



**SZKOŁA GŁÓWNA
GOSPODARSTWA
WIEJSKIEGO**

Study programme

Biotechnology

Faculty:	Faculty of Biology and Biotechnology
Level of study:	first cycle (engineering degree)
Education profile:	General academic
Form of study:	full-time studies
Academic year:	2023/24

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Basic information

Faculty name:	Faculty of Biology and Biotechnology
Major name:	Biotechnology
Level of study:	first cycle (engineering degree)
Profile of study:	General academic
Form of study:	full-time studies
Duration of studies (number of semesters):	7
Number of ECTS required to complete the studies:	210
The number of ECTS points a student obtains during classes conducted with the direct participation of academic teachers or other persons conducting classes:	115
Professional title awarded to graduates:	inżynier
ISCED code:	0510
Language of study:	english

Assigning the major to the fields and disciplines to which the learning outcomes relate

Biological sciences	100%
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Major characteristics

Major characteristics

Biotechnology is a faculty for those who want to help people and the planet through the understanding and use of natural biological mechanisms and advanced technology. It is a multidisciplinary degree combining knowledge from the natural and engineering sciences, with an emphasis on practical laboratory skills and biological knowledge that is up-to-date with the latest scientific discoveries. Subjects include cell biology, molecular biology, bioinformatics, organic chemistry, genetics, plant and animal physiology, genetic engineering, biophysics, veterinary and industrial microbiology. Due to the versatility of this field of study, graduates successfully find employment in the offices and laboratories of Polish and foreign biotechnology, pharmaceutical, and diagnostic companies, in top research institutes, in local authorities, in educational institutions, and in the wider bio-economy.

Learning objectives

The main objectives of the education process in the first degree programme in biotechnology are the provision of knowledge, skills and practical competences at the highest world level so that graduates are prepared to be competitive in today's labour market and to function in a knowledge-based society. The development of creativity, social, organisational and teamwork skills is particularly emphasised. The programme consists of a wide range of subjects, including a large number of electives (faculties). This allows students to develop their passions and strengthen their skills with a view to their intended career path. Through internships, additional training, freedom of choice in the location of the diploma thesis (it can be carried out not only at WULS, but also at many research institutes in Warsaw) and direct contacts with employers, we ensure that students learn about current opportunities on the labour market. At the same time, we try to keep important subjects of a more general nature in the programme, so that the choice of specialisation does not limit career prospects. This keeps all employment options open.

Education concept

Competent research and teaching staff from various WULS institutes and from outside the university with good publications and international experience teach individual subjects, both general and specialized. Staff are regularly evaluated on their performance and scientific development. The high proportion of laboratory courses with the use of modern equipment, which often also serve the research projects of the staff, is a priority of the teaching at the Faculty of Biotechnology. The lecture and practice rooms are well equipped and are concentrated on a compact and modern campus in the Ursynów district of Warsaw. In addition, to give students the opportunity to meet potential future employers, students are required to complete an internship in companies or institutes related to biotechnology. The development of biotechnology students is also supported by internationalization. This is achieved through the possibility of making extensive use of international exchange programs with very good foreign universities, as well as through individual contacts with foreign students who come to us. We constantly monitor and update our educational programs, adapting them to the changing state of knowledge in the fields and disciplines taught and to the needs of the market, in order to ensure a high level of professional competence among our graduates. We also engage in a constructive dialogue with biotechnology employers by discussing curricula and syllabi with them and responding to market developments they report. Through professional surveys and collaboration with local government, we monitor and analyze student and graduate satisfaction. We are building an image of a student-friendly university focused on high-quality, practical education through the activities described above. This is reflected in the positive ratings of the Faculty in the external accreditation process and parametric assessment.

Description of work placement (if provided for in the study programme)

The aim of the practical training is to enable the student to become acquainted with different workplaces related to biotechnology and to combine the knowledge acquired in university courses with laboratory and industrial practice. The student chooses the location of the placement: university/company/institute - he/she gets to know the scientific environment as well as the organisational and economic conditions of scientific institutes, biotechnology companies and other units involved in research.

Graduate profile

The graduate will be prepared to work in: scientific and research units of the biotechnology industry and related industries;

research, control, and diagnostic laboratories; and design units dealing with biotechnological processes. The graduate will be able to interpret and report biological data obtained in the course of their work, assess the suitability of available methods or equipment, and propose a possible best solution. The graduate will be able to plan an experiment to solve tasks related to the development of a biotechnological product. The graduate is prepared to take on research challenges and other professional work and is ready for further training and professional development.

Learning outcomes

Knowledge

Code	Content	PRK
BTj_K3_W01_inz	The graduate knows and understands technologies of performing biotechnological processes	P6S_WG
BTj_K3_W02_inz	The graduate knows and understands basics related to the life cycle of a biotechnological product, as well as devices and their instrumentation (measurement sensors) used in biotechnological production	P6S_WG
BTj_K3_W03	The graduate knows and understands key aspects of biotechnology	P6S_WG
BTj_K3_W04	The graduate knows and understands the necessity to use proper simple computational techniques (including statistical analysis, computational tools and computer software suites) for biological data	P6S_WG
BTj_K3_W05	The graduate knows and understands the principles which define the three-dimensional structure of biological macromolecules, with the ability to explain and provide the examples of the relationship between structure and function	P6S_WG
BTj_K3_W06	The graduate knows and understands the functions of various cells (prokaryotic and eukaryotic), being able to critically explain, how their properties are related to varying biological functions, knowing how they can be tested experimentally	P6S_WG
BTj_K3_W07_inz	The graduate knows and understands experimental methods serving the examination of important areas in the field of biotechnology, chemistry, biochemistry, biophysics, molecular biology and the related sciences;	P6S_WG
BTj_K3_W08	The graduate knows and understands the features of cellular metabolism and its control, including the knowledge of certain experimental techniques;	P6S_WG
BTj_K3_W09	The graduate knows and understands living organisms and their place in the natural environment, and how they can be used for the good of humanity;	P6S_WG
BTj_K3_W10	The graduate knows and understands terms, principles and theories related to processes and mechanisms which have shaped the world of nature, knowing how they can be used efficiently;	P6S_WG
BTj_K3_W11	The graduate knows and understands the principles of OHS and ergonomics;	P6S_WG
BTj_K3_W12	The graduate knows and understands the principles of mathematics and statistics for assessing and interpreting phenomena and processes occurring in the environment;	P6S_WG
BTj_K3_W13_inz	The graduate knows and understands the importance of processes necessary to asses and initiate research in the field of biotechnology;	P6S_WK
BTj_K3_W14	The graduate knows and understands the significance of copyright protection, the protection of industrial property and patent right;	P6S_WK
BTj_K3_W15_inz	The graduate knows and understands the systems currently recommended for managing quality and safety in the biotechnological industry; the principles of creating and developing the forms of individual entrepreneurship;	P6S_WK

Skills

Code	Content	PRK
BTj_K3_U01_inz	The graduate can utilise proper techniques and knowledge related to biotechnology in practice, under the care of a supervisor;	P6S_UW

Code	Content	PRK
BTj_K3_U02_inz	The graduate can perform and present an independent experiment (a final diploma thesis), which reflects features such as: e.g. competences associated with the ability of proper time management, solving a research problem as well as performing tasks and interpreting the quality of results;	P6S_UW
BTj_K3_U03	The graduate can provide and explain specific examples and apply proper experimental methods associated with the explanation of principles related to gene expression;	P6S_UW
BTj_K3_U04_inz	The graduate can present and discuss key principles of scientific interdisciplinary bases, as well as a multidisciplinary approach to the processes and mechanisms of life;	P6S_UW
BTj_K3_U05_inz	The graduate can understand and explain chemical processes forming a basis for explaining biochemical reactions, and able to apply proper techniques for their investigation;	P6S_UW
BTj_K3_U06_inz	The graduate can use laboratory equipment in order to gather observations and data	P6S_UW
BTj_K3_U07	The graduate can follow proper principles of safety and work ethics during the execution of scientific research using various experimental methods under laboratory and field conditions	P6S_UW
BTj_K3_U08_inz	The graduate can assess the social, economic and legal conditions of the activities of a biotechnologist;	P6S_UW
BTj_K3_U09_inz	The graduate can preliminarily assess the economic effect of the proposed modifications of a biotechnological process;	P6S_UW
BTj_K3_U10_inz	The graduate can critically assess the functionality and validity of technical and technological solutions used in a biotechnological process;	P6S_UW
BTj_K3_U11_inz	The graduate can be able to assess the usefulness of the available methods or devices and propose potentially the best solution when solving a practical problem related to the technological utilisation of biological material;	P6S_UW
BTj_K3_U12_inz	The graduate can plan and perform experiments related to the preparation, creation and utilisation of biological material in a production process;	P6S_UW
BTj_K3_U13_inz	The graduate can propose analytical methods and plan an experiment for solving engineering tasks related to various stages of creating a biotechnological product;	P6S_UW
BTj_K3_U14_inz	The graduate can translate the results of experiments into practical solutions;	P6S_UW
BTj_K3_U15_inz	The graduate can design modification of the features of a biological organism and the conditions of a process associated with the multiplication of biological material in accordance with the adopted assumptions, select devices and unit operations related to the extraction, purification and preservation of a bioproduct;	P6S_UW
BTj_K3_U16	The graduate can choose and apply proper symbols, graphical signs and language forms for presenting scientific ideas, plans and experimental results (e.g. the utilisation of chemical formulas for biological molecules);	P6S_UK
BTj_K3_U17	The graduate can analyse topics from genetics and molecular biology, provide and explain certain detailed examples;	P6S_UK
BTj_K3_U18	The graduate can coherently communicate within the scope of the topics pertaining to biotechnology both with specialists and with outside receivers;	P6S_UK
BTj_K3_U19	The graduate can use a foreign language in speech and in writing within the scope of fields of science and scientific disciplines proper for the field of biotechnology, according to the requirements defined for level B2 of the Common European Framework of Reference for Languages;	P6S_UK
BTj_K3_U20	The graduate can plan and organise work, both individual and in a team	P6S_UO

Code	Content	PRK
BTj_K3_U21	The graduate can coping with understanding, planning and analysing; being able to interpret and report biological data acquired while working individually and in a group;	P6S_UO
BTj_K3_U22	The graduate can find and assess information from various sources, including from original research, and present in a well organised manner (e.g. essays, reports and laboratory reports);	P6S_UU

Social competence

Code	Content	PRK
BTj_K3_K01	The graduate is ready to proper storage of data, updating and extending knowledge on topics related to biotechnology and the related sciences;	P6S_KK
BTj_K3_K02	The graduate is ready to development and application of one's skills in practice (including communication, teamwork), which enable effective lifelong learning with respect to biological sciences;	P6S_KK
BTj_K3_K03	The graduate is ready to for safe work via the selection and application of a proper technique of handling, storing and disposing of laboratory materials (e.g. using proper techniques in terms of handling, storing and disposing of bacteria, chemical substances and dangerous bio-waste);	P6S_KO
BTj_K3_K04	The graduate is ready to initiating and actively participating in the development and implementation of research and social projects;	P6S_KO
BTj_K3_K05	The graduate is ready to for thinking and acting in an entrepreneurial way	P6S_KO
BTj_K3_K06	The graduate is ready to presenting justified arguments supporting one's standpoint regarding scientific, ethical and social topics influencing the progress in biological sciences;	P6S_KR
BTj_K3_K07	The graduate is ready to recognising the scope and ethical nature of the effects of utilising biotechnology and its impact on the society; settling ethical dilemmas related to the work of a biotechnologist;	P6S_KR

Study plan

Semester 1

In semester 1, students complete library training and a health and safety course on a platform available at <https://szkolenia.sggw.pl>

Subject	Number of hours	ECTS points	Form of verification	
OHS training	OHS training: 4	0	Pass	O
Mathematics I	Lecture: 30 Auditorium exercises: 30	5	Exam	O
Information technologies	Laboratory exercises: 30	2	Pass with grade	O
Cell Biology	Lecture: 30 Laboratory exercises: 30	5	Exam	O
General and physical chemistry	Lecture: 45 Laboratory exercises: 30	7	Exam	O
Physics and biophysics	Lecture: 45 Laboratory exercises: 45	7	Exam	O
Ecology	Lecture: 15	1	Pass with grade	O
Foreign language I	Language course: 60	3	Pass	G
German language	Language course: 60	3	Pass with grade	F
Russian language	Language course: 60	3	Pass with grade	F
Polish language	Language course: 60	3	Pass with grade	F
Sum	394	30		

Semester 2

Subject	Number of hours	ECTS points	Form of verification	
Mathematics II	Lecture: 30 Auditorium exercises: 30	5	Exam	O
Propedeutics of biotechnology	Laboratory exercises: 15	1	Pass with grade	O
Organic chemistry	Lecture: 30 Laboratory exercises: 30	5	Exam	O
Botany	Lecture: 30 Auditorium exercises: 4 Laboratory exercises: 20 Field exercises: 6	5	Exam	O

Subject	Number of hours	ECTS points	Form of verification	
Animal anatomy	Lecture: 10 Laboratory exercises: 15	2	Pass with grade	O
Animal histology	Lecture: 10 Laboratory exercises: 15	2	Pass with grade	O
Design thinking	Lecture: 15 Auditorium exercises: 15	2	Pass with grade	O
Physical education	Physical education: 30	0	Pass	G
Physical education	Physical education: 30	0	Pass	F
Foreign language II	Language course: 60	3	Exam	G
German language	Language course: 60	3	Pass with grade	F
Russian language	Language course: 60	3	Pass with grade	F
Polish language	Language course: 60	3	Pass with grade	F
Faculties HS - an open list of optional subjects	Lecture: 30	2	Exam/pass with grade	G
The student chooses subjects for a total number of ECTS 2				
Ethics	Lecture: 30	2	Pass with grade	F
Interpersonal skills	Lecture: 30	2	Pass with grade	F
Faculties - an open list of optional subjects	Lecture: 15 Laboratory exercises: 15	2	Exam/pass with grade	G
The student chooses subjects for a total number of ECTS 2				
Physical Chemistry II	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Methods of microscopic visualization of processes and molecules	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Organic chemistry II	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Confirmation B2 foreign language	Contact hours: 2	1	Exam	O
Sum	427	30		

Semester 3

Subject	Number of hours	ECTS points	Form of verification	
Basic of engineering of biotechnological processes	Lecture: 30 Laboratory exercises: 30	5	Exam	O
Molecular biology	Lecture: 30 Laboratory exercises: 30	5	Exam	O
General Microbiology	Lecture: 30 Laboratory exercises: 30	5	Exam	O
Biochemistry	Lecture: 30 Laboratory exercises: 30	5	Exam	O
Plant physiology	Lecture: 40 Laboratory exercises: 20	4	Exam	O
Physical education	Physical education: 30	0	Pass	G
Physical education	Physical education: 30	0	Pass	F
Faculties - an open list of optional subjects	Contact hours: 75	6	Exam/pass with grade	G
The student chooses subjects for a total number of ECTS 6				
Finance, banking, marketing	Lecture: 30	2	Pass with grade	F
Biophysics II	Lecture: 15 Auditorium exercises: 15	2	Pass with grade	F
Engineering Graphics	Laboratory exercises: 15	2	Pass with grade	F
Proteome biochemistry	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Sum	405	30		

Semester 4

Subject	Number of hours	ECTS points	Form of verification	
Engineering of biotechnological processes	Lecture: 30 Laboratory exercises: 30	5	Exam	O
General genetics	Lecture: 30 Laboratory exercises: 30	5	Exam	O
Basics of genetics and animal breeding	Lecture: 30 Laboratory exercises: 15	3	Pass with grade	O
Animal physiology	Lecture: 30 Laboratory exercises: 30	4	Exam	O
Physiology of microorganisms	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	O
Enzymology and Biochemical Technics	Lecture: 15 Laboratory exercises: 30	3	Exam	O
General virology	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	O

Subject	Number of hours	ECTS points	Form of verification	
Faculties - an open list of optional subjects	Contact hours: 90	6	Exam/pass with grade	G
The student chooses subjects for a total number of ECTS 6				
Veterinary microbiology	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Preparative anatomy	Lecture: 10 Laboratory exercises: 20	2	Pass with grade	F
Food microbiology	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
The biotechnological use of microorganisms	Lecture: 15 Laboratory exercises: 10 Field exercises: 5	2	Pass with grade	F
Plant physiology II	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Chloroplasts biology	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Sum	420	30		

Semester 5

Subject	Number of hours	ECTS points	Form of verification	
Genetic engineering I	Lecture: 15 Laboratory exercises: 45	6	Exam	O
Basics of bioinformatics	Laboratory exercises: 45	4	Pass with grade	O
Biotechnological methods at environmental protection	Lecture: 15 Auditorium exercises: 7 Laboratory exercises: 6 Field exercises: 2	2	Exam	O
Physiomics	Lecture: 15	1	Exam	O
Fundamentals of design and development of technological lines	Lecture: 15 Project exercises: 15	3	Pass with grade	O
Social and legal aspects of biotechnology, part I	Lecture: 20	2	Pass with grade	O
Immunology	Lecture: 30 Laboratory exercises: 15	4	Exam	O
Faculties - an open list of optional subjects	Contact hours: 120	8	Exam/pass with grade	G
The student chooses subjects for a total number of ECTS 8				

