging problems; Reference to the literature and online sources	10	Preparation of a mini-presentation based on self-collected data	15	2BT_E_22_w_3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Physiology of adaptation to environment

Module code: 2BT_E_33

1. Number of the ECTS credits: 6

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_33_1	Student demonstrates the knowledge of techniques and tools for collecting physiological and environmental data and is able to find correlations between them.	2BT_E_W01_P 2BT_E_W03_P	2 3
2BT_E_33_2	Student operates with the acquired knowledge so that He/she is able to understand the experimental set-up and to discuss the results and compare them with the source material, analyze them clearly and present them in a way that enables to assess their appropriateness.	2BT_E_U01_P 2BT_E_U02_P 2BT_E_W09_P	2 3 1
2BT_E_33_3	Student demonstrates the knowledge of physiological vocabulary in English so that he/she is able to acquire information from electronic sources and benefis from experiments available in virtual laboratory. Student is in a habit to use available databases, including newsletters and scientific portals and use the rulet of critical assessment of their reliability.	2BT_E_K02_P 2BT_E_U05_P 2BT_E_U06_P	3 2 4
2BT_E_33_4	Student is able to analyze critically the information acquired without tutor’s help, from the electronic sources and analyze functional adaptations of animals to their habitats. Student demonstrates the ability to present scientific reports on comparative physiology.	2BT_E_K01_P 2BT_E_U06_P	4 4
2BT_E_33_5	Student is able to conclude from their physiological observations and experiments, connect them with their knowledge on natural science and notice adaptative significance of structure and functions of animal organisms.	2BT_E_K02_P	2

3. Module description

Description	The aim of the classes is to acquire the knowledge on functional adaptation of an organizm to various environmental conditions as well as practical skills to adequately describe physiological processes and collect experimental data. Celem zajęć jest uzyskanie przez studenta wiedzy na temat adaptacji funkcjonalnych organizmu zwierzęcego do różnorodnych warunków środowiskowych i praktycznych umiejętności pozwalających adekwatnie opisać procesy fizjologiczne i uzyskać dane eksperymentalne. Lectures cover

	the review of those organismal functions that are closely connected with the environment (respiratory, sensual and thermoregulation physiology) and the description of correlations between physico-chemical parameters of habitats and functions of an organism, including the scaling effect. Practical classes teach the students to observe and serach for data, analysis and processing of the data and creating of models of environmental adaptations. Personal studies with handbooks and databases are aimed at the preparation to the classes and creating schemes and reports used during the classes.
Prerequisites	Knowledge and skills on animal physiology and environmental issues acquired during the earlier study stages, enabling the student to synthesize the data and notice connections between the animals and the environment.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_33_w_1	colloquium	The written work to evaluate a knowledge and practical skills acquired during laboratory classes and lectures.	2BT_E_33_2, 2BT_E_33_3, 2BT_E_33_4, 2BT_E_33_5
2BT_E_33_w_2	Current evaluation of practical skills	Current evaluation of the task, models schemes, graphs and diagrams realization, including their correctness and connections with the main subject. Substantial and formal evaluation of the presented reports.	2BT_E_33_1, 2BT_E_33_2, 2BT_E_33_3, 2BT_E_33_4, 2BT_E_33_5

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
1BT_33_fs_1	lecture	Lecture applying audiovisual equipment, projection of films supplemented with comments on the physiological adaptative solutions fo animals to the specific environments.	20	Preparation for colloquium, including student’s own work in order to elaborate the parts of material, indicated by the lecturer, that have been omitted by the lecturer.	30	2BT_E_33_w_1
1BT_33_fs_2	practical classes	The analyses of selected problems of functional adaptations of animals to environment. Construction and analysis of diagrams and nomograms of correlations between animal function and physico-chemical properties of an environment.	40	Work on an article or popular science film, searching for data, preparation of presentation based on data acquired without tutor’s help.	60	2BT_E_33_w_1, 2BT_E_33_w_2

