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:	2025/26

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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%

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 field combining knowledge from natural, technical, medical, and agricultural sciences, emphasizing 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 offices and laboratories of Polish and international biotechnology and pharmaceutical companies, breeding companies, diagnostic laboratories, leading 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 engineering 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.

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	The graduate knows and understands facts, objects, phenomena and functioning of biological structures at the molecular, cellular, tissue, organismal, population and environmental levels	P6S_WG
BTj_K3_W02_inż	The graduate knows and understands advanced methods of observation and measurement of biological structures at various levels of complexity using technical devices measuring physical, chemical and imaging quantities	P6S_WG
BTj_K3_W03	The graduate knows and understands biotechnological aspects of the method and theory explaining the complex relationships of known prokaryotic and eukaryotic biological systems	P6S_WG
BTj_K3_W04_inż	The graduate knows and understands construction, operating principle and operating conditions of machines, devices and process installations used in the field of biotechnology on pro- and eukaryotic systems	P6S_WG
BTj_K3_W05_inż	The graduate knows and understands principles of performing process calculations, statistics, industrial and kinetic measurements for the evaluation and optimization of biotechnological processes	P6S_WG
BTj_K3_W06	The graduate knows and understands experimental methods in areas relevant to biotechnology using the achievements of chemistry, biochemistry, biophysics, molecular biology, bioinformatics and related sciences	P6S_WG
BTj_K3_W07_inż	The graduate knows and understands conditions of biotechnological processes in the modern economy, taking into account organizational, economic, ecological, ethical and social aspects	P6S_WK
BTj_K3_W08	The graduate knows and understands currently recommended quality and safety management systems in biotechnological activities; principles of creating and developing forms of entrepreneurship, taking into account the importance of protecting copyright, intellectual property and patent law	P6S_WK
BTj_K3_W09	The graduate knows and understands issues of humanities and social sciences covering fundamental dilemmas of contemporary civilization and ethical and ideological aspects	P6S_WK

Skills

Code	Content	PRK
BTj_K3_U01_inż	The graduate can recognize systemic aspects beyond the technical and ethical ones accompanying biotechnological activities	P6S_UW
BTj_K3_U02_inż	The graduate can make an economic evaluation of the proposed solutions and engineering activities undertaken in biotechnological processes	P6S_UW
BTj_K3_U03_inż	The graduate can critically analyze existing biotechnological solutions, evaluate and propose optimization	P6S_UW
BTj_K3_U04_inż	The graduate can plan and design new targeted biotechnological processes based on knowledge using advanced techniques, methods, tools and materials	P6S_UW
BTj_K3_U05_inż	The graduate can use analytical, instrumental, simulation and experimental methods to identify, formulate and solve engineering tasks in biotechnological processes	P6S_UW
BTj_K3_U06	The graduate can formulate and solve complex problems by conducting experiments and selecting and applying advanced methods and research tools in the field of biotechnology	P6S_UW

Code	Content	PRK
BTj_K3_U07	The graduate can evaluate, critically analyze and synthesize information from relevant sources regarding biotechnological processes and phenomena	P6S_UW
BTj_K3_U08	The graduate can use IT tools that use artificial intelligence, virtual reality and augmented reality	P6S_UW
BTj_K3_U09	The graduate can select and use appropriate source literature supporting biotechnological activities, including planning and implementation of processes, using appropriate symbols and graphic signs	P6S_UK
BTj_K3_U10	The graduate can communicate in a coherent way in the field of biotechnology participate in debate with specialists and a broad social representation	P6S_UK
BTj_K3_U11	The graduate can use a foreign language in speech and writing within the scope of fields of science and scientific disciplines relevant to the field of biotechnology in accordance with the requirements specified for level B2 of the Common European Framework of Reference for Languages	P6S_UK
BTj_K3_U12	The graduate can plan and organize individual and team work, including interdisciplinary work, interpret and report the obtained results	P6S_UO
BTj_K3_U13	The graduate can independently apply in practice the skills that enable effective lifelong learning in the field of biological sciences	P6S_UU

Social competence

Code	Content	PRK
BTj_K3_K01	The graduate is ready to critically confront existing biological and biotechnological knowledge with new scientific facts	P6S_KK
BTj_K3_K02	The graduate is ready to recognizing the importance of current biological knowledge in solving cognitive and practical problems and seeking expert knowledge in the event of difficulties in solving a problem on your own	P6S_KK
BTj_K3_K03	The graduate is ready to initiate and actively participate in the development and implementation of research and social projects	P6S_KO
BTj_K3_K04	The graduate is ready to think and act in an entrepreneurial manner	P6S_KO
BTj_K3_K05	The graduate is ready to fulfilling social obligations, co-organizing activities for the community, local, national and international	P6S_KR
BTj_K3_K06	The graduate is ready to to perform professional roles responsibly, to recognize the ethical nature and effects of using biotechnology, its impact on society, to resolve ethical dilemmas related to the work of a biotechnologist	P6S_KR

Study plan

Semester 1

Subject	Number of hours	ECTS points	Form of verification	Mandatory
OHS training	OHS training: 4	0	Pass	Obligatory subjects
Mathematics	Lecture: 30 Laboratory exercises: 30	5	Exam	Obligatory subjects
Information technologies	Laboratory exercises: 30	2	Pass with grade	Obligatory subjects
Cell Biology	Lecture: 30 Laboratory exercises: 30	5	Exam	Obligatory subjects
General and physical chemistry	Lecture: 45 Laboratory exercises: 30	7	Exam	Obligatory subjects
Physics	Lecture: 30 Laboratory exercises: 30	5	Exam	Obligatory subjects
Ecology	Lecture: 15	1	Pass with grade	Obligatory subjects
Design thinking	Lecture: 15 Auditorium exercises: 15	2	Pass with grade	Obligatory subjects
Design of Experiments in the Biological Sciences	Lecture: 15 Auditorium exercises: 15	2	Pass with grade	Obligatory subjects
Sum	**364**	**29**		

Semester 2

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Propedeutics of biotechnology	Laboratory exercises: 15	1	Pass with grade	Obligatory subjects
Organic chemistry	Lecture: 30 Laboratory exercises: 30	5	Exam	Obligatory subjects