Subject	Number of hours	ECTS points	Form of verification	
Veterinary virology	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Bioactive substances in human and animal nutrition	Lecture: 20 Laboratory exercises: 10	2	Pass with grade	F
Biotechnological use of bacteria	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Biotechnological use of moulds	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Basic of hygiene in food processing	Lecture: 30	2	Pass with grade	F
Green synthesis of metal nanoparticles	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Biology of plant-microbe interactions	Lecture: 30	2	Pass with grade	F
Herbivorous invertebrates and their enemies	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Sum	365	30		

Semester 6

Student submits questionnaire for selection of thesis topic; After semester 6 during the summer, the student implements 4 weeks of professional practise (practice supervisor: Dr hab. A. Fabiszewska)

Subject	Number of hours	ECTS points	Form of verification	
Cell and tissue cultures	Lecture: 20 Laboratory exercises: 45	6	Exam	O
Statistics	Laboratory exercises: 30	3	Pass with grade	O
Genetic engineering II	Lecture: 15 Laboratory exercises: 45	6	Exam	O
Industrial biotechnology	Lecture: 30 Laboratory exercises: 15	3	Exam	O
Faculties - an open list of optional subjects	Contact hours: 135	12	Exam/pass with grade	G
The student chooses subjects for a total number of ECTS 12				
R programming language	Laboratory exercises: 30	2	Pass with grade	F

Subject	Number of hours	ECTS points	Form of verification	
Nanotechnology and Neurobiology	Lecture: 15 Auditorium exercises: 15	2	Pass with grade	F
Monoclonal antibodies - production and use	Lecture: 15 Laboratory exercises: 30	4	Exam	F
Fundamentals of immunopathology	Lecture: 15 Laboratory exercises: 30	4	Exam	F
Food technology	Lecture: 30	2	Pass with grade	F
Biotechnological use of yeast	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Biopolymers in the production of food packaging	Lecture: 15	1	Pass with grade	F
Weed Science	Lecture: 15 Auditorium exercises: 25 Field exercises: 5	4	Exam	F
Plant resistance to harmful arthropods - yesterday, today, tomorrow	Lecture: 10 Laboratory exercises: 5	1	Pass with grade	F
Biostatistical methods in management of genetic resources	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Sum	335	30		

Semester 7

Subject	Number of hours	ECTS points	Form of verification	
Chemical safety	Lecture: 30 Laboratory exercises: 15	4	Exam	O
Seminar	Auditorium exercises: 30	2	Pass with grade	G
Seminar	Auditorium exercises: 30	2	Pass with grade	F
Professional practice	Apprenticeships: 160	6	Pass	G
Professional practice	Apprenticeships: 160	6	Pass	F
Faculties - an open list of optional subjects	Contact hours: 45	3	Pass with grade	G
The student chooses subjects for a total number of ECTS 3				
Data visualization methods	Laboratory exercises: 15	1	Pass with grade	F
Biotechnological use of waste	Lecture: 15	1	Pass with grade	F

Subject	Number of hours	ECTS points	Form of verification
Biotechnology of Animal Reproduction	Lecture: 15 Laboratory exercises: 15	2	Pass with grade F
Foodborne and waterborne pathogenic microorganisms	Lecture: 15	1	Pass with grade F
Plant active compounds in human life	Lecture: 15	1	Pass with grade F
Individual research project	Diploma thesis: 0	15	- G
Individual research project	Diploma thesis: 0	15	- F
Sum	280	30	

O - Obligatory subjects
G - Mandatory group
F - Elective subjects

Description of the learning outcomes assigned to the subjects and the curriculum content ensuring the achievement of these outcomes

Subject name:		Mathematics I	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the equations and inequalities involving absolute value, and polynomial and rational functions	BTj_K3_W04, BTj_K3_W12
	W2	the elementary functions - logarithm, exponential, sine, cosine	BTj_K3_W04, BTj_K3_W12
	W3	the applications of differential and integral calculus of function of one variable	BTj_K3_W04, BTj_K3_W12
Skills: (In terms of skills, the graduate can)	U1	solve simple equations and inequalities	BTj_K3_U09_inz, BTj_K3_U13_inz
	U2	apply differential calculus to find the least and the largest value of a function of one variable, analyze the graph of a function	BTj_K3_U09_inz, BTj_K3_U13_inz
	U3	compute an indefinite integral, definite integral and apply the definite integral to solve selected problems	BTj_K3_U09_inz, BTj_K3_U13_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	apply computational methods in practice	BTj_K3_K01
Course content ensuring the achievement of learning outcomes:		Selected concepts, theorems and methods of the foundations of higher mathematics and their application in solving specific exercises and problems related to the field of study. Number sets, absolute value, lines of a set, algebraic transformations, solving equations and inequalities, a function and its basic properties, elementary functions, the concept of the limit of a sequence and function, continuity of a function, the derivative of a function of one variable and its relation to the graph of a function, numerical and power series, Taylor polynomials and their applications, the indefinite integral, various methods of integration, the definite integral and its applications to the calculation of the area of plane areas and the volume of rotating solids.	
Examination methods:		Written exam, Test (written or computer based), Assessment of activity during classes	

Subject name:		Information technologies	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the appropriate way of performing calculations	BTj_K3_W04
	W2	the correctness of calculations using entered formulas	BTj_K3_W04
Skills: (In terms of skills, the graduate can)	U1	propose an appropriate graph for the graphical presentation of data	BTj_K3_U16, BTj_K3_U21, BTj_K3_U22
	U2	prepare a multi-page hierarchical document	BTj_K3_U16, BTj_K3_U21, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	prepare and archive knowledge	BTj_K3_K01
Course content ensuring the achievement of learning outcomes:		Advanced methods of using a spreadsheet: formatting cells, creating formulas using references to cells and names, creating charts, creating and modifying tables (databases), text editing, data management, basics of relational databases, methods of using a text editor: creating documents multipage, alternative solutions.	
Examination methods:		Project, Test (written or computer based)	

Subject name:		Cell Biology	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the terminology used to describe cellular structures, their function and chemical composition	BTj_K3_W06, BTj_K3_W08
	W2	the significance of generation and evolution of a cell in the development of living organisms on Earth and the relationships between the structure and the function of a cell	BTj_K3_W10
	W3	the cellular and tissue-based organization of plants and animals as well as the processes occurring in organelles and compartments of a eukaryotic cell	BTj_K3_W05, BTj_K3_W08, BTj_K3_W09
	W4	the empirical interpretation of the variability of cellular structures, being able to extend the knowledge related to cell biology, using the available sources of digital informations	BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W09
	W5	how to observe the occupational safety of oneself and the others, and how to behave in emergencies	BTj_K3_W11, BTj_K3_W14
Skills: (In terms of skills, the graduate can)	U1	utilise the techniques of microscopic examinations and cytochemical methods used in cell biology	BTj_K3_U03, BTj_K3_U05_inz, BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U15_inz, BTj_K3_U21, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	solve cognitive and practical problems	BTj_K3_K01
	K2	perform safe work in a laboratory	BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Cellular structure of animal and plant organisms, ultrastructure of animal and plant cells, functions of organelles and cell differentiation processes in various types of tissues, with particular emphasis on understanding the correlation between the structure of the cell and the served function.	
Examination methods:		Written exam, Written credit	

Subject name:		General and physical chemistry	ECTS: 7
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the concepts and principles from general and physical chemistry, discussed during lectures and classes and information on chemical processes	BTj_K3_W07_inz, BTj_K3_W10, BTj_K3_W11
	W2	the dangers of work in a chemical laboratory and the safety rules essential for personal protection in chemical labs	BTj_K3_W11
Skills: (In terms of skills, the graduate can)	U1	apply learned principles and dependences to perform chemical calculations, especially those related to concentrations of solutions, pH of solutions, thermochemistry, solubility product, kinetics of chemical reactions, electrochemistry and spectroscopy	BTj_K3_U05_inz
	U2	select and perform appropriate chemical reactions to qualitatively analyze selected inorganic salts	BTj_K3_U06_inz, BTj_K3_U16
	U3	operate standard laboratory equipment and use it to perform different type of titrations e.g. complexometric titrations, redox titrations, conductometric titrations, acid-base titrations and colorimetric measurements	BTj_K3_U06_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	cooperate in teams to perform experiments and physio-chemical data assessment, and to report on experiments done and the results collected	BTj_K3_K02, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Systematic knowledge from general and physical chemistry required for studying major subjects. Standard laboratory equipment. Principles of working in chemical laboratory. Formation of skills to conduct chemical calculations, independent work in the laboratory, drawing correct conclusions from performed experiments, clear reporting on experimental results.	
Examination methods:		Written exam, Report, Test (written or computer based)	

Subject name:		Physics and biophysics	ECTS: 7
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the general laws of physics which constitute a basis for understanding the phenomena taught under other natural and technical subjects	BTj_K3_W07_inz, BTj_K3_W10
	W2	the units of physical quantities and understands the record of their multiplicities defined by prefixes	BTj_K3_W07_inz, BTj_K3_W12
	W3	the primary techniques for measuring physical quantities	BTj_K3_W07_inz, BTj_K3_W10
	W4	the laws of biophysics, which constitute a basis understanding the functioning of plant and animal organisms	BTj_K3_W03, BTj_K3_W07_inz
	W5	the physical methods of imaging organisms	BTj_K3_W08
	W6	the statistical laws related to the measurements of physical quantities in organisms	BTj_K3_W12
Skills: (In terms of skills, the graduate can)	U1	use simple mechanical (a calliper, a weighing scale, a stopwatch), electrical (a voltmeter, an ammeter) and optical devices (a refractometer, a polarimeter)	BTj_K3_U01_inz, BTj_K3_U06_inz, BTj_K3_U20
	U2	process the results of measurements, estimate their inaccuracy, able to evaluate them critically using various sources	BTj_K3_U10_inz, BTj_K3_U14_inz
	U3	solve the simplest physical and biophysical problems, necessary to quantify the effects of phenomena and processes	BTj_K3_U16
	U4	distinguish between scientific and non-scientific theorems	BTj_K3_U04_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	develop the skills and use them in practice	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		Systematic knowledge from general and physical chemistry required for studying major subjects. Standard laboratory equipment. Principles of working in chemical laboratory. Formation of skills to conduct chemical calculations, independent work in the laboratory, drawing correct conclusions from performed experiments, clear reporting on experimental results.	
Examination methods:		Written exam, Report	

Subject name:		Ecology	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the ecological terminology, patterns and mechanisms relating to succession phenomena, circulation of matter and biological diversity	BTj_K3_W07_inz, BTj_K3_W09, BTj_K3_W10
	W2	the information on ecological research methodology and practical applications of ecology	BTj_K3_W07_inz, BTj_K3_W09, BTj_K3_W10
Skills: (In terms of skills, the graduate can)	U1	explain the essence of ecological interactions at the level of population, biocenosis, ecosystem, landscape and biosphere	BTj_K3_U04_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	recognize the value of animate nature and identify anthropogenic sources of threats to species and habitat diversity	BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		Developing the ability to perceive and interpret phenomena occurring in ecological systems (natural and anthropogenic) and to understand the relationship between animate and inanimate elements in the environment.	
Examination methods:		Written credit	

Subject name:		German language	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	vocabulary related to education, work, science, health, culture and entertainment, sport, technology, information exchange and the environment	BTj_K3_W10
	U1	describe phenomena, processes, procedures	BTj_K3_U16
	U2	communicate and take notes	BTj_K3_U18
	U3	provide explanations, give reasons, express opinions or present plans	BTj_K3_U18, BTj_K3_U21
	K1	prepare and give a presentation	BTj_K3_K02, BTj_K3_K06
	K2	work in a group and discuss	BTj_K3_K02, BTj_K3_K06
	K3	communicate in most everyday and professional situations without preparation	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		<p>Vocabulary related to education, work, science, health, culture and entertainment, sport, technology, information exchange and the environment.</p> <p>Grammatical structures: correct use of word forms and sentence constructions, word formation.</p> <p>Language functions: practicing communication, pronunciation and spelling.</p>	
Examination methods:		Written credit, Essay, Assessment of activity during classes	

Subject name:		Russian language	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	vocabulary connected with education, work, science, health, culture and entertainment, sport, technology, information exchange and environment	BTj_K3_W10
	U1	describe phenomena, processes, procedures	BTj_K3_U16
	U2	conduct correspondence and take notes	BTj_K3_U18
	U3	give explanations, give reasons, express opinions or make plans	BTj_K3_U18, BTj_K3_U21
	K1	prepare and deliver presentations	BTj_K3_K02, BTj_K3_K06
	K2	work in a team and conduct a discussion	BTj_K3_K02, BTj_K3_K06
	K3	communicate correctly in most situations of everyday life and professional life without preparation	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		Vocabulary connected with education, work, science, health, culture and entertainment, sport, technology, information exchange and environment. Grammar structures: correct use of word forms and sentence structures, word formation. Language functions: practising communication, pronunciation and spelling.	
Examination methods:		Written credit, Essay, Assessment of activity during classes	

Subject name:		Polish language	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	vocabulary connected with family, everyday life, housing, transport, work, education, nutrition, services, health, sport and natural environment	BTj_K3_W10
	U1	communicate on the elementary level in spoken and written forms	BTj_K3_U16
	U2	describe everyday phenomena	BTj_K3_U16
	U3	express opinions, give reasons or make plans	BTj_K3_U18, BTj_K3_U21
	K1	work in a team	BTj_K3_K02
	K2	communicate in different situations of everyday life	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		<p>Vocabulary related to education, work, science, health, culture and entertainment, sport, technology, information exchange and the environment.</p> <p>Grammatical structures: correct use of word forms and sentence constructions, word formation.</p> <p>Language functions: practicing communication, pronunciation and spelling.</p>	
Examination methods:		Written credit, Essay, Assessment of activity during classes	

Subject name:		Mathematics II	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the fundamental topics of linear algebra	BTj_K3_W04, BTj_K3_W12
	W2	the topics differential calculus of functions of many variables	BTj_K3_W04, BTj_K3_W12
	W3	the topics concerning differential equations	BTj_K3_W04, BTj_K3_W12
Skills: (In terms of skills, the graduate can)	U1	analyze, solve systems of linear equations. Perform calculations on matrices	BTj_K3_U09_inz, BTj_K3_U13_inz
	U2	find the least and the largest value of a function of several variables	BTj_K3_U09_inz, BTj_K3_U13_inz
	U3	solve simple differential equations	BTj_K3_U09_inz, BTj_K3_U13_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	apply computational methods in practice	BTj_K3_K01
Course content ensuring the achievement of learning outcomes:		Selected concepts, theorems and methods of higher mathematics and mathematical modelling and their application to solving specific tasks and problems related to the field of study. Topics such as: improper integral and its applications. Matrices and their application to solving systems of linear equations. Linear independence of vectors, elements of analytic geometry in R^n . Functions of many variables. Partial derivatives, extremes. Conditional extremes, determination of the smallest and largest value of a function. Ordinary differential equations. Elements of qualitative analysis of autonomous equations. Different models of population growth. Application of differential equations in biology and physics. Examples of mathematical modelling. Selected partial differential equations.	
Examination methods:		Written exam, Test (written or computer based), Assessment of activity during classes	

Subject name:		Propedeutics of biotechnology	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the definitions of biotechnology, the history and scope of biotechnology	BTj_K3_W03
	W2	the possibilities of using biotechnology in plant, animal and food production	BTj_K3_W09, BTj_K3_W13_inz
	W3	the information on biotechnologies used in plant, animal and food production	BTj_K3_W01_inz, BTj_K3_W03, BTj_K3_W13_inz
	W4	the principles of laboratory animal husbandry	BTj_K3_W09, BTj_K3_W13_inz
	W5	the food industries using biotechnology processes	BTj_K3_W01_inz, BTj_K3_W09
	W6	the aspects of biotechnology research using microorganisms	BTj_K3_W01_inz, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	design a commercial laboratory for micropropagation of plants	BTj_K3_U12_inz, BTj_K3_U17
	U2	assess the suitability of biotechnological methods for a specific production effect	BTj_K3_U12_inz, BTj_K3_U17
	U3	interpret the biological and physicochemical results of water analysis and assess whether the controlled process occurs correctly or not	BTj_K3_U12_inz, BTj_K3_U15_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	recognize ethical dilemmas in conducting laboratory animal husbandry	BTj_K3_K07
	K2	develop and apply acquired knowledge	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		The use of biotechnology in plant, animal and food production with special emphasis on methodology of plant in vitro cultures, micropropagation and obtaining virus-free seedling materials. The most important achievements and directions of development of biotechnology, genetic engineering, animal breeding and improvement, diagnostics and therapy. The aspects of the food industry, e.g. fermentation technologies and methods used when testing the ability of micro-organisms for biotechnological processes.	
Examination methods:		Report, Assessment of activity during classes	