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Phytoremediation

Module code: 2BT_E_32

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_32_1	Student describes and defines basic physicochemical methods of soil cleaning from toxic elements.	2BT_E_W01_P	1
2BT_E_32_2	Student describes phytoremediation as a one of the environmental biotechnology methods.	2BT_E_W04_P 2BT_E_W05_P	5 1
2BT_E_32_3	Student describes processes occurring in the soil during phytoremediation.	2BT_E_U03_P 2BT_E_W03_P	5 5
2BT_E_32_4	Student explains the mechanisms of uptake, accumulation and plant resistance to heavy metals.	2BT_E_K01_P 2BT_E_W03_P	2 5
2BT_E_32_5	Student explains the mechanisms of plant growth stimulation by endophytic and rhizospheric bacteria.	2BT_E_U02_P 2BT_E_W03_P	5 1
2BT_E_32_6	Student conducts experiments, describes and analyses the results of experiments, draws up conclusions and prepares the report.	2BT_E_K02_P 2BT_E_U01_P 2BT_E_W02_P	5 5 5
2BT_E_32_7	Student has a habit of reading new specialist literature.	2BT_E_K01_P	3
2BT_E_32_8	Student describes the role of ectomicorrhiza, arbuscular micorrhiza and bacteria as tools for enhancing the efficiency of phytoremediation.	2BT_E_W03_P	2

3. Module description	
Description	The module Phytoremediation enables students to get knowledge on physicochemical methods of soil cleaning from heavy metals and on phytoremediation as a method of environmental biotechnology. During the course student will learn about subsets (types) of phytoremediation (phytoextraction, phytostabilisation, rhizofiltration, phytodegradation, phytovolatilization), processes occurring in soils during phytoremediation, mechanisms of uptake of metals by plants, resistance of plants and microorganisms to heavy metals, role of endophytes and bacteria as well as ectomycorrhiza and arbuscular mycorrhiza in phytoremediation. During the practicals student learns how to cultivate plants in hydroponic systems, how to prepare and digest plant material and how to analyse obtained results.
Prerequisites	Basic knowledge on botanic and plant physiology.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_32_w_1	Activity during practical	During the practicals student will be evaluated for his ability to use all laboratory equipment properly, conduct experiments, analyse results and draw conclusions, prepare writing report.	2BT_E_32_4, 2BT_E_32_5, 2BT_E_32_6
2BT_E_32_w_2	test	Test covers materials from lectures and books recommended by lecturers.	2BT_E_32_1, 2BT_E_32_2, 2BT_E_32_3, 2BT_E_32_5, 2BT_E_32_7, 2BT_E_32_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_32_fs_1	lecture	Lectures with multimedia devices.	15	Knowledge of materials from lectures and textbooks suggested by lecturers.	15	2BT_E_32_w_2
2BT_E_32_fs_2	laboratory classes	Individual work in the laboratory, conducting of experiments on the basis of instruction, analyses of obtained results.	15	Preparation for practicals on the basis of literature. Preparing reports from conducted experiments.	35	2BT_E_32_w_1

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Plant biotechnology

Module code: 2BT_E_12

1. Number of the ECTS credits: 7

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_12_1	Student acquires an advanced knowledge of the modern methods in biotechnology applied in plant breeding and research on structure and function of plant genomes.	2BT_E_W01_P 2BT_E_W02_P	5 5
2BT_E_12_2	Student defines the goals, applications and environmental risk of the methods used in genetic modification of plant genomes.	2BT_E_U02_P 2BT_E_W04_P 2BT_E_W05_P	5 5 5
2BT_E_12_3	Student demonstrates the practical ability to apply the modern techniques to induce genetic variation in plants and gets familiar with the molecular analysis of transgenic plants.	2BT_E_U01_P 2BT_E_U02_P 2BT_E_U03_P 2BT_E_W08_P 2BT_E_W09_P	5 5 5 5 5
2BT_E_12_4	Student applies modern biotechnology tools for understanding the structure and function of plant genomes.	2BT_E_U01_P 2BT_E_U02_P	5 5
2BT_E_12_5	Students uses specialized electronic data bases and international services to update the reports on world wide status of genetically modified crops.	2BT_E_K01_P 2BT_E_K03_P 2BT_E_U06_P	5 5 5
2BT_E_12_6	Student is able to plan the basic equipment for plant biotechnology laboratory.	2BT_E_U03_P	5
2BT_E_12_7	Student describes the experiment outcomes, analyzes the results, makes conclusions and present them in the report or presentation.	2BT_E_K01_P	5