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Biophysic	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Obligatory subjects
Botany	Lecture: 30 Auditorium exercises: 3 Laboratory exercises: 21 Field exercises: 6	5	Exam	Obligatory subjects
Animal anatomy	Lecture: 10 Laboratory exercises: 15	2	Pass with grade	Obligatory subjects
Animal histology	Lecture: 10 Laboratory exercises: 15	2	Pass with grade	Obligatory subjects
Bioinformatics	Lecture: 5 Laboratory exercises: 30	2	Pass with grade	Obligatory subjects
Science in action: how to popularize and inspire	Field exercises: 10	1	Pass	Obligatory subjects
Foreign language I	Language course: 60	3	Pass	Mandatory group
German language	Language course: 60	3	Pass with grade	Elective subjects
Russian language	Language course: 60	3	Pass with grade	Elective subjects
Polish language	Language course: 60	3	Pass with grade	Elective subjects
Physical education	Physical education: 30	0	Pass	Mandatory group
Physical education	Physical education: 30	0	Pass	Elective subjects
Faculties HS - an open list of optional subjects	Lecture: 30	2	Pass with grade	Mandatory group
The student chooses subjects for a total number of ECTS 2				
Ethics	Lecture: 30	2	Pass with grade	Elective subjects
Interpersonal skills	Lecture: 30	2	Pass with grade	Elective subjects
Evolution of biological ideas	Lecture: 15 Auditorium exercises: 15	2	Pass with grade	Elective subjects
Faculties - an open list of optional subjects	Lecture: 15 Laboratory exercises: 15	4	Pass with grade	Mandatory group

Subject	Number of hours	ECTS points	Form of verification	Mandatory
The student chooses subjects for a total number of ECTS 4				
Economics, finance, marketing	Lecture: 30	2	Pass with grade	Elective subjects
Physical Chemistry II	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Methods of microscopic visualization of processes and molecules	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Organic chemistry II	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Sum	**410**	**29**		

Semester 3

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Basic of engineering of biotechnological processes	Lecture: 30 Laboratory exercises: 30	5	Exam	Obligatory subjects
Molecular biology	Lecture: 30 Laboratory exercises: 30	5	Exam	Obligatory subjects
General Microbiology	Lecture: 30 Laboratory exercises: 30	5	Exam	Obligatory subjects
Biochemistry	Lecture: 30 Laboratory exercises: 30	5	Exam	Obligatory subjects
Plant physiology	Lecture: 40 Laboratory exercises: 20	4	Exam	Obligatory subjects
Physical education	Physical education: 30	0	Pass	Mandatory group
Physical education	Physical education: 30	0	Pass	Elective subjects
Faculties - an open list of optional subjects	Contact hours: 75	4	Pass with grade	Mandatory group
The student chooses subjects for a total number of ECTS 4				

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Biophysics II	Lecture: 15 Auditorium exercises: 15	2	Pass with grade	Elective subjects
Proteome biochemistry	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Environmental mutagenesis	Lecture: 15 Auditorium exercises: 15	2	Pass with grade	Elective subjects
Plant symbioses in context of climate change	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Engineering Graphics	Laboratory exercises: 15	2	Pass with grade	Elective subjects
Foreign language II	Language course: 60	3	Exam	Mandatory group
German language	Language course: 60	3	Pass with grade	Elective subjects
Russian language	Language course: 60	3	Pass with grade	Elective subjects
Polish language	Language course: 60	3	Pass with grade	Elective subjects
Confirmation B2 foreign language	Contact hours: 2	1	Exam	Obligatory subjects
Sum	**467**	**32**		

Semester 4

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Engineering of biotechnological processes	Lecture: 30 Laboratory exercises: 30	5	Exam	Obligatory subjects
Genetics	Lecture: 30 Laboratory exercises: 30	5	Exam	Obligatory subjects
Animal genetics and breeding	Lecture: 30 Laboratory exercises: 15	3	Pass with grade	Obligatory subjects
Animal physiology	Lecture: 30 Laboratory exercises: 30	4	Exam	Obligatory subjects

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Physiology of microorganisms	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Obligatory subjects
Enzymology and Biochemical Technics	Lecture: 15 Laboratory exercises: 30	3	Exam	Obligatory subjects
General virology	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Obligatory subjects
Faculties - an open list of optional subjects	Contact hours: 90	6	Pass with grade	Mandatory group
The student chooses subjects for a total number of ECTS 6				
Veterinary microbiology	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Preparative anatomy	Lecture: 10 Laboratory exercises: 20	2	Pass with grade	Elective subjects
Food microbiology	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Biotechnological use of microorganisms	Lecture: 15 Laboratory exercises: 10 Field exercises: 5	2	Pass with grade	Elective subjects
Plants versus environmental challenges	Project exercises: 30	2	Pass with grade	Elective subjects
Chloroplasts biology	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Antioxidants	Project exercises: 30	2	Pass with grade	Elective subjects
Sum	**420**	**30**		

Semester 5

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Genetic engineering I	Lecture: 15 Laboratory exercises: 45	6	Exam	Obligatory subjects

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Microorganisms in biotechnology and environmental protection	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Obligatory subjects
Physiomics and modern plant phenotyping	Lecture: 15 Laboratory exercises: 45	6	Exam	Obligatory subjects
Social and legal aspects of biotechnology	Lecture: 20	2	Pass with grade	Obligatory subjects
Immunology	Lecture: 30 Laboratory exercises: 15	4	Exam	Obligatory subjects
Bioinformatics with Linux and R	Laboratory exercises: 30	2	Pass with grade	Obligatory subjects
Faculties - an open list of optional subjects	Contact hours: 120	8	Pass with grade	Mandatory group
The student chooses subjects for a total number of ECTS 8				
Veterinary virology	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Bioactive substances in human and animal nutrition	Lecture: 20 Laboratory exercises: 10	2	Pass with grade	Elective subjects
Biotechnological use of bacteria	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Biotechnological use of moulds	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Basic of hygiene in food processing	Lecture: 30	2	Pass with grade	Elective subjects
Green synthesis of metal nanoparticles	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Biology of plant-microbe interactions	Lecture: 30	2	Pass with grade	Elective subjects
Herbivorous invertebrates and their enemies	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Biomedical Techniques: Radiobiology, Imaging, and Electrophysiology	Lecture: 12 Laboratory exercises: 18	2	Pass with grade	Elective subjects
Fundamentals of design and development of technological lines	Lecture: 15 Project exercises: 15	2	Pass with grade	Elective subjects
Sum	**365**	**30**		

Semester 6

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Cell and tissue cultures	Lecture: 20 Laboratory exercises: 45	6	Exam	Obligatory subjects
Statistics	Laboratory exercises: 30	3	Pass with grade	Obligatory subjects
Genetic engineering II	Lecture: 15 Laboratory exercises: 45	6	Exam	Obligatory subjects
Industrial biotechnology	Lecture: 30 Laboratory exercises: 15	3	Exam	Obligatory subjects
Faculties - an open list of optional subjects	Contact hours: 135	12	Exam/pass with grade	Mandatory group
The student chooses subjects for a total number of ECTS 12				
Nanotechnology and Neurobiology	Lecture: 15 Auditorium exercises: 15	2	Pass with grade	Elective subjects
Monoclonal antibodies - production and use	Lecture: 15 Laboratory exercises: 30	4	Exam	Elective subjects
Fundamentals of immunopathology	Lecture: 15 Laboratory exercises: 30	4	Exam	Elective subjects
Food technology	Lecture: 30	2	Pass with grade	Elective subjects
Biotechnological use of yeast	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Biopolymers in the production of food packaging	Lecture: 15	1	Pass with grade	Elective subjects
Weed Science	Lecture: 15 Auditorium exercises: 25 Field exercises: 5	4	Exam	Elective subjects
Plant resistance to harmful arthropods - yesterday, today, tomorrow	Lecture: 10 Laboratory exercises: 5	1	Pass with grade	Elective subjects
Biostatistical methods in management of genetic resources	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Biotechnology project management	Project exercises: 30	2	Pass with grade	Elective subjects
Sum	**335**	**30**		