Subject name:		Organic chemistry	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the functional groups (formulas and names) present in organic compounds, the class of compounds, information on the reactivity solubility in water and non-polar solvents based on the structure of the molecule, the reactivity of organic compounds	BTj_K3_W07_inz
	W2	the types of biomolecules, their general formulas and reactivity	BTj_K3_W05
	W3	the essence of intermolecular interactions, the structure of proteins, sugars and fats	BTj_K3_W05, BTj_K3_W10
Skills: (In terms of skills, the graduate can)	U1	apply laboratory techniques that are the basis for further scientific work	BTj_K3_U04_inz, BTj_K3_U06_inz, BTj_K3_U16, BTj_K3_U20
Social competences: (Within the scope of competence, the graduate is ready to)	K1	apply laboratory tools and techniques in practice	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		Relationships between the structure of a relationship and its properties, and reactions important from the point of view of changes in living organisms. Relation of intermolecular interactions and chemical reactions with biochemistry and physiology. Structure of organic compounds including stereochemistry, rules of organic nomenclature. Discussion of the properties and reactions of the main groups of organic compounds, alcohols, halogen derivatives, carbonyl and carboxylic compounds, amines and multifunctional compounds, with particular emphasis on the relationship between the structure and properties of organic substances. Biomolecules - fats, saccharides, peptides.	
Examination methods:		Written exam, Test (written or computer based), Assessment of work in the laboratory	

Subject name:		Botany	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the general information on botany, adjusted to the field of study, and terminology used in botany	BTj_K3_W06, BTj_K3_W08, BTj_K3_W10
	W2	the position of plants in the Tree of Life, the systematics of land plants and life cycles characteristic for their main clades	BTj_K3_W09, BTj_K3_W10
	W3	the structure and functions of vegetative and generative organs of plants as well as the structural and functional adaptations of the ecological groups of plant to their habitat	BTj_K3_W05, BTj_K3_W06, BTj_K3_W08
	W4	the model plants and the most important plants supplying nutritional and industrial materials	BTj_K3_W09, BTj_K3_W10
Skills: (In terms of skills, the graduate can)	U1	perform microscopic observations of plant tissues and organs, followed by their analyses, especially in the context of linking the structure and the function, and can identify the most important, useful plants and determine their systematic positions	BTj_K3_U04_inz, BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U14_inz, BTj_K3_U20, BTj_K3_U21
	U2	individually find, critically analyze and utilize information related to botany, originating from various sources in the Polish language, also using the English language to an extent sufficient to use the sources of botanical knowledge in this language, also formulate their statements briefly, logically and clearly, properly using botanical terminology and indicate the connections of botany to other sciences, in particular physics and chemistry	BTj_K3_U07, BTj_K3_U10_inz, BTj_K3_U12_inz, BTj_K3_U18, BTj_K3_U19, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work efficiently, both individually and in a team, manifesting this by adhering to the principles of the OHS, respecting copyrights, accepting responsibility for their own work as well as readiness to succumb to the principles of teamwork and accountability for the tasks executed in a group on an e-learning platform, as well as by developing and implementing a work schedule that ensures meeting the deadlines	BTj_K3_K02, BTj_K3_K03
	K2	perform the self-assessment of his or her own knowledge, skills, and competences as well as constantly deepen the knowledge	BTj_K3_K01, BTj_K3_K05
Course content ensuring the achievement of learning outcomes:		Structure, function and development of plant structural components from the tissue level to vegetative and generative organs of seed plants. Characteristics of the processes leading to tissue and organ differentiation. Structural adaptation of plant tissues and organs to different environmental conditions. Evolutionary trends of major taxonomic groups of terrestrial plants.	
Examination methods:		Written exam, Presentation, Report, Test (written or computer based)	

Subject name:		Animal anatomy	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the macroscopic structure of organs and differences between species	BTj_K3_W09
	W2	the relationship between the morphology and function of organs and adaptation of the animal organism to the environment	BTj_K3_W03, BTj_K3_W05, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	analyze and combine information on particular levels organization of the animal body and its functioning	BTj_K3_U04_inz, BTj_K3_U13_inz, BTj_K3_U21
Social competences: (Within the scope of competence, the graduate is ready to)	K1	plan and carry out a biological experiment	BTj_K3_K01, BTj_K3_K02, BTj_K3_K06, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		The macroscopic general anatomical structures of domestic animals. Obtaining the understanding by students of the logical correlation between the macroscopic structure and the basic functions fulfilled by specific organs and systems of the animal organism. Movement apparatus: skeletal system, bone connections, muscular system. Anatomy of the respiratory system. Digestive apparatus. Genitourinary system. Anatomy of the cardiovascular and lymphatic systems. Somatic and autonomic nervous system, endocrine glands, sensory organs. Elements of anatomy birds.	
Examination methods:		Written credit, Written exam	

Subject name:		Animal histology	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the microscopic structure of cells, tissues and organs	BTj_K3_W05, BTj_K3_W06
	W2	the relationship between the morphology and function of organs and the adaptation of the animal organism to the living environment	BTj_K3_W03, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	analyze and combine information on individual levels of organization of the animal organism and its functioning	BTj_K3_U04_inz, BTj_K3_U13_inz, BTj_K3_U21
Social competences: (Within the scope of competence, the graduate is ready to)	K1	perform analysis of histological slides	BTj_K3_K01, BTj_K3_K02, BTj_K3_K06, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		The microscopic general histological structures of animals. The logical correlation between microscopic structure and the basic functions performed by specific cells, tissues, and organs. Histological structure of the endocrine system. Histology of the digestive system. Histology of the male and female reproductive system. Histology of the urinary system.	
Examination methods:		Written credit, Test (written or computer based)	

Subject name:		Design thinking	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	how to solve complex problems	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W03, BTj_K3_W04, BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W09, BTj_K3_W12, BTj_K3_W14, BTj_K3_W15_inz
Skills: (In terms of skills, the graduate can)	U1	solve complex problems	BTj_K3_U01_inz, BTj_K3_U02_inz, BTj_K3_U05_inz, BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U08_inz, BTj_K3_U13_inz, BTj_K3_U14_inz, BTj_K3_U17, BTj_K3_U19, BTj_K3_U20
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work in a team, either as its leader or member	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03, BTj_K3_K04, BTj_K3_K05
Course content ensuring the achievement of learning outcomes:	Characteristic of design thinking. Practical use of prototyping and the achievements of cognitive sciences in solving technical and complex problems. Brainstorming, 6 hat method, body storming. Empathy, defining the problem, generating ideas, prototyping, testing solutions. Planning the development path, career planning.		
Examination methods:	Project		

Subject name:		Physical education	ECTS: 0
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	how physical exercise affects the development and functioning of the body.	
	W2	the aspects of morphological, anatomical and physiological foundations of the functioning of the human body and the consequences and risks associated with lack of physical activity.	
	W3	how physical activity affects health at every stage of life.	
	W4	the relationship between effort and systematic work and the effect obtained.	
	U1	analyze the level of own physical fitness, correctly interpret and identify problems occurring during the performance of tasks and make the right decisions to solve them.	
	U2	prepare the body for the effort, control and assess the state of the body's efficiency, use the acquired movement habits in the correct performance of everyday motor activities.	
	U3	use various forms of physical activity taking into account the current state of health, physical capabilities and age.	
	U4	cooperate in a team with commitment and full responsibility in order to achieve a specific result.	
	U5	undertake tasks adequate to their own talents and abilities.	
	K1	control their own physical development at every stage, taking care of the body in health and illness.	
	K2	build social relationships and knows how to use it to achieve individual and team goals.	
	K3	take responsibility for the state of their own health and that of others, including their own family in the future.	
Course content ensuring the achievement of learning outcomes:		Familiarizing the student with safety rules in physical education classes. Provide the student with basic movements, movement and body function during the selected motor activity. Familiarizing the student with the rules and regulations in the selected sport discipline. Familiarizing the student with the organization and conduct of competitions as part of the selected physical activity.	
Examination methods:		Assessment of activity during classes	

Subject name:		German language	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	vocabulary related to education, work, science, health, culture and entertainment, sport, technology, information exchange and the environment	BTj_K3_W10
	U1	describe phenomena, processes, procedures	BTj_K3_U16, BTj_K3_U19
	U2	communicate and take notes	BTj_K3_U18, BTj_K3_U19
	U3	provide explanations, give reasons, express opinions or present plans	BTj_K3_U18, BTj_K3_U19, BTj_K3_U21
	K1	prepare and give a presentation	BTj_K3_K02, BTj_K3_K06
	K2	work in a group and discuss	BTj_K3_K02, BTj_K3_K06
	K3	communicate in most everyday and professional situations without preparation	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		<p>Vocabulary related to education, work, science, health, culture and entertainment, sport, technology, information exchange and the environment.</p> <p>Grammatical structures: correct use of word forms and sentence constructions, word formation.</p> <p>Language functions: practicing communication, pronunciation and spelling.</p>	
Examination methods:		Written credit, Essay, Assessment of activity during classes	

Subject name:		Russian language	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	vocabulary connected with education, work, science, health, culture and entertainment, sport, technology, information exchange and environment	BTj_K3_W10
	U1	describe phenomena, processes, procedures	BTj_K3_U16, BTj_K3_U19
	U2	conduct correspondence and take notes	BTj_K3_U18, BTj_K3_U19
	U3	give explanations, give reasons, express opinions or make plans	BTj_K3_U18, BTj_K3_U19, BTj_K3_U21
	K1	prepare and deliver presentations	BTj_K3_K02, BTj_K3_K06
	K2	work in a team and conduct a discussion	BTj_K3_K02, BTj_K3_K06
	K3	communicate correctly in most situations of everyday life and professional life without preparation	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		<p>Vocabulary connected with education, work, science, health, culture and entertainment, sport, technology, information exchange and environment.</p> <p>Grammar structures: correct use of word forms and sentence structures, word formation.</p> <p>Language functions: practising communication, pronunciation and spelling.</p>	
Examination methods:		Written credit, Essay, Assessment of activity during classes	

Subject name:		Polish language	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	vocabulary connected with family, everyday life, housing, transport, work, education, nutrition, services, health, sport and natural environment	BTj_K3_W10
	U1	communicate on the elementary level in spoken and written forms	BTj_K3_U16
	U2	describe everyday phenomena	BTj_K3_U16
	U3	express opinions, give reasons or make plans	BTj_K3_U18, BTj_K3_U21
	K1	work in a team	BTj_K3_K02
	K2	communicate in different situations of everyday life	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		Vocabulary connected with family, everyday life, housing, transport, work, education, nutrition, services, health, sport and natural environment. Grammar structures: correct use of word forms and sentence structures, word formation. Language functions: practising communication, pronunciation and spelling.	
Examination methods:		Written credit, Essay, Assessment of activity during classes	

Subject name:		Ethics	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the key ethical concepts related to biotechnology	BTj_K3_W03
	U1	assess the social and ethical conditions of the activities of a biotechnologist	BTj_K3_U08_inz
	K1	recognize the ethical nature of the effects of utilizing biotechnology and its impact on the society	BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		<p>What is ethics? What are main ethical positions? How to understand the concept of nature? Human rights and/versus animal rights. What is the ethical debate in biotechnology about? Genetic engineering. Cloning. Stem cells research. Transplantology. Production of GMOs. Biotechnology patents. Posthumanism and transhumanism. Religion and biotechnology. What is critical bioethics? Democratic tools for solving ethical dilemmas.</p>	
Examination methods:		Written credit	

Subject name:		Interpersonal skills	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the roles of humans in the society, economy and environment	BTj_K3_W09, BTj_K3_W14
	U1	analyse and evaluate conditions and solutions related to social and economic aspects of human functioning	BTj_K3_U02_inz, BTj_K3_U08_inz, BTj_K3_U20
	K1	proper interpersonal communication	BTj_K3_K02, BTj_K3_K07
	K2	gain and develop the interpersonal skills and methods	BTj_K3_K02, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		Soft and hard competences as well as tools and methods for the development of interpersonal skills. Overview of personal development paths useful in the labor market. The role and importance of interpersonal skills. Good communication techniques. Interpersonal communication. Verbal interpersonal communication. Non-verbal communication. Communication errors. Principles of savoir-vivre, selfpresentation and image creation (clothes, student behavior in selected situations). Observation and cognitive disorders. Motives and goals of human action, models and theories of motivation. The emergence of interpersonal conflicts and ways of dealing with them. Negotiation skills and manipulation. Personal and business coaching.	
Examination methods:		Test (written or computer based), Assessment of activity during classes	

Subject name:		Physical Chemistry II	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the concepts and laws of physical chemistry	BTj_K3_W07_inz, BTj_K3_W10, BTj_K3_W11
	U1	carry out standard physicochemical measurements within the scope of the subject content	BTj_K3_U06_inz, BTj_K3_U07
	U2	independently interpret and develop the results of measurements and draw correct substantive conclusions	BTj_K3_U16, BTj_K3_U22
	K1	work in a team, share measurements results and develop self confidential	BTj_K3_K02
	K2	prepare and present a presentation of a series of obtained measurement results	BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		<p>Issues in the field of physical chemistry and the practical application of laws describing physicochemical phenomena (with the use of mathematics). Development and interpretation of measurement results. Laws of thermodynamics. The laws of Hess and Kirchoff and their application. Van't Hoff's isotherm and isobar. Perfect gas. Real gas - real gas equation and critical point. Phase transformations and equilibria. Properties of the liquid. Osmosis. Extraction. Nernst's law of partition. Physical and chemical adsorption - research, description and applications. Chemical kinetics. Order and molecularity of reactions. Activation energy and catalysis.</p>	
Examination methods:		Written credit, Report, Presentation, Test (written or computer based)	

Subject name:		Methods of microscopic visualization of processes and molecules	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	basics of structural and functional organization, and functioning of plants on different levels of their organization	BTj_K3_W05, BTj_K3_W07_inz
	W2	basic techniques of light, electron and scanning probe microscopy and their implementations in biological research	BTj_K3_W02_inz, BTj_K3_W07_inz
	W3	issues of scientific and technological progress in biological sciences	BTj_K3_W02_inz, BTj_K3_W07_inz
	U1	use basic microscopic equipment and prepares probes for microscopic examinations	BTj_K3_U03, BTj_K3_U06_inz, BTj_K3_U11_inz
	U2	interpret results of microscopic observations on the basis of current knowledge concerning structural and functional organization of plants	BTj_K3_U01_inz, BTj_K3_U11_inz
	U3	find in different sources (including Internet) and critically analyze recent information concerning implementation of microscopy in research and professional tasks	BTj_K3_U19, BTj_K3_U21, BTj_K3_U22
	K1	implement rules of safety at work (HAS) when working alone or in a group	BTj_K3_K02, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Principles of technical construction of light microscopes, implementation of different illumination and observation techniques, „spin-disc“, confocal laser scanning microscope, transmission (TEM) and scanning (SEM) electron microscopes and scanning probe microscopes. Preprocessing of samples for light and electron microscopy: fixation, embedding in resins, sectioning, cryo-sectioning, ultramicrotomy, staining and contrasting. Confocal laser scanning microscopy (CLSM; direct observation of permanent and in vivo samples, localization and analyses of proteins, nucleic acids and other chemicals using different techniques, i.e. FRAP, FLIM, FRET, STED, co-localization, deconvolution).	
Examination methods:		Written credit, Essay	

Subject name:		Organic chemistry II	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the direct relationship between chemistry and biological sciences	BTj_K3_W10
	W2	the modern spectroscopic methods and their application	BTj_K3_W05, BTj_K3_W07_inz
Skills: (In terms of skills, the graduate can)	U1	explain the meaning of chirality in nature and the essence of asymmetric synthesis	BTj_K3_U04_inz, BTj_K3_U05_inz
	U2	discuss the importance of enzymatic reactions in chemistry	BTj_K3_U04_inz, BTj_K3_U05_inz, BTj_K3_U13_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	use the chemical knowledge to realistically assess ecological problems	BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Understanding the processes related to the synthesis of organic compounds and the synthesis techniques used in modern organic chemistry along with selected techniques for the identification of chemical compounds. Review of reaction mechanisms of organic compounds. Thermodynamic and kinetic control, total synthesis and retrosynthesis. Selected carbon-carbon bond formation reactions (aldol and retroaldol condensation in terms of glucose transformations in living organisms and ester condensation in terms of fatty acids synthesis). Asymmetric synthesis and its role in modern chemistry, enzymatic reactions in chemical synthesis, separation of enantiomers. Basics of NMR, IR and mass spectroscopy. Selected ecological problems (biodegradation, green chemistry).	
Examination methods:		Written credit, Assessment of work in the laboratory	

Subject name:		Confirmation B2 foreign language	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Skills: (In terms of skills, the graduate can)	U1	Use a foreign language at the B2 level	BTj_K3_U19
Course content ensuring the achievement of learning outcomes:		Self-preparation for the foreign language at B2 level exam.	
Examination methods:		Written exam	

Subject name:		Basic of engineering of biotechnological processes	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the processes (the exchange of heat, momentum, mass) occurring during a biotechnological process	BTj_K3_W02_inz
	W2	the impact of process conditions on the biological material	BTj_K3_W07_inz, BTj_K3_W12
	W3	the information on the devices and their instrumentation (measurement sensors) used in biotechnological production	BTj_K3_W04, BTj_K3_W07_inz, BTj_K3_W14, BTj_K3_W15_inz
	W4	the principles of OHS	BTj_K3_W11
Skills: (In terms of skills, the graduate can)	U1	conduct an experiment according to the instruction and can analyze the collected results	BTj_K3_U04_inz, BTj_K3_U06_inz, BTj_K3_U08_inz, BTj_K3_U09_inz, BTj_K3_U10_inz, BTj_K3_U11_inz, BTj_K3_U12_inz, BTj_K3_U13_inz, BTj_K3_U14_inz, BTj_K3_U15_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work with team	BTj_K3_K02, BTj_K3_K04
Course content ensuring the achievement of learning outcomes:		The processes occurring during the course of a biotechnological process. Indication of the possibility of design of process conditions taking into account the requirements of both process engineering and biological material, and explaining the mutual interactions between process and biological material.	
Examination methods:		Written exam, Report, Test (written or computer based)	