		2BT_E_U03_P 2BT_E_W02_P	5 5
2BT_E_12_8	Students follows the rules of safety work with the transgenic material and cares about laboratory equipment.	2BT_E_K02_P 2BT_E_K04_P	5 5

3. Module description	
Description	The module delivers the advanced knowledge on plant biotechnology and prepares students theoretically and practically in terms of the methods used in plant biotechnology. Particular emphasis is placed on learning the key methods of plant biotechnology used in plant breeding, including the production and analysis of genetically modified plants and haploids. The usefulness of genetically modified plants in other industries as well as in the basic research is also presented. During self-made experiments, students learn to handle with the equipment of modern specialized plant biotechnology laboratory. A wide range of laboratory techniques used in biotechnology of the crops as well as and model plants is demonstrated . Student acquires practice in collecting and analysis of empirical data, interpretation of the results and formulation of the hypothesis and conclusions.
Prerequisites	Principles of molecular biology, basis of biotechnology and in vitro cultures of plants on undergraduate level.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_12_w_1	Colloquium	The written work to evaluate a knowledge and practical skills acquired during laboratory.	2BT_E_12_4, 2BT_E_12_5
2BT_E_12_w_2	Evaluation of practical skills	Verification of student's compliance with the rules of the work in specialized laboratory including handling with aseptic conditions of work and modern laboratory devises; evaluation of student's ability for conducting experiments; data collection and formulation of the conclusions.	2BT_E_12_3, 2BT_E_12_4, 2BT_E_12_5, 2BT_E_12_6, 2BT_E_12_7, 2BT_E_12_8
2BT_E_12_w_3	Presentation of the report of the laboratory work	Preparation of a report describing the scheme of the experiment, the obtained results and conclusions.	2BT_E_12_4, 2BT_E_12_5, 2BT_E_12_6
2BT_E_12_w_4	Written exam	Getting a credit on the laboratory work and report is obligatory to enter the exam which evaluate the knowledge on problems presented during the lectures.	2BT_E_12_1, 2BT_E_12_2, 2BT_E_12_5

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_12_fs_1	lecture	Lectures supported with computer presentations in Power Point to illustrate the problems discussed.	30	Acquisition of knowledge presented in lectures; textbooks and research papers related to the topics discussed.	25	2BT_E_12_w_4
2BT_E_12_fs_2	laboratory classes	Conducting of the experiments following the instructions, the analysis of the results – under teacher supervision.	60	Preparation for laboratory tasks based on the instructions and recommended literature.	65	2BT_E_12_w_1, 2BT_E_12_w_2, 2BT_E_12_w_3

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Plant genomics

Module code: 2BT_E_16

1. Number of the ECTS credits: 6

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_16_01	Students acquire detailed knowledge on the structure and function of plant genomes and the way of its implementation in plant biotechnology.	2BT_E_W02_P	5
2BT_E_16_02	Students understand the methods of experimental design in genomics.	2BT_E_W04_P	5
2BT_E_16_03	Students know basic and advanced techniques of genome, epigenome and transcriptome analysis.	2BT_E_W09_P	5
2BT_E_16_04	Students solve scientific problems using methods of gene sequence analysis and gene expression analysis.	2BT_E_U01_P	5
2BT_E_16_05	Students analyze and critically evaluate results of studies published in the area of plant genomics.	2BT_E_U02_P	5
2BT_E_16_06	Students collect empirical data and draw conclusions from their own experiments and from literature data.	2BT_E_U04_P	5
2BT_E_16_07	Students evaluate the potential threats related to experimental methods and comply with rules of safe and good laboratory practices.	2BT_E_K04_P	5
2BT_E_16_08	Students routinely use the resources of scientific information and employ the rules of critical deduction for problem solving.	2BT_E_K01_P	5

3. Module description

Description	The module is aimed at broadening of students' knowledge of plant genomics. It introduces information on the plant genomes structure, the analysis of its function and regulation of gene expression. Particular emphasis is placed upon the strategies of genome sequencing, methods of gene isolation, gene expression analysis and proteome analysis in plants, as well as the regulation of gene expression via epigenetics mechanisms. Students acquire the skills of DNA sequencing, epigenome analysis, and gene expression analysis. Laboratory practicals also improve students' skills of data analysis and interpretation, both students' proper results and published in scientific studies.
Prerequisites	The knowledge and skills on basics of genetics, genetic analysis and molecular biology.