Semester 7

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Chemical safety	Lecture: 30 Laboratory exercises: 15	4	Exam	Obligatory subjects
Seminar	Auditorium exercises: 30	2	Pass with grade	Mandatory group
Seminar	Auditorium exercises: 30	2	Pass with grade	Elective subjects
Professional practice	Apprenticeships: 160	6	Pass	Mandatory group
Professional practice	Apprenticeships: 160	6	Pass	Obligatory subjects
Faculties - an open list of optional subjects	Contact hours: 45	3	Pass with grade	Mandatory group
The student chooses subjects for a total number of ECTS 3				
Data visualization methods	Laboratory exercises: 15	1	Pass with grade	Elective subjects
Biotechnological use of waste	Lecture: 15	1	Pass with grade	Elective subjects
Biotechnology of Animal Reproduction	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Elective subjects
Foodborne and waterborne pathogenic microorganisms	Lecture: 15	1	Pass with grade	Elective subjects
Plant active compounds in human life	Lecture: 15	1	Pass with grade	Elective subjects
Individual research project	Diploma thesis: 0	15	-	Mandatory group
Individual research project	Diploma thesis: 0	15	-	Obligatory subjects
Sum	**280**	**30**		

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

Subject name:		Mathematics	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_W06
	W2	the elementary functions - logarithm, exponential, sine, cosine	BTj_K3_W06
	W3	the applications of differential and integral calculus of function of one variable	BTj_K3_W06
Skills: (In terms of skills, the graduate can)	U1	solve equations and inequalities, use WolframAlpha mathematical computation software	BTj_K3_U08
	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_U08
	U3	compute an indefinite integral, definite integral and apply the definite integral to solve selected problems	BTj_K3_U08
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	program selection and the appropriate way of performing calculations	BTj_K3_W05_inż, BTj_K3_W06
	W2	calculation method and the correctness of calculations using entered formulas	BTj_K3_W05_inż, BTj_K3_W06
Skills: (In terms of skills, the graduate can)	U1	propose an appropriate graph for the graphical presentation of data depending on the query	BTj_K3_U05_inż, BTj_K3_U06, BTj_K3_U07
	U2	prepare a multi-page hierarchical document with data and use that data	BTj_K3_U05_inż, BTj_K3_U07
Social competences: (Within the scope of competence, the graduate is ready to)	K1	prepare and archive knowledge in the form of databases and make use of them	BTj_K3_K01, BTj_K3_K02
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. Generating database queries and reports.	
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_W01
	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_W01
	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_W01, BTj_K3_W03
	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_W06
	W5	how to observe the occupational safety of oneself and the others, and how to behave in emergencies	BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	utilise the techniques of microscopic examinations and cytochemical methods used in cell biology	BTj_K3_U06
Social competences: (Within the scope of competence, the graduate is ready to)	K1	solve cognitive and practical problems	BTj_K3_K01, BTj_K3_K03
	K2	perform safe work in a laboratory	BTj_K3_K05, BTj_K3_K06
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_W01
	W2	the dangers of work in a chemical laboratory and the safety rules essential for personal protection in chemical labs	BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	apply learned principles and dependences to perform chemical calcuations, especially those related to concentrations of solutions, pH of solutions, thermochemistry, solubility product, kinetics of chemical reactions, electrochemistry and spectroscopy	BTj_K3_U06, BTj_K3_U13
	U2	select and perform appropriate chemical reactions to qualitatively analyze selected inorganic salts	BTj_K3_U06
	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
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 studing 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	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 laws of physics which constitute a foundation for understanding the phenomena taught under other natural and technical subjects	BTj_K3_W01
	W2	the units of physical quantities and understands the record of their multiplicities defined by prefixes	BTj_K3_W01
	W3	the primary techniques for measuring physical quantities	BTj_K3_W06
	W4	the statistical laws related to the measurements of physical quantities in organisms	BTj_K3_W06
Skills: (In terms of skills, the graduate can)	U1	use mechanical (a calliper, a weighing scale, a stopwatch), electrical (a voltmeter, an ammeter) and optical devices (a refractometer, a polarimeter)	BTj_K3_U06, BTj_K3_U07
	U2	process the results of measurements, estimate their inaccuracy and evaluate them critically using various sources	BTj_K3_U06, BTj_K3_U07, BTj_K3_U12
	U3	solve the physical problems, necessary to quantify the effects of phenomena and processes	BTj_K3_U06, BTj_K3_U12, BTj_K3_U13
	U4	distinguish scientific from non-scientific claims	BTj_K3_U09, BTj_K3_U13
Social competences: (Within the scope of competence, the graduate is ready to)	K1	develop the skills and use them in practice	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Systematic knowledge from biophysics required for studing major subjects. Standard laboratory equipment. Principles of working in biophysic laboratory. Formation of skills to conduct calculations, independent work in the laboratory, drawing correct conclusions from performed experiments, clear reporting on experimental results.	
Examination methods:		Written exam, Assessment of work in the laboratory	

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_W01, BTj_K3_W03, BTj_K3_W09
	W2	the information on ecological research methodology and practical applications of ecology	BTj_K3_W03, BTj_K3_W06
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_U06, BTj_K3_U07, BTj_K3_U09
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_K01, BTj_K3_K02, BTj_K3_K05
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:		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_W03, BTj_K3_W06, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	solve complex problems	BTj_K3_U09, BTj_K3_U10, BTj_K3_U12
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_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:		Test (written or computer based), Project	