Subject name:		Molecular biology	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the molecular information on functioning of organisms, structure-function relationships at the level of macromolecules (nucleic acids, proteins, polysaccharides, lipids) and the principles of gene expression and inheritance of genetic information	BTj_K3_W03, BTj_K3_W05, BTj_K3_W06, BTj_K3_W13_inz
	W2	the principles of molecular biology techniques	BTj_K3_W04, BTj_K3_W07_inz
Skills: (In terms of skills, the graduate can)	U1	conduct a comparative analysis of gene expression in prokaryotic and eukaryotic organisms	BTj_K3_U01_inz, BTj_K3_U03, BTj_K3_U05_inz, BTj_K3_U21
	U2	perform basic molecular biology techniques and make the necessary calculations when preparing reaction conditions	BTj_K3_U01_inz, BTj_K3_U03, BTj_K3_U04_inz, BTj_K3_U05_inz, BTj_K3_U17, BTj_K3_U21
Social competences: (Within the scope of competence, the graduate is ready to)	K1	apply the obtained knowledge to the development of research projects in molecular biology	BTj_K3_K03, BTj_K3_K05, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		The issues in the field of molecular biology of the cell, regulation of gene expression and basic methods of genetic engineering, as well as with examples of the application of these methods in the diagnosis, therapy, prevention and epidemiology of diseases. DNA - structure and properties. DNA - organization in a prokaryotic and eukaryotic cells. The size and structure of the genome of various organisms (DNA and RNA viruses, prokaryotes and eukaryotes). DNA replication in pro- and eukaryotic cells, replication stages and enzymes involved in this process. Models of DNA replication, regulation of replication, DNA repair systems. Transcription process and its characterisation in prokaryotes and eukaryotes. RNA maturation. RNA editing. The stages of gene expression in pro- and eukaryotes. Mobile genetic elements. Translation process, its characterisation and regulation in pro- and eukaryotes. Post-translational modifications. Systems of protein translocation in cells. Control of gene expression; Study of gene expression at the level of nucleic acids and proteins. DNA sequencing. Evolution of genomes.	
Examination methods:		Written exam, Written credit	

Subject name:		General Microbiology	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the taxonomic, morphological and physiological criteria of prokaryotes and eukaryotes diagnostics	BTj_K3_W06, BTj_K3_W09, BTj_K3_W10
	W2	the specificity of the growth of microorganisms and the impact of external environmental factors on their development	BTj_K3_W03, BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W09
	W3	the relationship between microorganisms	BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	identify the basic groups of microorganisms	BTj_K3_U01_inz, BTj_K3_U04_inz, BTj_K3_U05_inz, BTj_K3_U06_inz
	U2	quantitatively characterize the microbiological quality of the environment	BTj_K3_U01_inz, BTj_K3_U04_inz, BTj_K3_U05_inz, BTj_K3_U06_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	consciously distinguish between the benefits and risks of the presence of microorganisms in the environment	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		The importance of microorganisms in shaping the natural environment and the possibility of using their biochemical potential. Microbiology as a science. Place of microorganisms in the world of living organisms. Special features of microorganisms. Taxonomic, morphological and physiological characteristics of prokaryotes and eukaryotes. Microorganisms of extreme environments. Conjugation, transduction and transformation as sources of microbial variability. The influence of external environmental factors (physical, chemical, biological) on the growth of microorganisms and the influence of microorganisms on changes in the environment. Mutual relations between microorganisms. Microorganisms as an indicator of environmental safety. Characteristics of the most important saprophytes and pathogens and the routes of their transmission. Methods of microbial inactivation. Benefits and dangers of the metabolic activity of microorganisms.	
Examination methods:		Written exam, Test (written or computer based), Assessment of work in the laboratory	

Subject name:		Biochemistry	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the structure of biochemical building blocks of the living organisms and understands how the structure may influence the function of the bio-molecules	BTj_K3_W05, BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W10
	W2	the principles of main analytical methods in biochemistry.	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W06, BTj_K3_W08, BTj_K3_W10
	W3	the concepts in metabolism integration and regulation and knows how it may be studied experimentally	BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W09, BTj_K3_W10
	W4	the safety rules in laboratory work	BTj_K3_W11
	U1	explain the chemical reactions hidden behind the biochemical processes and apply the correct techniques to study them	BTj_K3_U01_inz, BTj_K3_U05_inz, BTj_K3_U06_inz, BTj_K3_U10_inz, BTj_K3_U12_inz
	U2	safely and precisely operate simple instruments in the laboratory (automatic pipette, analytical weights, spectrophotometer, burette, chromatographic column, etc.)	BTj_K3_U01_inz, BTj_K3_U02_inz, BTj_K3_U05_inz
	U3	obey the safety rules	BTj_K3_U07, BTj_K3_U08_inz
	U4	apply correctly the chemical and physical symbols, graphs and calculations to explain the experimental results	BTj_K3_U16, BTj_K3_U18, BTj_K3_U19, BTj_K3_U20, BTj_K3_U21, BTj_K3_U22
	U5	plan, analyze, interpret and report the data obtained in the experiments conducted individually or in groups	BTj_K3_U16, BTj_K3_U17, BTj_K3_U18, BTj_K3_U19, BTj_K3_U20, BTj_K3_U21, BTj_K3_U22
	K1	work safely including handling, storage and disposal of laboratory equipment, chemical and biological material	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03
K2	prepare the experiment documentation and written reports	BTj_K3_K04, BTj_K3_K05, BTj_K3_K06, BTj_K3_K07	
Course content ensuring the achievement of learning outcomes:		Molecular structure of main groups of bio-active molecules and bio-polymers, correlation between their structure and function. Main concepts of metabolism and cross-talk of metabolism pathways. Importance of enzymatic catalysis. Basic methods of biochemical studies- spectral methods, chromatography, mass spectrometry. Basic concepts in experiment design. Biochemical calculations.	

Examination methods:	Written exam, Report, Test (written or computer based), Assessment of work in the laboratory
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Subject name:		Plant physiology	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the interdependencies between the physiological processes	BTj_K3_W04, BTj_K3_W05, BTj_K3_W06, BTj_K3_W07_inz
	W2	the mechanisms of regulation of physiological processes at the cellular, tissue and whole organism levels, taking into account internal and external factors	BTj_K3_W05, BTj_K3_W06, BTj_K3_W07_inz
	W3	how to define and classify plant responses to unfavorable environmental factors and knows how to propose ways to improve plant tolerance to stressors	BTj_K3_W06, BTj_K3_W07_inz
	U1	use methods of measuring selected parameters describing physiological processes	BTj_K3_U03, BTj_K3_U04_inz, BTj_K3_U05_inz, BTj_K3_U06_inz
	U2	perform simple experiments, collect data and interpret the results	BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U14_inz, BTj_K3_U21
	U3	apply safety rules in laboratory work and can demonstrate responsibility for the equipment and apparatus used	BTj_K3_U07
	K1	work as a team in carrying out exercises and preparing presentations	BTj_K3_K02, BTj_K3_K04, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Biological processes from a molecular level to the level of an organisms, relationships between the structure and functioning of plants, mechanisms regulating and coordinating biological processes during the growth and development of plants. The impact of external and internal factors on these processes. Photosynthesis and breathing, transport and distribution of assimilates, water management of a plant cell and a whole plant as well as mineral nutrition, structure and function of plant hormones, diversification and development of plants, characteristics of the development phases of plants and the impact of the environment on their course; the resistance of plants to unfavourable environmental factors.	
Examination methods:		Written exam, Presentation, Test (written or computer based)	

Subject name:		Finance, banking, marketing	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the financial phenomena	BTj_K3_W15_inz
	W2	the essence and principles of banking in Poland	BTj_K3_W15_inz
Skills: (In terms of skills, the graduate can)	U1	cause and analyze economic and financial phenomena	BTj_K3_U08_inz
	U2	define the concepts of marketing	BTj_K3_U09_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	actively participate in economic life owing to the acquired knowledge of the financial and economic aspects of this activity and is ready to advance the acquired knowledge and skills	BTj_K3_K01, BTj_K3_K05, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Information about market mechanisms related to finance, banking and marketing that will enable them to understand economic phenomena. Money, its functions and types. Monetary resources in the economy and their types. The financial system in a free market economy. Functions of the financial system. Banking system - functions of the banking system. Bank and banking system. Monetary policy of the central bank and the money market. Banking operations. Financial, money and currency markets. Public finances. State budget and its functions. State budget income and expenditure. Budget deficit. Personal Finance. Financial behavior of households - saving, investing, crediting. The genesis of the marketing approach to the market. The marketing environment of the enterprise, its structure and elements, influence on the marketing decisions made. Marketing mix tools. Price as a marketing tool - pricing policy and pricing strategies. Distribution channels as a marketing tool. Promotion functions, promotion and the product life cycle, forms of promotion, determinants of their choice, their advantages and disadvantages.	
Examination methods:		Test (written or computer based)	

Subject name:		Biophysics II	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the latest biophysical techniques used in biological research	BTj_K3_W03, BTj_K3_W07_inz
	W2	the latest imaging methods at the organism and cellular levels	BTj_K3_W07_inz, BTj_K3_W08
	U1	analyze contemporary scientific publications	BTj_K3_U04_inz, BTj_K3_U13_inz
	K1	engage in a discussion with modern science opponents and understand the potential risks that may be associated with modern science	BTj_K3_K02, BTj_K3_K05, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		The physical aspects of the functioning of organelles, cells, tissues and organisms, and research in biology. The latest imaging methods at the organism, tissue, cellular and subcellular level, including PET, SPECT, NMR, the latest techniques of fluorescence and light microscopy (confocal microscopy, STED), electron microscopy techniques (TEM, SEM), protein structure, basics of flow cytometry, electrophoresis, ion channel research methods.	
Examination methods:		Written credit, Presentation	

Subject name:		Engineering Graphics	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the information on presenting objects on the plane of a drawing	BTj_K3_W04
	U1	apply the basic methods and principles of presenting objects in cross-sections and their dimensioning	BTj_K3_U13_inz
	U2	demonstrate the ability to read construction and schematic drawings	BTj_K3_U10_inz
	U3	use information technology to carry out simple engineering tasks	BTj_K3_U11_inz
	K1	put skills into practice	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		The techniques of spatial imaging of objects on a plane with the use of selected programs. Principles of presenting objects in perspective, axonometry and using rectangular projections. Mapping objects in rectangular projections with the use of views, sections, auxiliary sections and cases. Dimensioning of elements and technical devices - dimensioning rules, dimensional tolerances. Performing a 2D digital drawing and creating a three-dimensional model of a simple object in AutoCAD.	
Examination methods:		Project, Test (written or computer based)	

Subject name:		Proteome biochemistry	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the features of various protein structures and the types of post-translational modifications	BTj_K3_W04, BTj_K3_W05, BTj_K3_W07_inz
	W2	the concept of the proteome and the principles of interaction between proteins	BTj_K3_W04, BTj_K3_W05, BTj_K3_W07_inz
Skills: (In terms of skills, the graduate can)	U1	perform an independent analysis of the qualitative and quantitative results of the proteome analysis using mass spectrometry methods	BTj_K3_U01_inz, BTj_K3_U06_inz, BTj_K3_U17
	U2	create a three-dimensional structure of various proteins using a program based on artificial intelligence and analyze structures using the PyMol program	BTj_K3_U01_inz, BTj_K3_U06_inz, BTj_K3_U17
Social competences: (Within the scope of competence, the graduate is ready to)	K1	independently understand proteomic experiments and independently analyze their results	BTj_K3_K01
Course content ensuring the achievement of learning outcomes:		Information on the structure and function of proteins, possible post-translational modifications, interactions between proteins and knowledge of techniques used in proteomics.	
Examination methods:		Test (written or computer based), Project	

Subject name:		Engineering of biotechnological processes	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the conditions of specific processes of separation and purification allowing for an increase in the efficiency of processes	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W03, BTj_K3_W04, BTj_K3_W08, BTj_K3_W13_inz, BTj_K3_W14, BTj_K3_W15_inz
	W2	the principles of bioreactors operations	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W04, BTj_K3_W08, BTj_K3_W12, BTj_K3_W13_inz, BTj_K3_W14, BTj_K3_W15_inz
Skills: (In terms of skills, the graduate can)	U1	select the proper construction of a bioreactor and a monitoring method for a specified type of process	BTj_K3_U06_inz, BTj_K3_U10_inz, BTj_K3_U11_inz, BTj_K3_U12_inz, BTj_K3_U13_inz
	U2	rationally select proper methods for extracting and purifying a biotechnological product	BTj_K3_U06_inz, BTj_K3_U10_inz, BTj_K3_U11_inz, BTj_K3_U12_inz, BTj_K3_U13_inz, BTj_K3_U20
	U3	critically address the results of the performed experiments and the possible methodological errors	BTj_K3_U02_inz, BTj_K3_U08_inz, BTj_K3_U09_inz, BTj_K3_U14_inz, BTj_K3_U21
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work with bioreactors	BTj_K3_K04, BTj_K3_K05
Course content ensuring the achievement of learning outcomes:		Construction and the operating principles of bioreactors as well as their instrumentation enabling to control and monitoring of a biotechnological process. Explaining the mechanisms of separation methods and purification of products during the biotechnological process. Discussion of the design solutions of bioreactors, tools for controlling a biotechnological process, kinetics of processes, methods for performing a biotechnological process and its balancing, a periodic process, a continuous process, a process with the recirculation of biomass, separating of biotechnological products, taking into account the operating principles and the design of devices used to carry out these processes, separation of biomass, centrifugation and filtration, fragmentation of cells, thickening processes, evaporation and cryoconcentration, crystallisation, extraction, membrane and electrokinetic processes, filtration on gels, distillation. convective drying, freeze drying, chromatographic methods.	
Examination methods:		Written exam, Report, Test (written or computer based)	

Subject name:		General genetics	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the mechanisms of inheritance of traits, genetic variation as well as the origin and reproduction biology of model species of microorganisms, plants and animals	BTj_K3_W03, BTj_K3_W06, BTj_K3_W10
	W2	how to use interdisciplinary information on design and present your own concept of improving plant and animal organisms	BTj_K3_W03, BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W10
	W3	the rules for making changes in genomes and the effects of these changes	BTj_K3_W03, BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W10
	W4	the ability to analyze basic issues in genetics and molecular biology and knows various detailed examples	BTj_K3_W03, BTj_K3_W06, BTj_K3_W10
	W5	the principles of gene expression	BTj_K3_W03, BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W10
	U1	analyze the basic issues of genetics and molecular biology and can give and explain various detailed examples	BTj_K3_U03, BTj_K3_U17, BTj_K3_U18, BTj_K3_U22
	U2	can give and explain specific examples, and is able to give and apply appropriate experimental methods	BTj_K3_U03, BTj_K3_U17, BTj_K3_U22
	K1	discuss the topic of social importance of understanding the principles of inheritance of traits and genetic improvement of organisms for the production of high-quality food and technological value, including copyright protection	BTj_K3_K01, BTj_K3_K02, BTj_K3_K07
	K2	expand, deepen and update knowledge and its practical use	BTj_K3_K01, BTj_K3_K02, BTj_K3_K07
	Course content ensuring the achievement of learning outcomes:		Knowledge of genetic and epigenetic determinants of phenotypic and functional variability of organisms as well as modern methods used in plant and animal breeding. Basic genetic concepts, gene and genome structure, genes and differentiation and development, transposons, natural and induced genetic variation, extra-gene inheritance, basics of genetic analysis, inheritance and heritability, genetic foundations of plant and animal immunity, use of genetics in plant breeding and animals.
Examination methods:		Written exam, Test (written or computer based)	

Subject name:		Basics of genetics and animal breeding	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the mechanisms of inheritance of traits, genetic variation, and the origin and biology of animal reproduction	BTj_K3_W03, BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W10
	W2	the issues of genetics and molecular biology and various detailed examples	BTj_K3_W03, BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W10
	W3	the principles of animal maintenance and animal welfare	BTj_K3_W03, BTj_K3_W06, BTj_K3_W10
Skills: (In terms of skills, the graduate can)	U1	analyze basic issues in the field of genetics and molecular biology and is able to give and explain various detailed examples	BTj_K3_U03, BTj_K3_U17, BTj_K3_U18, BTj_K3_U22
	U2	give and explain specific examples, and is able to give and apply appropriate experimental methods related to the breeding and use of farm animals	BTj_K3_U03, BTj_K3_U17, BTj_K3_U18, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	provide and explain specific examples, and apply appropriate experimental methods related to the breeding and use of farm animals	BTj_K3_K01, BTj_K3_K02, BTj_K3_K07
	K2	expand, deepen and update the knowledge and its practical use	BTj_K3_K01, BTj_K3_K02, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		The inheritance of qualitative and quantitative traits in different species of animals, the basics of population genetics, aspects of breeding work with the use of the latest knowledge in the field of molecular genetics, the issue of animal welfare, which is a guarantee of appropriate breeding conditions and the quality of animal research.	
Examination methods:		Written credit, Test (written or computer based)	