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
2BT_E_16_w01	Partial written tests	Partial written tests.	2BT_E_16_01, 2BT_E_16_02, 2BT_E_16_03, 2BT_E_16_04, 2BT_E_16_08
2BT_E_16_w02	Practical skills evaluation	Practical skills evaluated on every laboratory practical – evaluation of experiment conducting, the use of laboratory equipment, making observation and drawing conclusions.	2BT_E_16_02, 2BT_E_16_05, 2BT_E_16_06, 2BT_E_16_07, 2BT_E_16_08
2BT_E_16_w03	Final written test	Positive mark of laboratory practicals is the prerequisite to join to the final exam. The exam encompasses tasks from lectures.	2BT_E_16_01, 2BT_E_16_02, 2BT_E_16_03, 2BT_E_16_04
2BT_E_16_w04	Report of the laboratory classes	A written report verifying the ability to interpret the results of the experiments conducted independently by the student and exemplary literature data	2BT_E_16_06

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
2BT_E_16_fs01	lecture	Lectures illustrated with results derived from own experiments and scientific literature with the application of PowerPoint presentations.	15	Acquiring knowledge derived from lectures, books and supplementary literature.	35	2BT_E_16_w03
2BT_E_16_fs02	laboratory classes	Student’s individual laboratory work coordinated by supervisor, coupled with results analysis Possibility of consultations: Discussion on issues suggested by student, suggestion of literature and internet resources	45	Gathering knowledge and skills required for participation in lab classes . Acquaintance with issues discussed during classes and suggested literature	55	2BT_E_16_w01, 2BT_E_16_w02, 2BT_E_16_w04

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Social module

Module code: 2BT_E_56

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_56_01	Student has general knowledge of selected scientific methods and knows the issues specific to the discipline of science unrelated to the direction of study.	W_OOD	3
2BT_E_56_02	Student has the ability to set and analyze problems on the basis of the obtained content in the disciplines of science not connected with the direction of studies.	U_OOD	3
2BT_E_56_03	Student understands the need for an interdisciplinary approach to solving problems, integrating knowledge from various disciplines, and practice self-education to deepen the acquired knowledge.	KS_OOD	3

3. Module description

Description	The student selects the module (s) from the general university offer specified for the given field of study. The module aims to broaden the student's knowledge, skills and social competences.
Prerequisites	no prerequisites

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_56_w_1	pass	Verification based on pass or verbal verification (as required defined in the syllabus)	2BT_E_56_01, 2BT_E_56_02, 2BT_E_56_03

5. Forms of teaching						
code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_56_E_fs01	lecture	Lecture. Give the content of education in the verbal form with the use of visualization content. Focus on difficult material conceptually and indication of sources. Illustration content by examples.	30	Get acquainted with the subject matter of the lecture Use existing packages methods: textbooks, scripts, pages Internet, etc. Preparing for a credit in depends on the accepted form, defined detailed in the syllabus of the realization module.	45	2BT_E_56_w_1

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Specialization laboratory I

Module code: 2BT_E_03

1. Number of the ECTS credits: 8

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_03_1	Student has an up-to-date basic knowledge on the research methodology in the area of interest and explains their applicability in the process of realization of their master thesis.	2BT_E_W03_P 2BT_E_W04_P 2BT_E_W09_P	5 5 5
2BT_E_03_2	Under the supervision of the tutor a student plans and executes simple measurements, assessments and analyses using simple laboratory and/or field equipment as well as practices the skills in documentation of scientific research and in concluding based on obtained results.	2BT_E_U01_P 2BT_E_U03_P 2BT_E_W04_P	5 5 5
2BT_E_03_3	Under the supervision student leads statistical and graphical analyses of the results obtained during the laboratory classes.	2BT_E_K01_P 2BT_E_U01_P 2BT_E_U02_P 2BT_E_W01_P	5 5 5 5
2BT_E_03_4	Together with the tutors a student leads basic queries of scientific literature in the area of the studied discipline and writes short reviews, concerning copyrights / intellectual property law.	2BT_E_U02_P 2BT_E_U05_P 2BT_E_W05_P 2BT_E_W07_P	5 3 5 5
2BT_E_03_5	Student solves the bioethical dilemmas concerning biotechnological experiments and constructively criticises their own.	2BT_E_K02_P 2BT_E_K04_P 2BT_E_U04_P 2BT_E_U06_P	5 5 5 5