Subject name:		Design of Experiments in the Biological Sciences	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 fundamentals of the methodology of empirical biological sciences and the ruless of planning and designing experiments. The student identifies the research problem as the starting point for an experiment and formulates research hypotheses; student defines the purpose of experiments, designs experimental setups, designs experiments on an appropriate scale and number of technical and biological repetitions and selects appropriate research methods to achieve the defined objectives	BTj_K3_W02_inż, BTj_K3_W05_inż, BTj_K3_W06
	W2	the principles of data processing, formulating conclusions, and applying experimental results in scientific or practical contexts. The student also understands the necessity of using statistical methods for result analysis	BTj_K3_W05_inż, BTj_K3_W06
	W3	the principles of laboratory work: the student is familiar with occupational health and safety (OHS) regulations, understands the necessity of ensuring ergonomic organization of the workspace, and recognizes the importance of performing laboratory tasks with precision and responsibility.	BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	to plan and conduct an experiment: the student can formulate a research problem and hypothesis, define the purpose of the experiment, and design the study. Te student is capable of selecting appropriate research methods/techniques, is able to apply appropriate measurement accuracy and collect results at an appropriate level of accuracy;and adheres to occupational health and safety (OHS) regulations as well as ergonomic principles in the laboratory	BTj_K3_U04_inż, BTj_K3_U06
	U2	to document the research process, analyze data, visualize results, critically evaluate the quality of the obtained outcomes, and draw conclusions	BTj_K3_U07, BTj_K3_U09, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	to develop critical thinking and a responsible approach to conducting research tasks, emphasizing scientific ethics and accuracy in documenting results. The student demonstrates the ability to communicate openly and presents conclusions in scientific discussions. The student is prepared for effective teamwork in a research setting, including sharing tasks and taking responsibility for the obtained results	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Research model, sample size selection, methodology selection, measurement accuracy, experimental design, standardization of experimental conditions, experiment ergonomics, evaluation of experimental progress and obtained results, critical analysis of sources, the importance of reproducibility and transparency in research, specifics of plant, animal, yeast, and bacterial models. Technical and biological repetitions.	
Examination methods:		Written credit, 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, BTj_K3_W09
	W2	the possibilities of using biotechnology in plant, animal, food and industrial production	BTj_K3_W03, BTj_K3_W06, BTj_K3_W07_inż
	W3	the information on biotechnologies used in plant, animal and food production	BTj_K3_W07_inż
	W4	the principles of laboratory animal husbandry	BTj_K3_W01, BTj_K3_W02_inż
	W5	the food industries using biotechnology processes	BTj_K3_W05_inż, BTj_K3_W06, BTj_K3_W07_inż
	W6	the aspects of biotechnology research using microorganisms	BTj_K3_W01, BTj_K3_W02_inż
Skills: (In terms of skills, the graduate can)	U1	design a commercial laboratory for micropropagation of plants	BTj_K3_U02_inż, BTj_K3_U04_inż
	U2	assess the suitability of biotechnological methods for a specific production effect	BTj_K3_U01_inż, BTj_K3_U02_inż, BTj_K3_U03_inż
	U3	interpret the biological and physicochemical results of water analysis and assess whether the controlled process occurs correctly or not	BTj_K3_U03_inż, BTj_K3_U06
Social competences: (Within the scope of competence, the graduate is ready to)	K1	recognize ethical dilemmas in conducting laboratory animal husbandry	BTj_K3_K06
	K2	develop and apply acquired knowledge	BTj_K3_K01, BTj_K3_K03, BTj_K3_K04
Course content ensuring the achievement of learning outcomes:		The use of biotechnology in plant, animal, food and industrial 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. Devices used in plant, animal, food and industrial biotechnology.	
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_W01
	W2	the types of biomolecules, their general formulas and reactivity	BTj_K3_W01
	W3	the essence of intermolecular interactions, the structure of proteins, sugars and fats	BTj_K3_W03
Skills: (In terms of skills, the graduate can)	U1	apply laboratory techniques that are the basis for further scientific work	BTj_K3_U06
Social competences: (Within the scope of competence, the graduate is ready to)	K1	apply laboratory tools and techniques in practice	BTj_K3_K03, BTj_K3_K06
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:		Biophysic	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	physical phenomena underlying the life processes of organisms	BTj_K3_W01, BTj_K3_W03
	W2	the fundamental factors that determine the structure and functions of macromolecules	BTj_K3_W01, BTj_K3_W03
	W3	the fundamentals of diagnostic and therapeutic methods, including techniques used in in silico and in vitro studies, which are based on the principles of physics	BTj_K3_W03, BTj_K3_W06
Skills: (In terms of skills, the graduate can)	U1	to apply the laws of biophysics to explain life processes	BTj_K3_U06
	U2	assess the applicability of research techniques in the diagnosis and treatment of human diseases	BTj_K3_U07
	U3	perform and analyze experiments in the field of biophysics	BTj_K3_U06, BTj_K3_U09, BTj_K3_U12
	U4	distinguish between scientific and non-scientific theories	BTj_K3_U07, BTj_K3_U10
Social competences: (Within the scope of competence, the graduate is ready to)	K1	working in a team to conduct a scientific experiment	BTj_K3_K02, BTj_K3_K03, BTj_K3_K06
	K2	critical analysis of acquired knowledge	BTj_K3_K01, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Biological membranes. Ion transport. Ion channels. ATP synthesis. Electrophysiological techniques. Electrophysiological data analysis. Current and voltage. Electrodes and buffers. Gravity, sedimentation, and centrifugation. Viscosity and surface tension. Waves and acoustics. Heat and temperature (the influence of temperature and pressure on living organisms). Diagnostic techniques and spectroscopy. Radioactivity - natural cycles and applications in diagnostics.	
Examination methods:		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_W01
	W2	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_W01
	W3	the position of plants in the Tree of Life, the systematics of land plants including characteristics of the main clades	BTj_K3_W01
	W4	the model plants and the most important plants supplying nutritional and industrial materials	BTj_K3_W01
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 then prepare a raport of the observations in the form of a morphological and anatomical drawing	BTj_K3_U06
	U2	identify the most important model and useful plants of biotechnological significance and determine their systematic positions	BTj_K3_U07, BTj_K3_U09
	U3	individually find, critically analyze and utilize information related to botany, originating from various sources 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_U09
	U4	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_U10, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	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_K06
Course content ensuring the achievement of learning outcomes:		Meristems and their regulation. Cell differentiation as the basis of histogenesis. Tissues and their spatial organisation in primary and secondary structure of the plant body. Morphological structure of seedlings, juvenile, vegetative and generative stage of plants. Basics of plant embryology, including development of male and female gametophyte, mechanisms of pollination, fertilisation and embryogenesis in Angiosperms. Development of seeds and fruits, and their biological importance. Adaptations of plant structure and development to different habitats. Outline of systematics and evolutionary tendencies in seed plants. Characterization of commonly occurring families and plants with the greatest utilitarian importance. Plants as a source of raw materials.	
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_W01
	W2	the relationship between the morphology and function of organs and adaptation of the animal organism to the environment	BTj_K3_W01, BTj_K3_W03
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_U09, BTj_K3_U13
Social competences: (Within the scope of competence, the graduate is ready to)	K1	plan and carry out a biological experiment	BTj_K3_K03
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_W01
	W2	the relationship between the morphology and function of organs and the adaptation of the animal organism to the living environment	BTj_K3_W03
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_U07
Social competences: (Within the scope of competence, the graduate is ready to)	K1	perform analysis of histological slides	BTj_K3_K01, BTj_K3_K02
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 reprodyctive system. Histology of the urinary system.	
Examination methods:		Written credit, Test (written or computer based)	