Subject name:		Animal physiology	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the functioning of individual cellular structures / systems / organs such as: the nervous system, CNS, ANS, skeletal muscles, cardiac muscle, cardiovascular system, sense organs, respiratory system, smooth muscle, digestive system, liver, pancreas, kidney, female and male reproductive system, mammary gland, adipose tissue	BTj_K3_W08, BTj_K3_W09, BTj_K3_W10
	W2	the physiological fundamentals / mechanisms of sensation and perception, movement and maintenance of body posture, physiological fundamentals of behavior, endocrinology (hypothalamic-pituitary axis, peripheral endocrine glands and tissue hormones), regulation of blood flow in vessels, gas exchange as well as the species differences in the functioning of organs / systems and their physiological parameters (digestive system - specificity of digestion in ruminants, hermeregulation, kidney, reproductive system, pregnancy and lactation, physiology of birds)	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09, BTj_K3_W10
	W3	the methods of examining parameters determining the physiological state of the body such as: the nervous system (chronaxie, rheobase, conduction speed); skeletal muscle mechanics; physiological parameters of the cardiovascular system (stroke volume, minute volume, etc., blood pressure); respiratory system (air volumes); peripheral blood morphological analysis, methods of testing kidney function, indirect transformation	BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W09
	W4	the mechanisms integrating the functioning of the whole organism and maintaining the body's homeostasis (CNS, AUN, transmitters, co-transmitters, neuromodulators in the nervous system, hormones, eicosanoids, cytokines, growth factors, circulatory system, thermoregulation, water and electrolyte balance, acid-base balance, metabolism and energy)	BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W09
	W5	the functional connections between the organs / tissues and the disturbances in the functioning of the organs as examples of malfunctioning of the body	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09
	W6	the concepts of intellectual property protection	BTj_K3_W14
Skills: (In terms of skills, the graduate can)	U1	explain the physiological mechanisms / molecular mechanisms of cellular structures / organs / systems such as: the nervous system, CNS, AUN, skeletal muscles, heart muscle, cardiovascular system, sense organs, respiratory system	BTj_K3_U04_inz, BTj_K3_U14_inz
	U2	explain the physiological fundamentals / mechanisms of sensation and perception, movement and maintenance of body posture, physiological fundamentals of behavior, endocrinology (hypothalamic-pituitary axis, peripheral endocrine glands and tissue hormones), regulation of blood flow in vessels, gas exchange	BTj_K3_U04_inz, BTj_K3_U14_inz
	U3	indicate how the discussed tissues / organs / systems can affect each other and what are the consequences for the functioning of the body	BTj_K3_U04_inz, BTj_K3_U14_inz
	U4	indicate the parameters describing the physiological state of the organs / systems in question - can define the physiological (health) state of the body and can plan and carry out a simple experiment allowing the analysis of physiological parameters	BTj_K3_U04_inz, BTj_K3_U14_inz
	U5	perform a morphological analysis of peripheral blood by a traditional method, spirometry by various methods and examine blood saturation and can analyze information from publicly available databases, including scientific ones	BTj_K3_U04_inz, BTj_K3_U14_inz

Social competences: (Within the scope of competence, the graduate is ready to)	K1	evaluate and interpret the functioning of the body / systems / organs / cells in the context of the activities of the nervous system, CNS, ANS, skeletal muscle, cardiac muscle, cardiovascular system, sense organs, respiratory system, endocrine system, smooth muscle activity, digestive system, liver, pancreas, respiratory system, blood, kidney, reproductive system of the female and male, mammary gland, adipose tissue, their mutual impact, their interactions and ensure the homeostasis of the body	BTj_K3_K02, BTj_K3_K05, BTj_K3_K06
	K2	constantly update the knowledge in accordance with the latest general information and is ready to use scientific sources to expand this knowledge	BTj_K3_K02, BTj_K3_K05, BTj_K3_K06
	K3	cooperate with other people through consultations by sharing the knowledge and is ready to apply the knowledge and skills in further stages of education	BTj_K3_K02, BTj_K3_K05, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:	Understanding the physiological processes at the level of cells, tissues, systems and selected organs. Getting to know the mechanisms regulating the course of physiological processes, including the role of the nervous and endocrine systems. Tracing the course of physiological processes using computer simulations in the PhysioEx program as well as on the basis of laboratory exercises in the field of digestive physiology. Cell excitability, physiology of the nervous system, presentation of the structure and functions of the autonomic nervous system, physiology of the heart and circulatory system, discussion of the process of hemopoiesis, blood function and the role of its components, discussion of the digestive processes in the stomach of monogastric animals and the mechanisms of their regulation, specificity of digestion in the stomach of ruminants, the synthesis of the protein of microorganisms in the rumen and methods of its evaluation, the role of the pancreas and the liver in the processes of digestion and absorption in the small intestine, as well as the effects of plant anti-nutritional factors, mechanisms and regulation of hormone secretion and their role in maintaining homeostasis in the body, in processes in females and males and during lactation.		
Examination methods:	Written exam, Oral exam, Written credit, Oral credit, Test (written or computer based)		

Subject name:		Physiology of microorganisms	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the impact of environmental factors on the growth of microorganisms	BTj_K3_W04, BTj_K3_W08, BTj_K3_W09, BTj_K3_W14
	W2	the relations between microorganisms in the biotechnological processes	BTj_K3_W01_inz, BTj_K3_W07_inz, BTj_K3_W09, BTj_K3_W10, BTj_K3_W12, BTj_K3_W13_inz
Skills: (In terms of skills, the graduate can)	U1	interpret the results of the performed experiments	BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U10_inz, BTj_K3_U12_inz, BTj_K3_U13_inz, BTj_K3_U21
	U2	assess the usefulness of microorganisms for the production of the desired metabolites	BTj_K3_U11_inz, BTj_K3_U12_inz, BTj_K3_U21, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	assess the benefits and risks associated with the use of microorganisms in biotechnological processes	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Metabolism of microorganisms, the sources and methods of processing energy in the cells of yeast, mould and bacteria as well as the application of these changes to the generation of the desired metabolites. The physiological functions of microorganisms. Characteristics of metabolism. The sources of energy and its processing in the cell. Substrate transformations during breathing and the fermentation of microorganisms. Reproduction and cell growth (e.g. under starvation). Processing of chemical energy. Aerobic and anaerobic respiration of microorganisms. Fermentations as the physiological function of microorganism cells: alcohol, butyric, acetone-butanol, propionic, lactic and citric.	
Examination methods:		Written credit, Report, Test (written or computer based)	

Subject name:		Enzymology and Biochemical Technics	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the information on chemical, physical, molecular and thermodynamic enzyme action	BTj_K3_W05, BTj_K3_W07_inz
	W2	the mechanisms of action of inhibitors	BTj_K3_W05, BTj_K3_W07_inz, BTj_K3_W08
	W3	how to purify enzymes and measure their activity	BTj_K3_W04, BTj_K3_W05, BTj_K3_W07_inz, BTj_K3_W08
	W4	the apparatus considerations for working with enzymes	BTj_K3_W04, BTj_K3_W07_inz
	U1	study the kinetics and inhibition of an enzymatic reaction	BTj_K3_U05_inz, BTj_K3_U06_inz, BTj_K3_U20, BTj_K3_U21
	U2	calculate concentrations of solutions used for enzymatic determinations	BTj_K3_U16, BTj_K3_U20, BTj_K3_U21
	K1	apply skills in practice	BTj_K3_K02, BTj_K3_K05
Course content ensuring the achievement of learning outcomes:		The structure, specificity and action of enzymes and their mechanisms of catalysis, regulation and kinetics. Familiarization with the phenomena of enzymatic inhibition and how to determine them. Techniques for purification and measurement of enzyme activity and the importance of enzymes in metabolism and the application of enzyme systems in biotechnological processes.	
Examination methods:		Written exam, Report, Assessment of work in the laboratory	

Subject name:		General virology	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the properties of viruses that distinguish them from microorganisms	BTj_K3_W06
	W2	the different replication method of viruses compared to microorganisms	BTj_K3_W09, BTj_K3_W10
Skills: (In terms of skills, the graduate can)	U1	choose the right method of virus multiplication depending on the needs and possibilities	BTj_K3_U01_inz, BTj_K3_U02_inz
	U2	apply the basic methods of virological diagnostics	BTj_K3_U01_inz, BTj_K3_U02_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	convey his knowledge in the field of virology in a way that is understandable to the average recipient	BTj_K3_K01, BTj_K3_K02, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Information in the field of general virology to understand the non-microbial nature of viruses as intracellular infectious agents. Data and definitions describing the characteristics of the virus as a subcellular infectious biological microstructure. Differences between viruses and microorganisms, and the morphology and chemical composition of virions. Structure and functions of the viral genome, virus replication - types of infections and their consequences for the cell, including productive infection, non-productive infection with the mechanisms and consequences of virus-cell interaction, including viral oncogenesis. Infectious subviral agents and contemporary threat problems related to viral infections.	
Examination methods:		Written credit, Assessment of work in the laboratory	

Subject name:		Veterinary microbiology	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the information on the nature of infectious agents, and the pathogenesis of infectious diseases	BTj_K3_W06, BTj_K3_W09
	W2	the molecular basis of microbial virulence	BTj_K3_W03, BTj_K3_W06, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	learn the principles and techniques of working in a microbiology laboratory	BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U21
	U2	skillfully interpret the results of basic microbiological tests	BTj_K3_U21, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	interpret basic microbiological tests	BTj_K3_K02, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		The microbiological research techniques, working with live infectious agents and interpretation of the obtained results, identification of selected groups of bacteria. Understanding the molecular mechanisms of pathogenicity of microorganisms and their relationship with the host. Learning the mechanisms of resistance of microorganisms to antibiotics.	
Examination methods:		Written credit, Report	

Subject name:		Preparative anatomy	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the information on animal body structure	BTj_K3_W09
	W2	the techniques of preparation of the animal body	BTj_K3_W01_inz, BTj_K3_W07_inz
	W3	the relationship between the structure of organs and their functions	BTj_K3_W05
Skills: (In terms of skills, the graduate can)	U1	prepare anatomical specimens in order to use them in experimental work	BTj_K3_U01_inz, BTj_K3_U21
	U2	safely use anatomical tools	BTj_K3_U06_inz, BTj_K3_U07
	U3	recognize anatomical structures on the basis of source information and illustrations contained in e.g. atlases	BTj_K3_U12_inz, BTj_K3_U16
Social competences: (Within the scope of competence, the graduate is ready to)	K1	treat animal cadavers ethically and respectfully	BTj_K3_K07
	K2	work in a team during preparation	BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Muscles of the thoracic limb, muscles of the head, neck and trunk, muscles of the pelvic limb. The most important muscle attachments and functions, their innervation. The course of blood vessels supplying the head and limbs. Aorta, thoracic and abdominal arteries, Superficial veins. Cranial nerves, nerves of the thoracic limb, nerves of the pelvic limb. Internal organs and their location in body cavities.	
Examination methods:		Test (written or computer based), Assessment of work in the laboratory	

Subject name:		Food microbiology	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the concepts related to safety and hygiene of the production process of food, the impact of hygiene on the health safety of food	BTj_K3_W09, BTj_K3_W11
	W2	the processes of microbiological spoilage of raw materials and food products	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09, BTj_K3_W10
	W3	the pathogens carried by water and food	BTj_K3_W06, BTj_K3_W09
	U1	use different methods in assessment of the microbiological quality of raw materials and various types of food	BTj_K3_U05_inz, BTj_K3_U06_inz, BTj_K3_U21
	U2	use diagnostic methods to assess the microbiological quality of raw materials and food of plant and animal origin	BTj_K3_U05_inz, BTj_K3_U21
	K1	apply knowledge in the implementation of diagnostics in social projects	BTj_K3_K02, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Characteristic groups of microorganisms that cause contamination of raw materials and various types of food products, the influence of factors on the microbiological quality of food, characteristics of food-borne pathogens and the role of beneficial microorganisms in food fermentation.	
Examination methods:		Written credit	

Subject name:		The biotechnological use of microorganisms	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the biotechnological processes in which microorganisms are used	BTj_K3_W01_inz, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	use of microorganisms and analytical methods in the biotechnological process by working independently and in a team on a designated task	BTj_K3_U12_inz, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	present a research project	BTj_K3_K04
Course content ensuring the achievement of learning outcomes:		The biotechnological processes used in the food industry. Characteristics of microorganisms and selection of microorganisms used in biotechnology. Biotechnological sourcing of bioactive substances and their importance in industry.	
Examination methods:		Written credit, Project, Assessment of speeches during classes, Assessment of activity during classes	

Subject name:		Plant physiology II	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the life processes of the plant	BTj_K3_W04, BTj_K3_W05, BTj_K3_W06, BTj_K3_W07_inz
	W2	the influence of environmental and endogenous factors on the course of physiological processes in plants	BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	analyze the influence of environmental and endogenous factors on the course of physiological processes in plants (e.g. the effect of hormones on seed germination, allelopathy)	BTj_K3_U05_inz, BTj_K3_U06_inz
	U2	search for and use the necessary information from various sources and use them creatively to achieve the set goal	BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	select and evaluate basic experimental methods for studying the physiological responses of a plant	BTj_K3_K01, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		The mechanisms of regulation of life processes at various stages of ontogenesis - from seed germination to plant aging. Seed dormancy and germination. The impact of endogenous and exogenous factors on seed germination. Allelopathy, mechanisms of allelopathic interactions. The mechanisms of plant reaction to environmental stresses, allelopathy. Reactive oxygen species. Induction of oxidative stress and activation of the antioxidant system.	
Examination methods:		Presentation	

Subject name:		Chloroplasts biology	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the chloroplast structure and function	BTj_K3_W05, BTj_K3_W06, BTj_K3_W08
	W2	the general information on processes in chloroplasts and analysis of chloroplast function	BTj_K3_W05, BTj_K3_W07_inz, BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	use basic methods in chloroplast analysis	BTj_K3_U03, BTj_K3_U05_inz, BTj_K3_U06_inz
	U2	interpret experimental results from experiments related to chloroplast physiology	BTj_K3_U03, BTj_K3_U05_inz, BTj_K3_U06_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	experiment planning and data analysis related to chloroplast function	BTj_K3_K01, BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		Knowledge about the structure and function of chloroplast, metabolic processes in chloroplasts, and tools to analyze chloroplast function. Organisation of chloroplast genome. Expression of chloroplast genes: synthesis and editing of RNA, translation. Chloroplast biogenesis. Dynamics of photosynthetic membranes. Protein import into chloroplasts and protein maturation. Photosynthetic electron transport and photoprotection. Chloroplast retrograde signalling.	
Examination methods:		Written credit, Report	

Subject name:		Genetic engineering I	ECTS: 6
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the genetic material analysis and manipulation	BTj_K3_W01_inz, BTj_K3_W05, BTj_K3_W15_inz
	W2	the field of molecular research and molecular diagnostics	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W05
Skills: (In terms of skills, the graduate can)	U1	work with genetic material and can transform plants	BTj_K3_U01_inz, BTj_K3_U02_inz, BTj_K3_U10_inz, BTj_K3_U12_inz, BTj_K3_U13_inz
	U2	search for information from various sources and use it creatively	BTj_K3_U01_inz, BTj_K3_U02_inz
	U3	prepare a scientific poster in the field of genetic engineering	BTj_K3_U01_inz, BTj_K3_U02_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	understand the social importance of genetic manipulation	BTj_K3_K01, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		The role of genetic engineering in changing basic biological processes for research and application purposes. Potential application of biotechnological achievements in diagnostics, therapy or agriculture. Genetic engineering introduction and historical overview. Nobel News - discussion. Genetic engineering tools. Crisp/Cas9 technologies. Vectors. Long fragment libraries. Library browsing methods. Use of libraries. Introduction to omics analysis.	
Examination methods:		Written exam, Written credit, Project	