		2BT_E_W05_P	5
2BT_E_03_6	Student explains the necessity to follow the rules of cooperation, schedules and work plans in the laboratory, interprets the assumption of Good Laboratory Practice, occupational safety and health and first aid as well as is introduced to the responsibility for material and equipment during their preparation to the realization of their master projects.	2BT_E_K02_P 2BT_E_K03_P 2BT_E_U04_P 2BT_E_U06_P	5 5 5 5

3. Module description	
Description	The module enables a student to get accustomed with the specificity and directions of researches led in the chosen Department or Institute. During the laboratory classes student is introduced into each stage of research process. Especially, an attention is paid to the specificity of methodology within chosen specialization. Student learns various methods and assesses whether they are efficient and reliable. Student learns the validation of the methods considering their sensitivity, precision repeatability and to what extend they are time- and cost-consuming. Under the supervision assess the applicability of a given method for solving a specific scientific question. Student practices constructing of working hypotheses and then designs possible scenarios to verify them. Student is introduced into the self-examination, planning their own activities, adaptation to the schedule, preparation of material and equipment on their own, systematic and careful documentation of the works in the laboratory.
Prerequisites	Knowledge on natural sciences at the level that enables a student to understand the specificity of researches of the chosen Department or Institute as well as the rules on which specific methods are based. The ability to work in the biotechnological laboratory, among others the ability to operate simple laboratory equipment. Knowledge of English at the level that makes understanding scientific literature possible.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_03_w_1	Continuous assessment of practical skills	Estimation of a student's involvement, his/her solidity during the realization of the tasks, reliability in the documentation, creativity in the attempts and methods applied to solve problems.	2BT_E_03_1, 2BT_E_03_2, 2BT_E_03_3, 2BT_E_03_5, 2BT_E_03_6
2BT_E_03_w_2	Laboratory report	Assessed are the correctness and way of preparation and presentation of the partial reports after the experiments, professionalism and solidity of method validation, creativity in the attempts to the elaboration of results and working conclusions.	2BT_E_03_1, 2BT_E_03_2, 2BT_E_03_3, 2BT_E_03_4
2BT_E_03_w_3	Final pass/report	Assessed are the completeness, way of specification and presentation of the observations and results obtained during the whole course of laboratory classes, correctness and accuracy of the description of cognitive value and final conclusions.	2BT_E_03_1, 2BT_E_03_3, 2BT_E_03_4

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_03_fs_1	laboratory classes	- practicing of methods used in a given Department or Institute - validation of the methods - planning, conducting and analysis of results obtained from simple experiments	120	- systematic query of literature on the studied specialisation Review of special material, indicated by the tutor – as the preparation for the classes - completing of the documentation	80	2BT_E_03_w_1, 2BT_E_03_w_2, 2BT_E_03_w_3

		- discussion on the stages of research process - documentary works after the experiments - talks about the rules of laboratory works, way of documenting and reporting - practices in posing working hypotheses and planning how to verify them - practicing in leading cultures of animals, plants or cells (optionally),		- completing of the reports after each class - preparation of the final report from all the classes realized within the laboratory classes		

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Specialization laboratory II

Module code: 2BT_E_04

1. Number of the ECTS credits: 8

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_04_1	Student possess deepened knowledge of research methodology within the research area of the Department or Institute, assess the reliability of the methods and plan show to apply them in their own investigations.	2BT_E_U03_P 2BT_E_W04_P 2BT_E_W09_P	5 5 5
2BT_E_04_2	Student plans and executes the measurements, assessments and analyses (coherent with the main research stream of the Department/Institute) using laboratory or field equipment and concludes on the basis of their own results.	2BT_E_U01_P 2BT_E_U03_P	5 5
2BT_E_04_3	Student elaborates statistically and graphically the results of their laboratory of field classes witout the tutor's help.	2BT_E_K01_P 2BT_E_U02_P 2BT_E_U03_P 2BT_E_W01_P	5 5 5 5
2BT_E_04_4	Student queries for the literature on the studied subject, creates their own database of source materials and, using this literature, writes reviews, being aware of intellectual property law / copyrights.	2BT_E_U02_P 2BT_E_W05_P 2BT_E_W07_P	5 5 5
2BT_E_04_5	During the planning and realization of their own investigations, student solves bioethical dilemmas concerning biotechnological experiments, constructively criticizes their own activities as well as the activities of other participants of the classes.	2BT_E_K02_P 2BT_E_K04_P 2BT_E_U04_P 2BT_E_U06_P 2BT_E_W08_P	5 5 5 5 5
2BT_E_04_6	Student obeys the rules of cooperation and follows the schedules and plans of laboratory work, conforms to the assumptions of		