Subject name:		Bioinformatics	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 databases of biological sequences and scientific literature, understands their structure, annotation method and interconnections	BTj_K3_W01, BTj_K3_W05_inż
Skills: (In terms of skills, the graduate can)	U1	edit and annotate newly sequenced nucleic acid molecules, retrieve and read strand information, nucleic acid and protein sequences from a database, design PCR primers covering specific regions	BTj_K3_U05_inż, BTj_K3_U08, BTj_K3_U09
	U2	infer the putative function of an unknown biological sequence based on himself comparisons made to other sequences in databases	BTj_K3_U05_inż, BTj_K3_U08, BTj_K3_U09
Social competences: (Within the scope of competence, the graduate is ready to)	K1	solve bioinformatics problems and deepen knowledge based on information available in databases	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		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).	
Examination methods:		Case, Written credit	

Subject name:		Science in action: how to popularize and inspire	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	what is studying and how to popularize science	BTj_K3_W09
	W2	specialized terminology in the field of studies and popularization of science	BTj_K3_W01, BTj_K3_W09
Skills: (In terms of skills, the graduate can)	U1	formulate statements concisely, logically and clearly, correctly use correct terminology in oral and written statements	BTj_K3_U10, BTj_K3_U12, BTj_K3_U13
	U2	actively popularize science in an interesting way for a broader audience	BTj_K3_U10, BTj_K3_U13
	U3	build credibility and support for science in society	BTj_K3_U10, BTj_K3_U13
Social competences: (Within the scope of competence, the graduate is ready to)	K1	apply occupational health and safety rules	BTj_K3_K02, BTj_K3_K06
	K2	conduct in accordance with the Student Code of Ethics	BTj_K3_K06
	K3	individual and team work, which is expressed by responsibility for one's own work and readiness to submit to team work	BTj_K3_K02, BTj_K3_K03, BTj_K3_K05
	K4	self-assessment of one's own knowledge, skills and competences	BTj_K3_K01
Course content ensuring the achievement of learning outcomes:		Principles of studying and academic culture. Popularization of science – promotional events, newsletters, posters, brochures, videos, project profiles, news for social media. Communicating knowledge in a simple and attractive way. Adapting channels and language to target audiences.	
Examination methods:		Report	

Subject name:		German language	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	vocabulary related to education, work, science, health, culture and entertainment, sport, technology, information exchange and the environment	BTj_K3_W01
Skills: (In terms of skills, the graduate can)	U1	describe phenomena, processes, procedures	BTj_K3_U11
	U2	communicate and take notes	BTj_K3_U11
	U3	provide explanations, give reasons, express opinions or present plans	BTj_K3_U11
	U4	prepare and give a presentation	BTj_K3_U11, BTj_K3_U12
	U5	work in a group and discuss	BTj_K3_U10, BTj_K3_U11, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	communicate in most everyday and professional situations without preparation	BTj_K3_K05, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Vocabulary related to education, work, science, health, culture and entertainment, sport, technology, information exchange and the environment. Grammatical structures: correct use of word forms and sentence constructions, word formation. Language functions: practicing communication, pronunciation and spelling.	
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:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	vocabulary connected with education, work, science, health, culture and entertainment, sport, technology, information exchange and environment	BTj_K3_W01
Skills: (In terms of skills, the graduate can)	U1	describe phenomena, processes, procedures	BTj_K3_U11
	U2	conduct correspondence and take notes	BTj_K3_U11
	U3	give explanations, give reasons, express opinions or make plans	BTj_K3_U11
	U4	prepare and deliver presentations	BTj_K3_U11, BTj_K3_U12
	U5	work in a team and conduct a discussion	BTj_K3_U10, BTj_K3_U11, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	communicate correctly in most situations of everyday life and professional life without preparation	BTj_K3_K05, BTj_K3_K06
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:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	vocabulary connected with family, everyday life, housing, transport, work, education, nutrition, services, health, sport and natural environment	BTj_K3_W01
Skills: (In terms of skills, the graduate can)	U1	communicate on the elementary level in spoken and written forms	BTj_K3_U11
	U2	describe everyday phenomena	BTj_K3_U11
	U3	express opinions, give reasons or make plans	BTj_K3_U11, BTj_K3_U12
	U4	work in a team	BTj_K3_U10, BTj_K3_U11, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	communicate in different situations of everyday life	BTj_K3_K05, BTj_K3_K06
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: correst 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:		Physical education	ECTS: 0
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 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.	
Skills: (In terms of skills, the graduate can)	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.	
Social competences: (Within the scope of competence, the graduate is ready to)	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:		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 physical processes (the exchange of heat, momentum, mass) occurring during a biotechnological process and the relationships between them	BTj_K3_W02_inż, BTj_K3_W05_inż
	W2	the impact of process conditions on the biological material of various origins	BTj_K3_W02_inż, BTj_K3_W05_inż
	W3	the information on the devices and their instrumentation (measurement sensors) used in biotechnological production and their regulatory relationships	BTj_K3_W02_inż, BTj_K3_W04_inż, BTj_K3_W05_inż
	W4	the principles of OHS	BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	conduct an experiment according to the instruction and can analyze the collected results	BTj_K3_U05_inż, BTj_K3_U06, BTj_K3_U12
	U2	select the appropriate bioreactor design and monitoring method for a specific type of process and biological material	BTj_K3_U03_inż, BTj_K3_U05_inż
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work with team	BTj_K3_K03, BTj_K3_K04, BTj_K3_K05
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. Design solutions of bioreactors.	
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_W01
	W2	the principles of molecular biology techniques	BTj_K3_W06
Skills: (In terms of skills, the graduate can)	U1	conduct a comparative analysis of gene expression in prokaryotic and eukaryotic organisms	BTj_K3_U06, BTj_K3_U07
	U2	perform molecular biology techniques and make the necessary calculations when preparing reaction conditions	BTj_K3_U09
	U3	can use Artificial Intelligence, Virtual Reality and Augmented Reality in the application of general IT tools	BTj_K3_U06, BTj_K3_U08
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_K06
Course content ensuring the achievement of learning outcomes:		The issues in the field of molecular biology of the cell, regulation of gene expression and 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_W01
	W2	the specificity of the growth of microorganisms and the impact of external environmental factors on their development	BTj_K3_W01, BTj_K3_W03
	W3	the relationship between microorganisms	BTj_K3_W01, BTj_K3_W03
Skills: (In terms of skills, the graduate can)	U1	identify groups of microorganisms	BTj_K3_U06
	U2	quantitatively characterize the microbiological quality of the environment	BTj_K3_U09, BTj_K3_U10
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:
Knowledge: (In terms of knowledge, the graduate knows and understands)	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_W01
	W2	the principles of main analytical methods in biochemistry	BTj_K3_W01, BTj_K3_W06
	W3	the concepts in metabolism integration and regulation and knows how it may be studied experimentally	BTj_K3_W03
	W4	the safety rules in laboratory work	BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	explain the chemical reactions hidden behind the biochemical processes and apply the correct techniques to study them	BTj_K3_U07
	U2	safely and precisely operate instruments in the laboratory (automatic pipette, analytical weights, spectrophotometer, burette, chromatographic column, etc.)	BTj_K3_U06
	U3	obey the safety rules	BTj_K3_U12
	U4	apply correctly the chemical and physical symbols, graphs and calculations to explain the experimental results	BTj_K3_U12
	U5	plan, analyze, interpret and report the data obtained in the experiments conducted individually or in groups	BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work safely including handling, storage and disposal of laboratory equipment, chemical and biological material	BTj_K3_K01, BTj_K3_K06
	K2	prepare the experiment documentation and written reports	BTj_K3_K01, BTj_K3_K03
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	