Subject name:		Basics of bioinformatics	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the databases of biological sequences and scientific literature	BTj_K3_W04, BTj_K3_W05, BTj_K3_W07_inz, BTj_K3_W12, BTj_K3_W13_inz
	U1	edit and describe newly sequenced nucleic acid molecules as well as the sequence nucleic acid and protein from the database, and can design primers for PCR reactions	BTj_K3_U15_inz, BTj_K3_U17, BTj_K3_U19, BTj_K3_U22
Skills: (In terms of skills, the graduate can)	U2	infer the putative function of an unknown biological sequence based on himself comparisons made to other sequences in databases	BTj_K3_U12_inz, BTj_K3_U17, BTj_K3_U18, BTj_K3_U22
	K1	solve simple bioinformatics problems and deepening knowledge based on database	BTj_K3_K01
Social competences: (Within the scope of competence, the graduate is ready to)			
Course content ensuring the achievement of learning outcomes:		<p>Concepts related to the analysis of fast-growing sequential, structural and functional data. Principles of analysis of own results in the context of other genomic data (transcriptomes, proteomes, metabolomes). Databases and computer programs. Bioinformatics tools and interpretation of obtained results. Biological databases, data formats, inquiry form. Comparing 2 sequences, amino acid similarity, similarity tables, similarity factor, similarity search in databases, FASTA and BLAST algorithms, expect value. Methods of reading and processing sequence data (Chromas). Preparation of a restriction map (REMAP program from the EMBOSS package). Reading frames using an application from the EMBOSS package (PLOT ORF, SHOW ORF and GET ORF). Generating a protein sequence based on a nucleotide sequence (TRANSEQ program from the EMBOSS package) Basic sequence databases (DDBJ, EMBL, GenBank). Protein sequence databases. Genomic browsers. Reaching various sources of biological information via ExPASy server, databases: Swiss Prot, PROSITE. Principles of primer design, basic and advanced parameters, programs: OLIGO, eprimer3 (EMBOSS)), PRIME (GCG).</p>	
Examination methods:		Written credit, Project	

Subject name:		Biotechnological methods at environmental protection	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the processes and devices used in wastewater treatment	BTj_K3_W01_inz, BTj_K3_W03, BTj_K3_W13_inz, BTj_K3_W15_inz
	W2	the processes and devices used in sewage sludge treatment	BTj_K3_W01_inz, BTj_K3_W03, BTj_K3_W13_inz, BTj_K3_W15_inz
Skills: (In terms of skills, the graduate can)	U1	calculate the required efficiency of wastewater treatment plants and mass balances of equipment	BTj_K3_U10_inz, BTj_K3_U13_inz
	U2	perform measurements of basic parameters characterizing wastewater and activated sludge	BTj_K3_U05_inz, BTj_K3_U06_inz, BTj_K3_U13_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	presenting opinions on technologies used in wastewater treatment plants and providing the public with reliable knowledge about the impact of wastewater on the environment	BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Qualitative and quantitative characteristics of wastewater. Pollutant loads and population equivalent. Legal conditions of wastewater disposal to the environment and sewage system. Processes and technologies of physicochemical wastewater treatment; aerobic and anaerobic wastewater treatment; activated sludge and biofilm; integrated removal of carbon and nutrients. Technological systems and equipment of municipal and industrial wastewater treatment plants. Characteristics of sewage sludge and sludge management in a wastewater treatment plant. Reliable amount of wastewater, pollutant loads, the necessary efficiency of a wastewater treatment plant, and balancing pollutants in a wastewater treatment plant. Physical and chemical analysis of wastewater, characteristics of activated sludge. Analysis of the technological system of the technical object of the wastewater treatment plant.	
Examination methods:		Written exam, Test (written or computer based)	

Subject name:		Physiomics	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the structure of plant and animal cells and the physiological processes	BTj_K3_W04, BTj_K3_W05, BTj_K3_W06
	W2	the physiomic approach integrates the entire plant metabolism at all levels of its organization into one network of mutual dependencies	BTj_K3_W04, BTj_K3_W05, BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W10, BTj_K3_W12
	W3	the importance of a holistic and systemic approach to the functioning of plants, starting from the molecular level, through cells, tissues and organs, and ending with the entire plant organism	BTj_K3_W03, BTj_K3_W04, BTj_K3_W05, BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W09, BTj_K3_W10, BTj_K3_W12, BTj_K3_W13_inz
	W4	the mechanisms of gene expression	BTj_K3_W08, BTj_K3_W10
Skills: (In terms of skills, the graduate can)	U1	comprehensively assess the complexity of biochemical signals occurring in plants	BTj_K3_U01_inz, BTj_K3_U02_inz, BTj_K3_U03, BTj_K3_U04_inz, BTj_K3_U05_inz, BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U08_inz, BTj_K3_U09_inz, BTj_K3_U10_inz, BTj_K3_U11_inz, BTj_K3_U12_inz, BTj_K3_U13_inz, BTj_K3_U14_inz, BTj_K3_U15_inz, BTj_K3_U16, BTj_K3_U17, BTj_K3_U18, BTj_K3_U19, BTj_K3_U21, BTj_K3_U22
	K1	identify significant mechanisms influencing the physiology of plants, which should be analyzed in more detail in the systems studied	BTj_K3_K02, BTj_K3_K06, BTj_K3_K07
Social competences: (Within the scope of competence, the graduate is ready to)	K2	recognize the complexities of signal conduction mechanisms in plants	BTj_K3_K01

<p>Course content ensuring the achievement of learning outcomes:</p>	<p>A comprehensive (holistic) approach to the functioning of the plant organism, the adaptation of plant life strategies to changing environmental conditions resulting from evolutionary processes. Specialist terminology used in plant physiomics. Differences in structure and function between plant and animal cells. Photosynthesis, structure and function of the photosynthetic apparatus, mechanism of action and regulation of the photosynthetic electron transport chain, extinction and dissipation of excess excitation energy (NPQ). Breathing and the respiratory electron transport chain. Interrelationship between respiration and photosynthesis. Regulation of plant temperature and NPQ, the role of NPQ in the mechanism of light cell memory and plant acclimatization, regulation of growth and yield. The role of chloroplast retrosignals in the coordination of plant responses to environmental stresses and the regulation of gene expression, the role of cis and trans regulatory elements. Molecular physiology of biotic and abiotic stress in plants. Cellular automaton and intelligent signal network in plants, regulation of transpiration and water consumption efficiency. Electrical signals in plants and their role.</p>
<p>Examination methods:</p>	<p>Written exam</p>

Subject name:		Fundamentals of design and development of technological lines	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the principles of designing and technological lines in the field of biotechnology	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W03, BTj_K3_W04
	W2	the need to identify the conditions related to the design of technological lines or plants depending on the location, raw material base, and market situation, the size and type of production waste, ways of its management or disposal, and the possibility of implementing selected quality standards, taking into account the adaptation to the guidelines contained in applicable standards and legal regulations of the country	BTj_K3_W01_inz, BTj_K3_W03, BTj_K3_W04, BTj_K3_W11, BTj_K3_W15_inz
	U1	design a technological line or a production plant as part of teamwork	BTj_K3_U15_inz, BTj_K3_U20
	K1	use computer-aided design programs such as AutoCAD and search for information and news available in libraries, the Internet, engineering and design companies, etc. and creative use in achieving the set goal	BTj_K3_K01, BTj_K3_K05
	K2	cooperate with other specialists in the design of technological lines or industrial plants	BTj_K3_K02, BTj_K3_K05
Course content ensuring the achievement of learning outcomes:		The principles of technological design of food industry plants, computer aided design, CAD applications and packages, construction issues, land development concept, safety and quality of biotechnological products, and ecological aspects.	
Examination methods:		Written credit, Project, Assessment of activity during classes	

Subject name:		Social and legal aspects of biotechnology, part I	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the national and international legal regulations concerning the use of biotechnology	BTj_K3_W10, BTj_K3_W14, BTj_K3_W15_inz
	U1	understand the issues of biosafety of biotechnology	BTj_K3_U07, BTj_K3_U12_inz, BTj_K3_U13_inz
	U2	discuss the possibilities of protecting intellectual property rights in biotechnology	BTj_K3_U08_inz, BTj_K3_U13_inz, BTj_K3_U18
	K1	discuss the issues related to social perception and acceptance of biotechnology in Poland and in the world	BTj_K3_K06, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		The most important issues related to the public perception of biotechnology and the legal regulations creating the legal framework for the use of biotechnology, with particular emphasis on GMOs. Biotechnology and conditions for its development. Social perception of biotechnology. Biological safety and biohazards. International law related to biotechnology. National law on biotechnology with particular emphasis on GMOs. Forms of intellectual property in biotechnology. Patenting in biotechnology.	
Examination methods:		Essay, Test (written or computer based)	

Subject name:		Immunology	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the structure and functions of individual parts of the immune system in the context of the physiology of other body systems	BTj_K3_W02_inz, BTj_K3_W06
	W2	the mechanisms of innate and adaptive immunity	BTj_K3_W02_inz, BTj_K3_W06, BTj_K3_W08
	W3	the mechanisms responsible for general and local immune response induction as well as the methods required for the assessment of those types of immune responses	BTj_K3_W06, BTj_K3_W08
	W4	the mechanisms of regulation of the immune response induced by infectious agents and cancer	BTj_K3_W06, BTj_K3_W08, BTj_K3_W10
	W5	the types of vaccines, understands the mechanisms of their mode of action, and the need for immunoprophylaxis of infectious diseases in humans and animals	BTj_K3_W02_inz, BTj_K3_W08, BTj_K3_W10
	W6	the mechanisms related to the transfer of passive immunity from the mother and understands the causes of immune disorders related to maternal antibodies	BTj_K3_W05, BTj_K3_W06, BTj_K3_W08, BTj_K3_W10
	W7	the mechanisms and describes the development of all types of hypersensitivity reactions and the consequences resulting from these mechanisms	BTj_K3_W05, BTj_K3_W06, BTj_K3_W08, BTj_K3_W10
	W8	the causes and effects of the innate and adaptive immunodeficiencies	BTj_K3_W02_inz, BTj_K3_W05, BTj_K3_W06
	W9	the basis of autoimmune diseases in humans and animals	BTj_K3_W05, BTj_K3_W10
	W10	the importance of the use of serological tests (qualitative and quantitative) in the diagnosis of infectious diseases and the relationship between selected disciplines within the areas of natural sciences	BTj_K3_W04, BTj_K3_W07_inz, BTj_K3_W10
Skills: (In terms of skills, the graduate can)	U1	prepare serum for serological assays	BTj_K3_U01_inz, BTj_K3_U03
	U2	perform a simple serological test (quantitative and qualitative serological assays like agglutination test, immunodiffusion assay, and neutralization test) and can interpret the results of serological tests in the context of the diagnosis of infectious diseases	BTj_K3_U01_inz, BTj_K3_U03
	U3	use monoclonal antibodies conjugated with the appropriate markers in the context of the diagnosis of infections and the assessment of the patient's health (immunofluorescence, immunoenzyme, and radioimmunological assays) and can detect antibodies in the patient's serum or other identification of an infectious agent	BTj_K3_U01_inz, BTj_K3_U03
	U4	isolate specific populations of immunocompetent cells and determine their activity using immunoenzyme and immunofluorescence techniques, and molecular biology techniques	BTj_K3_U01_inz

Social competences: (Within the scope of competence, the graduate is ready to)	K1	formulate the opinions in context of the importance of immunology and serological tests, applied in the diagnosis of infectious diseases, autoimmune diseases, and the identification of immunodeficiencies	BTj_K3_K01
	K2	use immunoprophylaxis against infectious diseases of humans and animals	BTj_K3_K02
	K3	apply the acquired knowledge and skills in further stages of education	BTj_K3_K02, BTj_K3_K03
	K4	cooperate with other colleagues by exchanging opinions and sharing the competences	BTj_K3_K04, BTj_K3_K06
	K5	constantly deepen the knowledge and improve own skills with the use of scientific resources	BTj_K3_K02, BTj_K3_K04, BTj_K3_K05
Course content ensuring the achievement of learning outcomes:	The innate and adaptive protective mechanisms and their relationships and dependencies in health and disease. The development of immunity in the course of infectious diseases. The evasion of immune mechanisms by infectious agents.		
Examination methods:	Written exam, Written credit		

Subject name:		Veterinary virology	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the concepts describing the replication of viral genomes and the most important features distinguishing the molecular mechanisms of replication of viral genomes belonging to different classes	BTj_K3_W08
	U1	explain the differences in the functioning of viral genomes depending on the type and class of nucleic acid	BTj_K3_U17
	U2	use basic virological laboratory techniques	BTj_K3_U01_inz
	K1	work safely in a virology laboratory	BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Extended information in the field of virology covering the most important families of viruses pathogenic to animals and humans, taking into account family-specific genome replication strategies. Types and classes of nucleic acids that form genomes of different families of viruses. DNA-virus genome replication strategies. Replication strategies of RNA-virus genomes.	
Examination methods:		Written credit	

Subject name:		Bioactive substances in human and animal nutrition	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the division, chemical structure, origin and methods of obtaining biologically active compounds of plant and animal origin	BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W09
	W2	the influence of individual biologically active compounds on selected biochemical processes occurring in the cell, tissue and in a given organ	BTj_K3_W13_inz, BTj_K3_W14
Skills: (In terms of skills, the graduate can)	U1	determine the effect of biologically active compounds on the rate of biochemical transformations occurring in the organ in both physiological and pathophysiological states	BTj_K3_U22
	U2	isolate biologically active compounds in order to preserve their highest biological value	BTj_K3_U05_inz, BTj_K3_U11_inz
	U3	identify potential advantages and disadvantages of using biologically active compounds	BTj_K3_U05_inz, BTj_K3_U11_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	take responsibility for making decisions regarding the communication of information on the role of biologically active compounds in human and animal nutrition	BTj_K3_K01, BTj_K3_K06
	K2	improve his/her knowledge and skills	BTj_K3_K01, BTj_K3_K06, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		The latest knowledge on the mechanisms of action of biologically active compounds of plant and animal origin on humans. Food enrichment, nutrient supplementation and functional food. Division, occurrence and chemical structure of biologically active substances. Flavonoids - structure, occurrence, bioavailability, mechanisms of influence on the cell and the whole organism. The use of taurine and carnitine in human and animal nutrition. Digestive enzyme inhibitors. Vegetable lectins. Methods of eliminating anti-nutritional factors. The use of modern methods in the study of food supplements. The importance of free radical mechanisms in the formation of certain diseases. Possibilities of using biologically active compounds in diet prophylaxis and diet therapy - examples of application. Protein and peptide biologically active food ingredients. Biologically active lipid compounds - influence on the body's metabolism (essential fatty acids, long-chain fatty acids, conjugated diets, trans acids, lipid components of the cell membrane, vitamins and other lipid-soluble compounds.	
Examination methods:		Written credit	

Subject name:		Biotechnological use of bacteria	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the lists of prokaryotic organisms in biotechnology	BTj_K3_W06, BTj_K3_W09
	W2	the mechanisms of regulation of bacterial metabolism in order to overproduce metabolites	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09, BTj_K3_W13_inz
	W3	the bacteria used in the biotechnological process and the conditions of their cultivation in order to produce the desired metabolite	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09, BTj_K3_W13_inz
Skills: (In terms of skills, the graduate can)	U1	carry out the process of obtaining selected biotechnological products with the use of bacteria	BTj_K3_U01_inz, BTj_K3_U06_inz, BTj_K3_U21
	U2	use basic experimental and analytical techniques important in the control of biotechnological processes involving bacteria	BTj_K3_U01_inz, BTj_K3_U06_inz
	U3	interpret the results of determinations important in biotechnological processes involving bacteria and formulate conclusions	BTj_K3_U21
Social competences: (Within the scope of competence, the graduate is ready to)	K1	apply knowledge in the microbial and biotechnological laboratory	BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		The methods and goals of the biotechnological use of bacteria for the overproduction of selected compounds and the techniques of their acquisition and purification. Overview of the conditions for obtaining selected biotechnological products with the participation of bacteria and the regulation of their metabolism. Traditional and innovative applications of bacteria in various branches of biotechnology.	
Examination methods:		Written credit, Report	

Subject name:		Biotechnological use of moulds	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the lists of moulds organisms in biotechnology	BTj_K3_W06, BTj_K3_W09
	W2	the mechanisms of regulation of fungal metabolism in order to overproduce metabolites	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09, BTj_K3_W13_inz
	W3	the moulds used in the biotechnological process and the conditions of their cultivation in order to produce the desired metabolite	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09, BTj_K3_W13_inz
Skills: (In terms of skills, the graduate can)	U1	carry out the process of obtaining selected biotechnological products with the use of moulds	BTj_K3_U01_inz, BTj_K3_U06_inz, BTj_K3_U21
	U2	use basic experimental and analytical techniques important in the control of biotechnological processes involving moulds	BTj_K3_U01_inz, BTj_K3_U06_inz
	U3	interpret the results of determinations important in biotechnological processes involving moulds and formulate conclusions	BTj_K3_U21
Social competences: (Within the scope of competence, the graduate is ready to)	K1	apply knowledge in the microbial and biotechnological laboratory	BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Methods and goals of the biotechnological use of moulds for the overproduction of selected compounds and the techniques of their acquisition and purification. Presentation of the in-depth characteristics of mould in terms of applications in biotechnology. Overview of the conditions for obtaining selected biotechnological products with the participation of mould and the regulation of their metabolism. Traditional and innovative uses of moulds and their metabolites.	
Examination methods:		Written credit, Report	