	Good Laboratory Practice, occupational safety and health during the work and knows the bases of first aid, is responsible for the materials and equipment during the realization of their MSc project.	2BT_E_K04_P 2BT_E_U04_P	4 5

3. Module description	
Description	The aim of the module is to prepare a student to the planning and realization of the researches necessary to complete their MSc project . At this stage all student's activities are supervisioned by a tutor and are constantly controlled. Student acquire laboratory and research experience. The aims, working hypotheses, methodology, the sequence of actions, conditions of sample gathering, conditions of performing measurements, analyses and assessment are formulated. During the classes student performs advanced measurements applying the methodology typical for the specificity of the Department/ Institute. Student learns how to gather and archive their own results as well as how to record, select and order the data acquired from various sources. With the tutor's help student systematically queries for literature on the studied subject. A special attention is paid to the preparation of the student for him to be able to elaborate, professionally, the preliminary results of their project.
Prerequisites	Knowledge on biology, chemistry, physics at the level that enables the student to understand the specificity of the research preformed in the Department/ Institute and the bases on which research methods are based. Skills to work in the biological laboratory, including operating with equipment and apparatuses. Knowledge of English.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_04_w_1	Continuous assessment of practical skills	Assessed is the creativity in the attempt to the studied issues and in the way of solving problems, solidity in measurements, reliability in documentary works, recording of the results, quality of source materials gathered, and the degree of understanding of the materials.	2BT_E_04_1, 2BT_E_04_2, 2BT_E_04_3, 2BT_E_04_4, 2BT_E_04_5, 2BT_E_04_6
2BT_E_04_w_2	Laboratory report	Assessed are the correctness and way of preparation of the reports of the laboratory works, completeness of the protocols, solidity of elaboration of the preliminary results, correctness of the conclusions and quality of the documentary materials.	2BT_E_04_1, 2BT_E_04_2, 2BT_E_04_3, 2BT_E_04_4
2BT_E_04_w_3	Final pass/final report	Assessed are the form of presentation of the observations and results collected during whole course of the classes, creative attempt to the process of construction fo student's own research model, cognitive value and correctness of the aims and working hypotheses within their own MSc project.	2BT_E_04_1, 2BT_E_04_2, 2BT_E_04_3, 2BT_E_04_4

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_04_fs_1	laboratory classes	- practicing of research methods necessary for the realization of the research project - construction of various variants of experimental models -discussion on the aims of the research project and creating of the working hypotheses -collecting, selection and processing of data	120	- searching for scientific literature- - systematic monitoring of the recent publications on the studied subject - completing of the reports from laboratory works and final report - works on text and graphic editors, spreadsheets - works on database and statistical software	80	2BT_E_04_w_1, 2BT_E_04_w_2, 2BT_E_04_w_3

		(own or acquired from other sources) -practicing of statistical and graphical data analysis -practicing of lab methodology - conducting plant or animal cultures (optionally)		specific for the laboratory equipment users of for research methodology - completing of the documentation from the lab/field works- optionally		