Subject name:		Plant 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 course and interdependencies between physiological processes	BTj_K3_W01
	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_W03
	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_W01, BTj_K3_W03
	W4	safety rules in laboratory work and understands how to responsibly use the equipment and instruments	BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	use methods of measuring parameters describing physiological processes	BTj_K3_U06
	U2	perform experiments, collect data and interpret the results	BTj_K3_U06, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work as a team in carrying out exercises and preparing presentations	BTj_K3_K02, BTj_K3_K03
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:		German language	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	vocabulary related to education, work, science, health, culture and entertainment, sport, technology, information exchange and the environment	BTj_K3_W01
Skills: (In terms of skills, the graduate can)	U1	describe phenomena, processes, procedures	BTj_K3_U11
	U2	communicate and take notes	BTj_K3_U11
	U3	provide explanations, give reasons, express opinions or present plans	BTj_K3_U11
	U4	prepare and give a presentation	BTj_K3_U11, BTj_K3_U12
	U5	work in a group and discuss	BTj_K3_U10, BTj_K3_U11, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	communicate in most everyday and professional situations without preparation	BTj_K3_K05, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Vocabulary related to education, work, science, health, culture and entertainment, sport, technology, information exchange and the environment. Grammatical structures: correct use of word forms and sentence constructions, word formation. Language functions: practicing communication, pronunciation and spelling.	
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:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	vocabulary connected with education, work, science, health, culture and entertainment, sport, technology, information exchange and environment	BTj_K3_W01
Skills: (In terms of skills, the graduate can)	U1	describe phenomena, processes, procedures	BTj_K3_U11
	U2	conduct correspondence and take notes	BTj_K3_U11
	U3	give explanations, give reasons, express opinions or make plans	BTj_K3_U11
	U4	prepare and deliver presentations	BTj_K3_U11, BTj_K3_U12
	U5	work in a team and conduct a discussion	BTj_K3_U10, BTj_K3_U11, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	communicate correctly in most situations of everyday life and professional life without preparation	BTj_K3_K05, BTj_K3_K06
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:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	vocabulary connected with family, everyday life, housing, transport, work, education, nutrition, services, health, sport and natural environment	BTj_K3_W01
Skills: (In terms of skills, the graduate can)	U1	communicate on the elementary level in spoken and written forms	BTj_K3_U11
	U2	describe everyday phenomena	BTj_K3_U11
	U3	express opinions, give reasons or make plans	BTj_K3_U11, BTj_K3_U12
	U4	work in a team	BTj_K3_U10, BTj_K3_U11, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	communicate in different situations of everyday life	BTj_K3_K05, BTj_K3_K06
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: correst 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:		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_U11
Course content ensuring the achievement of learning outcomes:		Self-preparation for the foreign language at B2 level exam.	
Examination methods:		Written exam	

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_W04_inż, BTj_K3_W05_inż, BTj_K3_W07_inż, BTj_K3_W08
	W2	the principles of advanced biotechnological operations	BTj_K3_W01, BTj_K3_W02_inż, BTj_K3_W04_inż
Skills: (In terms of skills, the graduate can)	U1	select the proper equipment and a monitoring method for a specified type of process	BTj_K3_U04_inż, BTj_K3_U05_inż, BTj_K3_U09
	U2	rationally select proper methods for extracting and purifying a biotechnological product	BTj_K3_U04_inż, BTj_K3_U05_inż, BTj_K3_U09
	U3	critically address the results of the performed experiments and the possible methodological errors	BTj_K3_U03_inż, BTj_K3_U07, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work with bioreactors	BTj_K3_K03, BTj_K3_K04, BTj_K3_K06
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:		Genetics	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 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
	W2	how to use interdisciplinary information on design and present your own concept of improving plant and animal organisms	BTj_K3_W03
	W3	the rules for making changes in genomes and the effects of these changes	BTj_K3_W01, BTj_K3_W03
	W4	the ability to analyze issues in genetics and molecular biology and knows various detailed examples	BTj_K3_W01, BTj_K3_W06
	W5	the principles of gene expression	BTj_K3_W01, BTj_K3_W06
Skills: (In terms of skills, the graduate can)	U1	analyze the issues of genetics and molecular biology and can give and explain various detailed examples	BTj_K3_U07, BTj_K3_U09
	U2	can give and explain specific examples, and is able to give and apply appropriate experimental methods	BTj_K3_U06
Social competences: (Within the scope of competence, the graduate is ready to)	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_K02, BTj_K3_K03, BTj_K3_K05
	K2	expand, deepen and update knowledge and its practical use	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03
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:		Animal genetics and 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_W01
	W2	the issues of genetics and molecular biology and various detailed examples	BTj_K3_W01
	W3	the principles of animal maintenance and animal welfare	BTj_K3_W01
Skills: (In terms of skills, the graduate can)	U1	analyze issues in the field of genetics and molecular biology and is able to give and explain various detailed examples	BTj_K3_U07, BTj_K3_U12
	U2	give and explain specific examples, and is able to chose and apply appropriate experimental methods related to the breeding and use of farm animals	BTj_K3_U06
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_K02, BTj_K3_K03
	K2	expand, deepen and update the knowledge and its practical use	BTj_K3_K01, BTj_K3_K02
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_W01
	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, hermoregulation, kidney, reproductive system, pregnancy and lactation, physiology of birds)	BTj_K3_W01
	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_W03
	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_W03
	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_W03
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_U06, BTj_K3_U07
	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_U06, BTj_K3_U07
	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_U06
	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 experiment allowing the analysis of physiological parameters	BTj_K3_U07, BTj_K3_U09
	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_U06, BTj_K3_U07