Subject name:		Basic of hygiene in food processing	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the information on so-called sanitary minimum entitling to work in contact with foodstuffs	BTj_K3_W11, BTj_K3_W15_inz
	W2	the methods of water treatment and disinfection, the technical, hygienic and sanitary requirements for food industry plants and the current issues of food legislation in the field of production hygiene	BTj_K3_W11, BTj_K3_W15_inz
	W3	the organization of sanitary supervision over food production in Poland and the European Union	BTj_K3_W11, BTj_K3_W14, BTj_K3_W15_inz
	U1	carry out the correct process of cleaning and disinfecting devices, technological lines and packaging, and can select washing and/or disinfecting agents depending on the type of contamination	BTj_K3_U07
	U2	design an effective cleaning and/or disinfection process and to control them	BTj_K3_U07
	U3	plan the air purification process in the plant and control its condition	BTj_K3_U07
	U4	characterize pathogenic microorganisms present in food	BTj_K3_U07
	K1	apply the knowledge and skills into practice	BTj_K3_K03, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Hygiene techniques in food production plants, legal regulations related to these issues and methods of control in this regard. Cleaning and disinfection processes. Cleaning and disinfecting agents. Obligations of employees and employers in the field of production hygiene, an exemplary hygiene plan, disinfestation, deratization, effectiveness control of cleaning and disinfection, cleaning and disinfection of packaging. Air and water cleanliness in plants. Technical, hygienic and sanitary requirements for plants. Production hygiene legislation. Organization of sanitary supervision over food production: pathogenic microorganisms in food.	
Examination methods:		Written credit	

Subject name:		Green synthesis of metal nanoparticles	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	how to develop a task plan related to the researcher's needs	BTj_K3_W01_inz
	W2	the methods of synthesis of nanostructures employing plant materials	BTj_K3_W07_inz
Skills: (In terms of skills, the graduate can)	U1	plan the synthesis of nanostructures with the use of selected plant materials	BTj_K3_U01_inz
	U2	prepare a written study in the field of scientific discipline relevant for the field of study	BTj_K3_U02_inz, BTj_K3_U13_inz, BTj_K3_U14_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	develop research on the green synthesis of nanostructures	BTj_K3_K01
Course content ensuring the achievement of learning outcomes:		Synthesis of metallic nanoparticles. Physical, chemical and biological methods of nanostructure synthesis. The use of living organisms in the synthesis of nanoparticles. Optimization of nanoparticle synthesis through the selection of reducing agents and other reaction parameters. Physicochemical characteristics of the resulting nanostructures.	
Examination methods:		Written credit, Project	

Subject name:		Biology of plant-microbe interactions	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the mechanisms of structural and functional responses of plants to infection with symbiotic and pathogenic microorganisms	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09, BTj_K3_W10
	W2	the roles played by symbiotic interactions in environment	BTj_K3_W09, BTj_K3_W10
	W3	the structural and cytological basis on plant defence mechanism to different pathogens	BTj_K3_W09, BTj_K3_W10
Skills: (In terms of skills, the graduate can)	U1	select suitable sources of information and prepare properly-documented research report concerning structure and functions of plant responses in symbiotic and pathogenic interactions	BTj_K3_U03, BTj_K3_U04_inz, BTj_K3_U15_inz, BTj_K3_U18, BTj_K3_U19, BTj_K3_U20, BTj_K3_U21, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	organize own and team work and take the responsibility for effects of these activities	BTj_K3_K01, BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		Structural, functional and molecular responses of susceptible and resistant host plants to infection with fungi (Uredinales), plant parasitic nematodes, viroids, viruses and phytoplasmas. Structural, functional and molecular responses of plants in interactions with symbiotic nitrogen-fixing bacteria (<i>Rhizobium</i> sp.), mycorrhiza and other diazotrophic symbioses (<i>Frankia</i> and cyanobacteria). Methods of obtaining plants with artificial resistance to pathogens.	
Examination methods:		Essay	

Subject name:		Herbivorous invertebrates and their enemies	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the principles of integration of non-chemical methods in Integrated plant protection (IPM)	BTj_K3_W10
	W2	the key principles allowing for the identification of the most economically important pests	BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	analyze and explain tri-trophic interactions (plant - pest - enemies) and identify the advantages for humans and the environment resulting from the application of the chosen non-chemical methods decreasing pest population density	BTj_K3_U14_inz
	U2	procure information from various sources, analyze it, report (in form of essays, reports and/or laboratory reports) and draw conclusions, both individually and in a team	BTj_K3_U20, BTj_K3_U21, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	update and broaden their knowledge and skills	BTj_K3_K01
	K2	develop and implement non-chemical methods before the application of synthetic pesticides becomes necessary	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		The biology of herbivorous invertebrates that attack crops and their natural enemies. The key aspects of sustainable plant protection against herbivorous invertebrates (e.g. pests) as a part of sustainable agriculture. Explaining mass pests appearances on crops. Explaining the Economic Injury Level (EIL) Concept. Presenting modern pest monitoring, signaling and forecasting methods. Discussing pest prevention methods (quarantine, agro-technical treatments, mixed crops, resistant crops) and interventional methods (mechanical, physical, biological, chemical) to decrease pest population density. Presenting integrated pest management (IPM) methods based on case studies.	
Examination methods:		Written credit, Test (written or computer based)	

Subject name:		Cell and tissue cultures	ECTS: 6
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the current state of knowledge on cell and tissue cultures	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W03, BTj_K3_W06
	W2	the construction, equipment and principles of operation (including health and safety regulations) of the plant and animal culture laboratory	BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W11
Skills: (In terms of skills, the graduate can)	U1	work sterile in a chamber with vertical laminar airflow of the 2nd class of biological safety and can use basic (and some advanced) techniques of in vitro culture	BTj_K3_U07, BTj_K3_U10_inz, BTj_K3_U12_inz, BTj_K3_U22
	U2	use optical devices to observe cells, tissues and organs in vitro: a fluorescent stereoscopic microscope and an inverted microscope image analyzer with a fluorescent attachment	BTj_K3_U06_inz, BTj_K3_U12_inz, BTj_K3_U15_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	constantly deepen the knowledge of the in vitro cultures, important for the development of modern plant biotechnology, and searching through various sources for information expanding this knowledge, as well as is ready to organize and present this knowledge	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		Knowledge and skills in the field of modern plant and animal biotechnology. Morphogenetic abilities of plant cells, preparation of plant material, nutrients, physical conditions of the culture. Growth regulators in plant in vitro cultures. methods of vegetative reproduction. Microbial contamination and antibiotic therapy. Obtaining haploid plants and doubled haploids; protoplast culture and fusion. Selection and testing of features in culture in vitro (somaclonal variability, selection conditions and its effectiveness). Types of cell culture and tissues;. Primary cultures: methods of isolation, purification and identification of cells on the example of cells of various organs. Establishing and running primary farms. Assessment of the physiological state of isolated cells: indicators of cell viability and metabolic activity. Cell lines: types, growth assessment, maintenance of cell lines, kinetics of cell culture, passage, development of cell lines; characteristics of selected cell lines; stem cells: sources of stem cells, methods of isolating and culturing stem cells; advantages and limitations of cell culture and tissues.	
Examination methods:		Written exam, Written credit, Project, Assessment of speeches during classes	

Subject name:		Statistics	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the distributions of random variables and estimation the parameters of the distribution	BTj_K3_W04, BTj_K3_W07_inz, BTj_K3_W12
	W2	the need for statistical inference about the population based on the sample results	BTj_K3_W04, BTj_K3_W07_inz, BTj_K3_W12, BTj_K3_W13_inz
Skills: (In terms of skills, the graduate can)	U1	choose the appropriate method for statistical data analysis	BTj_K3_U02_inz, BTj_K3_U04_inz, BTj_K3_U07
	U2	perform basic statistical analyzes	BTj_K3_U21
	U3	describe the performed statistical analyzes and draw conclusions	BTj_K3_U21
Social competences: (Within the scope of competence, the graduate is ready to)	K1	apply the known statistical methods in practice	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		The divisions of mathematical statistics and their practical use in the field of biotechnology. The tools for making analyzes useful in the performance and writing of an engineering thesis. Descriptive statistics (distribution series, data presentation, individual statistical measures) and the theory of probability (random events, random variable, theoretical distributions of a random variable), the statistical inference (point and interval estimation) and testing statistical hypotheses (assumptions of the theory verification of hypotheses, parametric and non-parametric hypotheses, errors, selected statistical tests), the regression and correlation analysis (types of dependence, correlation coefficient).	
Examination methods:		Written credit	

Subject name:		Genetic engineering II	ECTS: 6
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the genetic material analysis and manipulation	BTj_K3_W01_inz, BTj_K3_W05, BTj_K3_W15_inz
	W2	the field of molecular research and molecular diagnostics	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W05
Skills: (In terms of skills, the graduate can)	U1	work with genetic material, can transform plants	BTj_K3_U01_inz, BTj_K3_U02_inz, BTj_K3_U10_inz, BTj_K3_U12_inz, BTj_K3_U13_inz
	U2	search for information from various sources and use it creatively	BTj_K3_U01_inz, BTj_K3_U02_inz
	U3	prepare a scientific poster in the field of genetic engineering	BTj_K3_U01_inz, BTj_K3_U02_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	understand the social importance of genetic manipulation	BTj_K3_K01, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:	The role of genetic engineering in changing basic biological processes for research and application purposes. Potential application of biotechnological achievements in diagnostics, therapy or agriculture. The omics analysis. The genome and transcriptome, sequencing technology and molecular maps. Gene construction. The genomic modifications.		
Examination methods:	Written exam, Written credit, Project		

Subject name:		Industrial biotechnology	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the different stages of the production	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W03
	W2	the parameters of the process	BTj_K3_W08, BTj_K3_W12, BTj_K3_W13_inz, BTj_K3_W14, BTj_K3_W15_inz
Skills: (In terms of skills, the graduate can)	U1	give strains and conditions of the bioreactor for selected examples of biopolymers	BTj_K3_U05_inz, BTj_K3_U13_inz, BTj_K3_U15_inz, BTj_K3_U19, BTj_K3_U20
	U2	plan and organize work for the biotechnological process design, individually or in a team	BTj_K3_U13_inz, BTj_K3_U15_inz, BTj_K3_U20
Social competences: (Within the scope of competence, the graduate is ready to)	K1	cooperate in the group and use the proper data for the process design	BTj_K3_K01, BTj_K3_K04
Course content ensuring the achievement of learning outcomes:		The combination of engineering and biotechnological processes in order to produce selected food ingredients as well as pharmaceutical and chemical components: characteristics of the biotechnological process in combination with process engineering, organization and economic analysis of bioprocesses, and examples of selected production processes on an industrial scale (production of organic compounds, e.g. acetic acid, production of selected biopolymers: polysaccharides, amino acids and proteins, drugs and vaccines).	
Examination methods:		Written exam, Report	

Subject name:		R programming language	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the commands of the Linux operating system and software in this system	BTj_K3_W04
	W2	the concepts used in programming languages	BTj_K3_W04
	W3	the useful functions and types of charts for representing different types of data	BTj_K3_W04, BTj_K3_W06
	U1	efficiently navigate in the Linux command line environment and can create scripts and professional charts	BTj_K3_U01_inz, BTj_K3_U03
	K1	data analysis from experiments and their professional presentation	BTj_K3_K01, BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		The commands of the Linux system and selected programming languages and the possibility of using them for data presentation. The information about the graphical interface of the operating system Linux, the concepts about programming (constants, variables, functions and their arguments, types of data), and functions. The automate code (loops and conditional statements).	
Examination methods:		Project	

Subject name:		Nanotechnology and Neurobiology	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the terms and theories regarding neurophysiology and nerve cells as well as interplay between elements of nerve system in the living organism	BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W09, BTj_K3_W10
	W2	the terms and theories regarding nanotechnology and utilization of nanotechnology in biotechnology and medicine	BTj_K3_W01_inz, BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W10, BTj_K3_W13_inz
Skills: (In terms of skills, the graduate can)	U1	critically review available scientific knowledge and can draw his own opinion and conclusions from researched topic	BTj_K3_U04_inz, BTj_K3_U08_inz, BTj_K3_U22
	U2	present and discuss researched topic on the group forum	BTj_K3_U18, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	perform individual and group work and communication	BTj_K3_K01, BTj_K3_K02, BTj_K3_K06, BTj_K3_K07
	K2	formulate strategy regarding storage, actualization and enhancement of biotechnological knowledge	BTj_K3_K01, BTj_K3_K02, BTj_K3_K05, BTj_K3_K06, BTj_K3_K07
	K3	prepare and give a presentation of the thesis and defend presented arguments	BTj_K3_K01, BTj_K3_K02, BTj_K3_K05, BTj_K3_K06, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		Current knowledge regarding nerve system. Definitions and laws regarding nanotechnology. Application of nanotechnology in biotechnology and medicine. Nerve cells. Blood-brain barrier. Neuron and neuronal theory. Signal conduction and modulation. Degeneration, regeneration, neuronal growth. Cannon-Rosenbluth law. Development of nerve system. Development of brain. Migration of nerve cells. Synaptogenesis. Neuronal plasticity. Neurotrophic factors. Sex dimorphism of brain. Central and peripheral nerve system. Somatic nerve system. Autonomic nerve system. Limbic system. Instinct and control of behaviour. Pain. Sensory integration.	
Examination methods:		Written credit, Presentation	

Subject name:		Monoclonal antibodies - production and use	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the principles of the production and use of antibodies monoclonal in cytometric studies flow-through, ELISA, and immunocytochemistry methods	BTj_K3_W06, BTj_K3_W08
	W2	the principles of cell isolation from various biological materials, their preparation for immunophenotyping, and the evaluation of their activity using chosen monoclonal antibodies	BTj_K3_W06, BTj_K3_W08
	W3	the principles of work using the flow cytometry technique	BTj_K3_W07_inz
	U1	select and prepare monoclonal antibodies for flow cytometry, ELISA, and immunocytochemistry techniques	BTj_K3_U01_inz, BTj_K3_U14_inz
	K1	develop the skills needed in practice	BTj_K3_K02, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		The techniques of producing and using monoclonal antibodies in medicine (hematology, oncology), veterinary medicine (epizootiology) and biology. Nerve cells. Blood-brain barrier. Neuron and neuronal theory. Signal conduction and modulation. Degeneration, regeneration, neuronal growth, Cannon-Rosenbluth law. Development of nerve system. Development of brain. Migration of nerve cells. Synaptogenesis;. Neuronal plasticity. Neurotrophic factors. Sex dimorphism of brain. Central and peripheral nerve system. Somatic nerve system. Autonomic nerve system. Limbic system. Instinct and control of behaviour. Pain. Sensory integration.	
Examination methods:		Written exam, Presentation	

Subject name:		Fundamentals of immunopathology	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the hypersensitivity and auto-aggressive mechanisms	BTj_K3_W10
	W2	the principles of the selection of immunopathology techniques	BTj_K3_W07_inz
Skills: (In terms of skills, the graduate can)	U1	search the information from various sources and can use originally scientific facts to achieve the assumed goal	BTj_K3_U04_inz, BTj_K3_U19, BTj_K3_U22
	U2	improve diagnostic and therapeutic methods in clinical immunology	BTj_K3_U01_inz, BTj_K3_U04_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	constantly update own knowledge and develop the skills needed in practice	BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		<p>Principles of regulating basic mechanisms of innate and acquired immunity, including excessive or incorrect response, which results in the development of hypersensitivity and autoimmune diseases. Methods used in research on the pathogenesis of diseases.</p> <p>Hypersensitivity classification. Mechanisms of development of diseases with hypersensitivity and autoimmunity. Selected diseases from type I, II-IV hypersensitivity in animals. The autoimmune diseases in animals. Hypersensitivity and auto-aggressive diseases pharmacotherapy.</p> <p>Fundamental immune mechanisms of cancer. The role of extracellular vesicles in the immune response.</p>	
Examination methods:		Written exam, Presentation	

Subject name:		Food technology	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the information on raw materials for the food industry	BTj_K3_W11, BTj_K3_W15_inz
	W2	the information on food preservation methods	BTj_K3_W11, BTj_K3_W15_inz
	W3	the phenomena occurring in the processes and operations that make up the technological process	BTj_K3_W11, BTj_K3_W14, BTj_K3_W15_inz
	U1	utilize the basic knowledge of operations and unit processes in food technology	BTj_K3_U07
	U2	select methods of preservation depending on technological conditions	BTj_K3_U07
	U3	apply the basic knowledge of the design and production of probiotic food, including overcoming the difficulties associated with the production process and the final product storage	BTj_K3_U07
	U4	follow the legal requirements that must be met in order for a food product to be defined as "probiotic"	BTj_K3_U07
	K1	constantly expand knowledge and its practical use	BTj_K3_K03, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		The characteristics of the food industry raw materials, operations and unit processes used in food production and its preservation, including probiotic food, along with the legal regulations related to these issues. Pre-treatment of raw materials, mechanical operations. Thermal operations, the influence of heating and cooling on food quality. The use of physicochemical processes, crystallization, coagulation and gelling, emulsion formation and agglomeration in food technology. Chemical processes: hydrolysis, hydrogenation and transesterification in food technology. The use of enzymes. Packaging for the food industry. Production of food of plant and animal origin, including probiotic, fermented or non-fermented (market examples). Definition of a probiotic strain and probiotic criteria. Characteristics of the most commonly used probiotic strains. Production of probiotics biomass. Methods of testing probiotics in food products.	
Examination methods:		Written credit	