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Specialization seminar I

Module code: 2BT_E_07

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_07_1	Student describes and explains the significance of advanced techniques and tools in the investigation on natural phenomena.	2BT_E_W02_P 2BT_E_W09_P	5 5
2BT_E_07_2	Student understands crucial significance of the experimental works in biotechnology and is able to define and describe the significance of molecular analyses in biotechnological studies.	2BT_E_U02_P 2BT_E_U06_P	5 5
2BT_E_07_3	Student searches for and interpretes scientific literature concerning the selected biotechnological issue. Demonstrates the Reed to update his/her knowledge on biotechnology and similar areas.	2BT_E_U02_P 2BT_E_U05_P	5 5
2BT_E_07_4	Student forms and improves the personal abilities of autopresentation and scientific discussion.	2BT_E_K01_P 2BT_E_K02_P 2BT_E_K03_P 2BT_E_K04_P	5 5 5 5
2BT_E_07_5	Student understands the significance of scientific research in the context of intellectual property law.	2BT_E_W07_P	5
2BT_E_07_6	Student is aware of the costs of the experimental studies and knows the basic mechanisms of the financing.	2BT_E_K04_P 2BT_E_W06_P 2BT_E_W07_P	5 5 5

3. Module description

Description	

	The aims of the module: improvement in the independent elaboration of the issues connected with the researches of the chosen Department or Institute with special stress on the methodology and, the preparation of a presentation and contribution to the scientific discussion on the presented issues, improvement in theoretical knowledge on the basic research methods; query of the literature on the recent issues in natural sciences with special stress on plant and microbial biotechnology, independent elaboration on the selected issue, preparation of presentation or poster, improvement in presentation and discussion on scientific questions.
Prerequisites	Interests in the research profile of the chosen Department or Institute. Positive result of an interview assessing the knowledge and practical skills of the candidate on natural science at the level that enables the student to realize MSc project and prepare MSc thesis on Her/his own .Knowledge of English at the level that enables the student to cope with scientific literature in English.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_07_w_1	Test of the autopresentation abilities	Ability to prepare and clear presentation of a scientific report or poster about a selected issue. The assessment of substantial and technical value of the poster, ability to synthetize the data as well as the ability to choose appropriate literature, including this written in English.	2BT_E_07_1, 2BT_E_07_2, 2BT_E_07_3, 2BT_E_07_4, 2BT_E_07_5, 2BT_E_07_6
2BT_E_07_w_2	Continuous assessment	Activity in discussion and attitude to the classes.	2BT_E_07_1, 2BT_E_07_2, 2BT_E_07_3, 2BT_E_07_4, 2BT_E_07_5, 2BT_E_07_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_07_fs_1	seminar	Activity in discussion and attitude to the classes. Possibility of consultations: Works with the supervisor’s help, selection and analyses of the literature.	30	Query and analysis of literature, presentation of report or poster. Preparation of the question that should be discussed during the consultations.	45	2BT_E_07_w_1, 2BT_E_07_w_2

1.	Field of study	Biotechnology
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Specialization seminar II

Module code: 2BT_E_08

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_08_1	Student presents the recent achievements of plant and microbial.	2BT_E_U02_P 2BT_E_U06_P 2BT_E_W01_P 2BT_E_W02_P 2BT_E_W03_P 2BT_E_W05_P	5 5 5 5 5 5
2BT_E_08_2	Student understands crucial significance of experimental works in biotechnology and is able to define and describe the significance of molecular analyses in biotechnological researches.	2BT_E_K01_P 2BT_E_U01_P 2BT_E_U02_P 2BT_E_U03_P 2BT_E_W04_P	5 5 5 5 5
2BT_E_08_3	Student searches for and interprets scientific literature, including this in English, on the chosen biotechnological problem. Demonstrate the Reed to update their knowledge of biotechnology and similar sciences.	2BT_E_U02_P 2BT_E_U05_P	5 5
2BT_E_08_4	Student shapes and improves the personal capabilities of self-presentation and scientific discussion.	2BT_E_K01_P 2BT_E_K02_P 2BT_E_K03_P 2BT_E_K04_P	5 5 5 5
2BT_E_08_5	Student understands the significance of scientific research in the context of intellectual property law.	2BT_E_W07_P	5

2BT_E_08_6	Student is aware of the costs of researches in experimental science and knows Basic mechanisms of the financing of the researches.	2BT_E_K04_P 2BT_E_W06_P 2BT_E_W07_P	5 5 5