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_K01
	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
	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_K01, BTj_K3_K02, BTj_K3_K03
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_W01
	W2	the relations between microorganisms in the biotechnological processes	BTj_K3_W03
Skills: (In terms of skills, the graduate can)	U1	interpret the results of the performed experiments	BTj_K3_U07, BTj_K3_U12
	U2	assess the usefulness of microorganisms for the production of the desired metabolites	BTj_K3_U07
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_K03, BTj_K3_K06
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:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the information on chemical, physical, molecular and thermodynamic enzyme action	BTj_K3_W01, BTj_K3_W02_inż
	W2	the mechanisms of action of inhibitors	BTj_K3_W02_inż, BTj_K3_W06
	W3	how to purify enzymes and measure their quantity and activity	BTj_K3_W02_inż, BTj_K3_W06
	W4	the apparatus considerations for working with enzymes in the appropiate scale	BTj_K3_W02_inż, BTj_K3_W04_inż, BTj_K3_W06
Skills: (In terms of skills, the graduate can)	U1	study the kinetics and inhibition of an enzymatic reaction	BTj_K3_U03_inż, BTj_K3_U05_inż
	U2	calculate concentrations of solutions used for enzymatic determinations	BTj_K3_U05_inż
	U3	apply skills in practice	BTj_K3_U13
Social competences: (Within the scope of competence, the graduate is ready to)	K1	to create enzyme systems in biotechnological processes in appropiate scale	BTj_K3_K03, BTj_K3_K04, BTj_K3_K06
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 taking into account their scale.	
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_W01
	W2	the different replication method of viruses compared to microorganisms	BTj_K3_W01
Skills: (In terms of skills, the graduate can)	U1	choose the right method of virus multiplication depending on the needs and possibilities	BTj_K3_U06
	U2	apply the methods of virological diagnostics	BTj_K3_U06
Social competences: (Within the scope of competence, the graduate is ready to)	K1	convey the knowledge in the field of virology in a way that is understandable to the average recipient	BTj_K3_K02, BTj_K3_K05
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:		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	different methods of genetic material analysis and directed and undirected manipulation using recombination and de novo synthesis	BTj_K3_W01, BTj_K3_W02_inż, BTj_K3_W05_inż
	W2	principles of molecular research and molecular diagnostics in vector and vectorless systems	BTj_K3_W03, BTj_K3_W05_inż
Skills: (In terms of skills, the graduate can)	U1	search for information from various sources and use it creatively to design a gene construct with a specific function	BTj_K3_U03_inż, BTj_K3_U05_inż
	U2	isolate, amplify, purify and work with genetic material, can transform plants and bacteria by selecting appropriate methods	BTj_K3_U03_inż, BTj_K3_U05_inż, BTj_K3_U09
	U3	prepare a scientific poster in the field of genetic engineering	BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	understand the social importance of genetic manipulation	BTj_K3_K02, BTj_K3_K03, BTj_K3_K05
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 hitorical 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:		Microorganisms in biotechnology and 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	specialized terminology related to microorganisms in biotechnology and environmental protection.	BTj_K3_W01
	W2	specific technological processes that utilize microorganisms in biotechnology and environmental protection.	BTj_K3_W02_inż, BTj_K3_W04_inż
Skills: (In terms of skills, the graduate can)	U1	effectively select and use techniques and research tools related to the practical applications of microorganisms	BTj_K3_U03_inż, BTj_K3_U04_inż, BTj_K3_U05_inż
	U2	use specialist literature to describe and interpret laboratory results	BTj_K3_U03_inż, BTj_K3_U05_inż, BTj_K3_U07, BTj_K3_U09
Social competences: (Within the scope of competence, the graduate is ready to)	K1	form opinions on specific technologies used in biotechnology and environmental protection	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		Characteristics of methods for cultivating industrial microorganisms and the equipment used; types of bioreactors; Industrial use of selected "workhorse" microorganisms; Improvement of industrial strains; Technological processes: aerobic and anaerobic treatment of sewage, activated sludge, and biological membranes, fermentations.	
Examination methods:		Written exam, Test (written or computer based)	

Subject name:		Physiomics and modern plant phenotyping	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 structure of plant and animal cells and the physiological processes occurring in them	BTj_K3_W01
	W2	that the physiomic approach integrates the entire plant metabolism at all levels of its organization into a single network of mutual dependencies	BTj_K3_W03
	W3	the importance of a holistic and systemic approach to the functioning of plants, starting from the molecular level, cells, tissues and organs, and ending with the entire plant organism	BTj_K3_W01
	W4	the mechanisms of gene expression	BTj_K3_W03
	W5	how phenotypic data can be used to analyse plant responses to optimal and stressful conditions	BTj_K3_W01, BTj_K3_W02_inż, BTj_K3_W05_inż
	W6	measurement and information tool for collecting phenotypic data in a proper recording format	BTj_K3_W02_inż, BTj_K3_W06
Skills: (In terms of skills, the graduate can)	U1	design a set of devices for plant phenotype assessment in laboratory applications	BTj_K3_U04_inż, BTj_K3_U05_inż, BTj_K3_U06
	U2	comprehensively assess the complexity of biochemical signals occurring in plants based on the results of appropriate measurements	BTj_K3_U01_inż, BTj_K3_U03_inż, BTj_K3_U06, BTj_K3_U07, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	indication of important mechanisms influencing the condition of plants in specific genetic and environmental systems	BTj_K3_K01
	K2	recognize the complexities of signal conduction mechanisms in plants related to signal transmission and integration	BTj_K3_K01, BTj_K3_K02
	K3	design thinking aimed at group problem solving	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03
Course content ensuring the achievement of learning outcomes:		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 andthe 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. Phenotypic data and methods of their collection, analysis and interpretation.	
Examination methods:		Written exam, Report, Test (written or computer based)	

Subject name:		Social and legal aspects of biotechnology	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 national and international legal regulations concerning the use of biotechnology	BTj_K3_W07_inż
Skills: (In terms of skills, the graduate can)	U1	understand the issues of biosafety of biotechnology	BTj_K3_U01_inż, BTj_K3_U10
	U2	discuss the possibilities of protecting intellectual property rights in biotechnology	BTj_K3_U01_inż, BTj_K3_U09
Social competences: (Within the scope of competence, the graduate is ready to)	K1	discuss the issues related to social perception and acceptance of biotechnology in Poland and in the world	BTj_K3_K01, BTj_K3_K03, BTj_K3_K06
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_W01
	W2	the mechanisms of innate and adaptive immunity	BTj_K3_W01
	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_W01, BTj_K3_W03
	W4	the mechanisms of regulation of the immune response induced by infectious agents and cancer	BTj_K3_W01, BTj_K3_W03
	W5	the types of vaccines, the mechanisms of their mode of action, and the need for immunoprophylaxis of infectious diseases in humans and animals	BTj_K3_W01, BTj_K3_W03, BTj_K3_W06, BTj_K3_W08
	W6	the mechanisms related to the transfer of passive immunity from the mother and the causes of immune disorders related to maternal antibodies	BTj_K3_W01, BTj_K3_W03
	W7	the mechanisms and the development of all types of hypersensitivity reactions and the consequences resulting from these mechanisms	BTj_K3_W01, BTj_K3_W03
	W8	the causes and effects of the innate and adaptive immunodeficiencies	BTj_K3_W01, BTj_K3_W03
	W9	the basis of autoimmune diseases in humans and animals	BTj_K3_W01, BTj_K3_W03
	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_W01
Skills: (In terms of skills, the graduate can)	U1	prepare serum for serological assays	BTj_K3_U06
	U2	perform a 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_U06, BTj_K3_U07, BTj_K3_U12
	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_U06
	U4	isolate specific populations of immunocompetent cells and determine their activity using immunoenzyme and immunofluorescence techniques and molecular biology techniques	BTj_K3_U06, BTj_K3_U07
Social competences: (Within the scope of competence, the graduate is ready to)	K1	formulate the opinions in the 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_K02, BTj_K3_K03, BTj_K3_K06