Subject name:		Biotechnological use of yeast	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the morphological and physiological features of yeast enabling their identification and use in various biotechnological processes	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09
	W2	the technologies in which yeast is used	BTj_K3_W01_inz, BTj_K3_W08, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	plan and carry out experiments on the use of biological material in the production process	BTj_K3_U12_inz, BTj_K3_U13_inz
	U2	critically assess the functionality and legitimacy of technical and technological solutions used in the biotechnological process (e.g. process conditions related to the multiplication of biological material, selected devices and unit operations related to the extraction, purification and preservation of the bioproduct)	BTj_K3_U09_inz, BTj_K3_U10_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	update, store and increase knowledge on biotechnology topics	BTj_K3_K01, BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		Yeast metabolism, the practical application of yeast in biotechnological processes. Systematic, morphological and physiological characteristics of yeasts important in biotechnology. Overview of the processes related to the use of yeast in the fermentation industry (yeast, baking, distilling, winemaking, brewing). Protein synthesis (SCP), obtaining vitamins, lipids, biosurfactants, etc. The use of yeast to obtain biopreparations (bioaccumulation of elements).	
Examination methods:		Written credit, Report, Test (written or computer based)	

Subject name:		Biopolymers in the production of food packaging	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the division and characteristics of biopolymers used for the production of biodegradable including edible packaging	BTj_K3_W06, BTj_K3_W09
	W2	the functions of biopolymers and the possibilities of their use for the production of packaging as well as knows the methods and possibilities of modifying the raw material composition of biopolymers packaging in order to obtain their advantageous functional properties	BTj_K3_W09, BTj_K3_W10
	W3	the methods and possibilities of modifying polymers in order to obtain their advantageous functional properties	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W05, BTj_K3_W15_inz
Skills: (In terms of skills, the graduate can)	U1	properly select the sources and synthesize the obtained information as well as draw conclusions, perceive various determinants of professional issues, including technological, ethical, economic and ecological	BTj_K3_U01_inz, BTj_K3_U10_inz, BTj_K3_U11_inz, BTj_K3_U13_inz, BTj_K3_U21, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	broaden his knowledge of a given subject and act in the public interest	BTj_K3_K02, BTj_K3_K04, BTj_K3_K05
Course content ensuring the achievement of learning outcomes:		The information on the construction and production techniques of biopolymers and their possible applications. Introduction to food packaging, and importance and benefit of biodegradable packaging. Types of biopolymers used in the production of packaging. Biodegradability of polymers. Characteristics and preparation of selected biopolymers of plant, animal and microbiological origin. Modification of biopolymers in order to give new or improve the already existing functional properties. Possibilities of using biopolymers as modern food packaging materials (edible packaging, active and intelligent packaging).	
Examination methods:		Written credit	

Subject name:		Weed Science	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the weeds that are the most common in our agriculture	BTj_K3_W09, BTj_K3_W10
	W2	the field of biology and weed competition	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09, BTj_K3_W10
Skills: (In terms of skills, the graduate can)	U1	propose a method of weed control appropriate to the state of weed infestation	BTj_K3_U02_inz, BTj_K3_U04_inz, BTj_K3_U07, BTj_K3_U14_inz
	U2	explain the molecular mechanism of weed resistance to herbicides	BTj_K3_U04_inz, BTj_K3_U14_inz, BTj_K3_U17
Social competences: (Within the scope of competence, the graduate is ready to)	K1	predict the extent of the negative impact of chemical methods on plants and the environment	BTj_K3_K03, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		The biology of selected weeds, techniques for their elimination from crops and the mechanism of acquiring weed resistance to herbicides. The positive role of weeds. Agrotechnical, mechanical, physical, chemical and biological methods of weed control. Behavior of herbicides in soil. Ingress and metabolism of herbicides in the plant. Mechanisms of action of herbicides. Natural herbicides. Photodynamic herbicides. Acetolactate synthesis inhibitors. Adjuvants - substances supporting the action of foliar and soil herbicides. Ecological infrastructure.	
Examination methods:		Written exam, Written credit, Assessment of activity during classes, Oral credit	

Subject name:		Plant resistance to harmful arthropods - yesterday, today, tomorrow	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the mechanisms of plant resistance against invertebrate herbivores	BTj_K3_W09
	W2	the methods and technics used to assess plant resistance against pests	BTj_K3_W10, BTj_K3_W13_inz
Skills: (In terms of skills, the graduate can)	U1	choose the proper method to assess plant resistance against a pest	BTj_K3_U11_inz
	U2	collect, analyze and explain the results, as well as use internet and library databases to interpret them	BTj_K3_U21, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	prepare and use new methods/ technologies to increase the quality of crop production	BTj_K3_K01
	K2	work individually and in a team	BTj_K3_K02
	K3	take the responsibility for the quality of crop production and the natural and agricultural environments	BTj_K3_K04
Course content ensuring the achievement of learning outcomes:		Plant resistance to pests and its various classifications, sources of plant resistance to pests and the possibility of using transgenic plants, and the importance of plant resistance in integrated pest management programs for commercial crops. Mechanisms of constitutive resistance - antixenosis, anibiosis, tolerance. Induced resistance and the conditions necessary for it to emerge - signaling pathways, priming phenomenon, effectors and elicitors. Indirect resistance - definitions, the necessary conditions for it to emerge and its effectiveness in decreasing pest population density. Sources of plant resistance against pests. The relevance of plant resistance against pests (constitutive, induced, indirect) in integrated pest management systems.	
Examination methods:		Test (written or computer based), Report, Assessment of activity during classes	

Subject name:		Biostatistical methods in management of genetic resources	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the methods and procedures used in the characterization of genetic resources	BTj_K3_W01_inz, BTj_K3_W04, BTj_K3_W07_inz, BTj_K3_W09, BTj_K3_W12
	W2	the status quo of DNA marker-assisted management of genetic resources in the world	BTj_K3_W01_inz, BTj_K3_W04, BTj_K3_W07_inz, BTj_K3_W09, BTj_K3_W12
Skills: (In terms of skills, the graduate can)	U1	apply and properly evaluate the effectiveness of biostatistical methods to analysis of data from characterization of genetic resources	BTj_K3_U04_inz, BTj_K3_U22
	U2	use computer programs designed to analyze the genetic structure of a population	BTj_K3_U04_inz, BTj_K3_U22
	U3	develop and apply in practice his skills in the field of characterizing genetic resources using biostatistical methods	BTj_K3_U04_inz, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	develop practical skills in characterizing genetic resources with biostatistical methods	BTj_K3_K01, BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		The methods and procedures used in the management of genetic resources and DNA analysis techniques. The current state of genetic resources for food and agriculture. The problems and challenges in creating and managing ex situ collections. Methods for characterizing the resources of gene banks. The most important methods of highthroughput analyses of DNA polymorphism. Amplicon sequencing in characterisation of genetic variation. The concept of core collection. Strategies and examples for practical use of the natural variation from genetic resources.	
Examination methods:		Written credit, Presentation, Test (written or computer based), Assessment of activity during classes	

Subject name:		Chemical safety	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the principles of chemical safety in the environment	BTj_K3_W03, BTj_K3_W05
	W2	the mechanism of action and consequences of toxic substances in the organisms	BTj_K3_W03, BTj_K3_W05, BTj_K3_W07_inz
	W3	the principles of chemical safety and its legal basis	BTj_K3_W03, BTj_K3_W07_inz, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	estimate the impact of toxic compounds on organisms and environment	BTj_K3_U08_inz, BTj_K3_U14_inz
	U2	collect toxicological data, including environmental aspects, select biological material for toxicological analysis and perform basic toxicological analysis	BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U11_inz
	U3	identify toxicological hazards based on the labeling of chemical substances and preparations	BTj_K3_U08_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	put knowledge into practice	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03
	K2	constantly update knowledge using objective sources of information	BTj_K3_K01, BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		Information on environmental pollution: sources of pollution, the fate of toxic compounds in the environment, biological effects on living organisms, systems and scope of monitoring the presence of xenobiotics in the environment. Assessment of the risk of hazard resulting from the exposure to toxic compounds, already present, as well as newly introduced into the environment. Toxicology as a scientific discipline and its scope. Chemical safety, including the classification of poisons and methods and labeling in accordance with the latest regulations.	
Examination methods:		Written exam	

Subject name:		Seminar	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the problems in the field of modern biotechnology	BTj_K3_W03, BTj_K3_W09, BTj_K3_W12
	U1	prepare and deliver scientific papers	BTj_K3_U01_inz, BTj_K3_U02_inz, BTj_K3_U16, BTj_K3_U18, BTj_K3_U19, BTj_K3_U20, BTj_K3_U21
	U2	use professional and scientific literature to prepare a diploma thesis	BTj_K3_U02_inz, BTj_K3_U22
	U3	present and discuss problems in the field of modern biotechnology	BTj_K3_U18
	K1	work in a group	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03, BTj_K3_K06, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		Aspects of the food, plant, or animal biotechnology, based on current scientific literature. Rules for writing of a diploma thesis and its presentation. Developing the ability to present the topic in an orderly and logical manner, taking care of the language correctness, originality of the work, and maintaining all formal requirements. The meaning and manner of conducting a scientific discussion.	
Examination methods:		Presentation, Assessment of speeches during classes	

Subject name:		Professional practice	ECTS: 6
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the problems of modern biotechnology	BTj_K3_W03, BTj_K3_W04, BTj_K3_W09, BTj_K3_W12, BTj_K3_W14, BTj_K3_W15_inz
	W2	the principles of OHS	BTj_K3_W11
Skills: (In terms of skills, the graduate can)	U1	use the professional and scientific literature related to the performed tasks	BTj_K3_U19, BTj_K3_U22
	U2	prepare a final report	BTj_K3_U06_inz, BTj_K3_U22
	U3	perform the entrusted tasks under supervision of a tutor	BTj_K3_U01_inz, BTj_K3_U02_inz, BTj_K3_U06_inz, BTj_K3_U07
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work in a group under the supervision	BTj_K3_K02, BTj_K3_K03, BTj_K3_K04, BTj_K3_K05
Course content ensuring the achievement of learning outcomes:		Functioning of the workplace/laboratory and conducting experiments (analyses) in the place of the internship. The health and safety rules and the structure of a given practice place (company, laboratory, scientific institute). Writing a full report of completed internships, and in particular of personally performed work. Summarizing all the practices and drawing appropriate conclusion.	
Examination methods:		Report, Opinion of the practice supervisor	

Subject name:		Data visualization methods	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the useful functions and types of graphs for representing different kinds of data	BTj_K3_W04
	W2	the experimental visualization at the planning stage	BTj_K3_W04
Skills: (In terms of skills, the graduate can)	U1	efficiently navigate in the environment of data visualization programs, create studies and professional charts	BTj_K3_U01_inz, BTj_K3_U21
Social competences: (Within the scope of competence, the graduate is ready to)	K1	analyze data from experiments and their professional presentation	BTj_K3_K01, BTj_K3_K02
Course content ensuring the achievement of learning outcomes:		Presenting the raw data, information, and analysis of results using the learned visualization methods. Graphs for raw data (line, bar, picture, scatter), graphs for assessing the distribution of variables (normality plots, histograms), dependence graphs (correlations, regressions), complex graphs (categorized, cross-sectional, merged). Chart exploration (rotating, zooming, panning, hiding planes and frames). Processes to automate the creation and customization of charts. Data and information report. Data presentation using infographics.	
Examination methods:		Project, Assessment of activity during classes	

Subject name:		Biotechnological use of waste	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the industrial waste in terms of its composition and the possibility of using it as valuable substrates in the cultivation of microorganisms	BTj_K3_W01_inz, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	select a substrate for the biosynthesis of a specific metabolite	BTj_K3_U01_inz, BTj_K3_U05_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	to active actions aimed at ecological waste disposal	BTj_K3_K04, BTj_K3_K05
Course content ensuring the achievement of learning outcomes:		Utilization of industrial waste in biotechnological production of biomass of microorganisms and their metabolites. Examples of biotechnological development of products from the potato, fruit and vegetable, dairy, oil, cellulose, sugar, fish, biofuels, and other industries.	
Examination methods:		Written credit	

Subject name:		Biotechnology of Animal Reproduction	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the diagnostic tests and techniques in animal reproductive biotechnology, including preliminary and detailed tests of semen in various animal species	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W03, BTj_K3_W06, BTj_K3_W07_inz, BTj_K3_W10, BTj_K3_W13_inz
Skills: (In terms of skills, the graduate can)	U1	perform some techniques of obtaining in vivo and producing embryos in vitro, as well as basic endocrinological and immunological laboratory diagnostics	BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U08_inz, BTj_K3_U11_inz, BTj_K3_U12_inz, BTj_K3_U13_inz, BTj_K3_U14_inz, BTj_K3_U15_inz, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	further acquire knowledge in the field of advanced biotechnology procedures of gametes and embryos used in animal production and in assisted reproductive techniques in the treatment of animal infertility (for high breeding value and those in danger of extinction)	BTj_K3_K01, BTj_K3_K02, BTj_K3_K06, BTj_K3_K07
Course content ensuring the achievement of learning outcomes:		Information concerning the techniques of animal reproduction biotechnology and selected issues related to the fields of biology, endocrinology, immunology, physiology of animal reproduction, as well as biotechnological procedures of animal reproduction and their applications.	
Examination methods:		Written credit	

Subject name:		Foodborne and waterborne pathogenic microorganisms	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the criteria of morphological and physiological diagnostics of saprophytic and pathogenic microorganisms	BTj_K3_W06, BTj_K3_W08, BTj_K3_W09, BTj_K3_W10
	W2	the pathways for the entry of microorganisms that pose a threat to the human bod	BTj_K3_W09, BTj_K3_W10, BTj_K3_W11
	W3	the factors promoting and inhibiting the growth of microorganisms	BTj_K3_W08, BTj_K3_W10, BTj_K3_W11
	U1	interpret the results of the performed experiments	BTj_K3_U04_inz, BTj_K3_U22
	K1	work safely owing to the awareness of the benefits and dangers related to the utilization of microorganisms in biotechnological processes	BTj_K3_K01, BTj_K3_K03, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Etiological factors of diseases occurring after eating of food containing harmful microorganisms. The body's defence mechanisms against the development of various kinds of poisoning and the rules for avoiding poisoning through the proper safety procedures in the industrial production and distribution of food.	
Examination methods:		Written credit, Report	

Subject name:		Plant active compounds in human life	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
<p>Knowledge: (In terms of knowledge, the graduate knows and understands)</p> <p>Skills: (In terms of skills, the graduate can)</p> <p>Social competences: (Within the scope of competence, the graduate is ready to)</p>	W1	the most important biologically active compounds occurring in plants and the directions of utilization of these compounds and plant raw materials	BTj_K3_W09, BTj_K3_W10
	U1	find information on sourcing, characteristics and application of plant active compounds	BTj_K3_U05_inz, BTj_K3_U22
	K1	identify and research the biological activity of plant compounds and is ready to deepen knowledge in this field	BTj_K3_K01, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Biologically active compounds present in herbal plants and their role in phytotherapy. The general characteristics of the main groups of biologically active substances occurring in plants, including essential oils, glycosides and alkaloids. Plant raw materials rich in the biologically active compounds and possible applications of the raw materials and isolated compounds in the prevention and treatment of various diseases, as well as in aromatherapy and cosmetics.	
Examination methods:		Report, Test (written or computer based)	

Subject name:		Individual research project	ECTS: 15
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the safety rules for health protection and prevention of accidents	BTj_K3_W11
	W2	the problems in the field of modern biotechnology and information on professional and scientific literature in the scope of performed tasks	BTj_K3_W03, BTj_K3_W04, BTj_K3_W09, BTj_K3_W12
Skills: (In terms of skills, the graduate can)	U1	prepare final reports	BTj_K3_U01_inz, BTj_K3_U16, BTj_K3_U19, BTj_K3_U21, BTj_K3_U22
	U2	perform the entrusted tasks under supervision of a tutor	BTj_K3_U01_inz, BTj_K3_U02_inz, BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U16, BTj_K3_U21, BTj_K3_U22
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work in a group	BTj_K3_K02, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Planning and carrying out research as part of the engineering program. Shaping the student's abilities to: employ the knowledge gained in biotechnology within the framework of the selected educational path, utilize the research infrastructure, employ analytical methods learned, find the needed information from a variety of sources available, and develop critical and creative approaches. The analysis of results and preparation of the diploma thesis.	
Examination methods:		Diploma thesis	

Programme indicators

2023/24/S_D/3/BBT/BTj/all

Name	Value
Potwierdzenie - na podstawie planu studiów, że student realizuje zajęcia z dziedziny nauk humanistycznych i/lub społecznych, którym przypisano nie mniej niż 5 punktów ECTS	6
Potwierdzenie - na podstawie planu studiów, że student ma możliwość wyboru zajęć, którym łącznie przypisano liczbę punktów ECTS nie niższą niż 30% ECTS określonych dla programu tych studiów	68/210 (32.38%)
Potwierdzenie, że program studiów o profilu ogólnoakademickim obejmuje zajęcia związane z prowadzoną w uczelni działalnością naukową, w wymiarze większym niż 50% liczby punktów ECTS, określonej dla programu tych studiów	193.5/210 (92.14%)
Potwierdzenie, że liczba punktów ECTS uzyskanych w programie studiów poprzez realizację zajęć z wykorzystaniem metod i technik kształcenia na odległość jest nie wyższa niż 75% ogólnej liczby punktów ECTS w programie studiów o profilu ogólnoakademickim	0/210 (0%)
Liczba godzin w programie	2626