3. Module description	
Description	The module is the continuation of the activities realized during specialization seminar I and widens its extent. The aim of the module: the improvement in independent elaboration of subjects connected with the profile of the chosen Department/Institute, basing on critical analysis of the recent scientific literature; presentation of the MSc project issue and taking part in the discussion about the presented scientific issues; deepening of the theoretical knowledge of the scientific issues with a special stress on the profile of the chosen Department/Institute; review of the world scientific literature about biotechnology, especially plant and microbial biotechnology; independent elaboration of selected issue, presentation of presentation or poster using Power Point software, continuous improvement in presentation and discussion of scientific issues.
Prerequisites	Completing of the specialisation seminar I in chosen Department/Institute. Knowledge of English in the extent that enables the student to cope with English scientific literature. Interest in the research profile of the chosen Department/Institute.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
2BT_E_08_w1	The test of the ability to present themselves	The ability to prepare and clearly present a scientific report or poster on the chosen subject, using Power Point software. The assessment of substantial and technical quality of the presentation or poster, ability to synthesize information and ability to select appropriate literature, including this in English.	2BT_E_08_1, 2BT_E_08_2, 2BT_E_08_3, 2BT_E_08_4, 2BT_E_08_5, 2BT_E_08_6
2BT_E_08_w2	Continuous assessment	Contribution to the discussion, general attitude during the classes.	2BT_E_08_1, 2BT_E_08_2, 2BT_E_08_3, 2BT_E_08_4, 2BT_E_08_5, 2BT_E_08_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_E_08_fs1	seminar	Presentation and discussion on the presented report or poster. Possibility of consultations: Works under the supervision, selection and analysis of the literature, discussion on the questions raised by the student.	30	Searching for and analyses of scientific literature, preparation of presentation or poster.	45	2BT_E_08_w1, 2BT_E_08_w2

1.	**Field of study**	**Biotechnology**
2.	Faculty	Faculty of Natural Sciences
3.	Academic year of entry	2021/2022 (winter term), 2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Statistical methods in natural sciences

Module code: 2BT_E_02

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_E_02_1	Student applies advanced computer software for statistics.	2BT_E_K02_P 2BT_E_W01_P	4 4
2BT_E_02_2	Student applies advanced computer software for statistics.	2BT_E_U01_P 2BT_E_W01_P	4 4
2BT_E_02_3	Student realizes planning experiments according to assumed statistical models.	2BT_E_U01_P 2BT_E_U03_P	3 3
2BT_E_02_4	Student arranges and performs statistical calculations of the observed data, and formulates conclusions and interprets the results of statistical analyzes.	2BT_E_K02_P 2BT_E_W03_P	4 4
2BT_E_02_5	Student formulates hypotheses and verifies their correctness on the basis of statistical tests.	2BT_E_U03_P 2BT_E_W08_P	5 5

3. Module description

Description	The objective of the unit is to present the advanced statistical methods applied in natural sciences and to adopt practical methods with the use of computer software for statistics
Prerequisites	Basic knowledge of mathematics and statistics from the courses of the first level of studies.

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
2BT_E_02_w_1	Test of the lecture	Written test verifying a level of understanding, knowledge and skills.	2BT_E_02_1, 2BT_E_02_2, 2BT_E_02_3, 2BT_E_02_4, 2BT_E_02_5
2BT_E_02_w_2	Reports	Written reports of every subject of the course. Assessed are choice and application of the appropriate statistical method.	2BT_E_02_1, 2BT_E_02_2, 2BT_E_02_3, 2BT_E_02_4, 2BT_E_02_5
2BT_E_02_w_3	Practical test	Work with a computer with application of the advanced software STATISTICA. Assessed are data arrangement, a choice of the right test and interpretation of the result.	2BT_E_02_1, 2BT_E_02_2, 2BT_E_02_3, 2BT_E_02_4

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
2BT_E_02_fs_1	lecture	Presentation of chosen subjects of application of statistics in natural sciences with the use of audiovisual aids.	10	Individual study, work with the recommended literature to widen and systematize student’s knowledge.	15	2BT_E_02_w_1
2BT_E_02_fs_2	discussion classes	Discussion on specific statistical problems and application of appropriate methods and tests in statistical inference.	15	Individual study, calculation, work with the recommended literature, elaboration the reports.	15	2BT_E_02_w_3
2BT_E_02_fs_3	practical classes	Work with a computer, statistical data processing with the use of a statistical software.	20	Self-preparation to practical on the basis of the lecture, individual work with a computer.	30	2BT_E_02_w_2, 2BT_E_02_w_3