	K2	discussion on the need for immunoprophylaxis of infectious diseases of humans and animals	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03, BTj_K3_K06
	K3	apply the acquired knowledge and skills in further stages of education	BTj_K3_K01, BTj_K3_K06
	K4	cooperate with other colleagues by exchanging opinions and sharing the competences	BTj_K3_K02, BTj_K3_K05, BTj_K3_K06
	K5	constantly deepen their knowledge and improve their skills with the use of scientific resources	BTj_K3_K01, BTj_K3_K02
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:		Fundamentals of design and development of technological lines	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 designing and technological lines in the field of biotechnology	BTj_K3_W04_inż, BTj_K3_W05_inż, BTj_K3_W07_inż
	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_W02_inż, BTj_K3_W04_inż, BTj_K3_W05_inż, BTj_K3_W07_inż
Skills: (In terms of skills, the graduate can)	U1	design a technological line or a production plant as part of teamwork	BTj_K3_U03_inż, BTj_K3_U04_inż
	U2	to use computer programs that support design, e.g. AutoCAD	BTj_K3_U05_inż, BTj_K3_U08
	U3	search for information and news available in libraries, the Internet, engineering and design companies and use them creatively to achieve the intended goal	BTj_K3_U07, BTj_K3_U09
	U4	discuss the social importance and need for cooperation with other specialists in the design of technological lines or industrial plants	BTj_K3_U10, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	using the acquired knowledge, skills and engineering competences in professional work	BTj_K3_K05, BTj_K3_K06
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:		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, BTj_K3_W02_inż
	W2	the construction, equipment and principles of operation (including health and safety regulations) of the plant and animal culture laboratory	BTj_K3_W04_inż, BTj_K3_W07_inż, BTj_K3_W08
	W3	issues involving the use of cells and their metabolites on various scales	BTj_K3_W01, BTj_K3_W04_inż, BTj_K3_W05_inż, BTj_K3_W06
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 techniques of in vitro culture	BTj_K3_U05_inż, BTj_K3_U06
	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_U05_inż, BTj_K3_U06
	U3	select the inoculum size and culture conditions to suit the scale of the planned process	BTj_K3_U02_inż, BTj_K3_U04_inż, BTj_K3_U07
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_K04
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_W06
	W2	the need for statistical inference about the population based on the sample results	BTj_K3_W05_inż, BTj_K3_W06
Skills: (In terms of skills, the graduate can)	U1	choose the appropriate method for statistical analysis of various biological data	BTj_K3_U05_inż, BTj_K3_U08
	U2	perform statistical analyzes	BTj_K3_U05_inż, BTj_K3_U08
	U3	describe the performed statistical analyzes and draw conclusions	BTj_K3_U05_inż, BTj_K3_U08
Social competences: (Within the scope of competence, the graduate is ready to)	K1	apply the known statistical methods in practice	BTj_K3_K03, BTj_K3_K06
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	different methods of genetic material analysis and directed and undirected manipulation using recombination and de novo synthesis	BTj_K3_W01, BTj_K3_W02_inż, BTj_K3_W05_inż
	W2	principles of molecular research and molecular diagnostics in vector and vectorless systems	BTj_K3_W03, BTj_K3_W05_inż
Skills: (In terms of skills, the graduate can)	U1	search for information from various sources and use it creatively to design a gene construct with a specific function	BTj_K3_U03_inż, BTj_K3_U05_inż
	U2	isolate, amplify, purify and work with genetic material, can transform plants and bacteria by selecting appropriate methods	BTj_K3_U03_inż, BTj_K3_U05_inż, BTj_K3_U09
	U3	prepare a scientific poster in the field of genetic engineering	BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	understand the social importance of genetic manipulation	BTj_K3_K02, BTj_K3_K03, BTj_K3_K05
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	microbial strains and bioreactor operating conditions for examples of biopolymer production and examples of biopolymer production on an industrial scale	BTj_K3_W01, BTj_K3_W02_inż, BTj_K3_W04_inż
Skills: (In terms of skills, the graduate can)	U1	describe the processes taking place in the bioreactor, characterize the individual process stages and provide parameters of the biopolymer production process	BTj_K3_U03_inż, BTj_K3_U05_inż
	U2	plan and organize work for the biotechnological process design, individually or in a team	BTj_K3_U03_inż, BTj_K3_U04_inż, BTj_K3_U06, BTj_K3_U07, BTj_K3_U12
	U3	describe and explain the principles of economic analysis of a biotechnological process	BTj_K3_U02_inż, BTj_K3_U03_inż, BTj_K3_U07
	U4	argue the advisability of using microorganisms to produce bioproducts	BTj_K3_U01_inż, BTj_K3_U09, BTj_K3_U10, BTj_K3_U13
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_K03, 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:		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_W01
	W2	the mechanism of action and consequences of toxic substances in the organisms	BTj_K3_W03
	W3	the principles of chemical safety and its legal basis	BTj_K3_W07_inż, BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	estimate the impact of toxic compounds on organisms and environment	BTj_K3_U03_inż, BTj_K3_U07
	U2	collect toxicological data, including environmental aspects, select biological material for toxicological analysis and perform toxicological analysis	BTj_K3_U04_inż, BTj_K3_U05_inż
	U3	identify toxicological hazards based on the labeling of chemical substances and preparations	BTj_K3_U07, BTj_K3_U09
	U4	update knowledge using objective sources of information	BTj_K3_U09, BTj_K3_U13
Social competences: (Within the scope of competence, the graduate is ready to)	K1	using knowledge about chemical hazards in practice using norms and standards	BTj_K3_K02, BTj_K3_K03, BTj_K3_K05
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. Toxicological norms and standards.	
Examination methods:		Written exam	

Subject name:		Seminar	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 problems in the field of modern biotechnology	BTj_K3_W01, BTj_K3_W07_inż, BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	prepare and deliver papers on scientific research, development and methodological work	BTj_K3_U10, BTj_K3_U12, BTj_K3_U13
	U2	use professional and scientific literature to prepare a diploma thesis	BTj_K3_U07, BTj_K3_U09
	U3	present and discuss problems in the field of modern biotechnology	BTj_K3_U01_inż, BTj_K3_U10
	U4	work in a group	BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	active involvement in the community, critical approach to the biotechnological knowledge held	BTj_K3_K01, BTj_K3_K05, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Aspects of the food, plant, or animal biotechnology, based on current technical and 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_inż, BTj_K3_W05_inż
	W2	the principles of OHS	BTj_K3_W08
Skills: (In terms of skills, the graduate can)	U1	use the technical and scientific literature related to the performed tasks	BTj_K3_U07
	U2	prepare a final report	BTj_K3_U10, BTj_K3_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work in a group under the supervision	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03, BTj_K3_K06
Course content ensuring the achievement of learning outcomes:		Functioning of the workplace/laboratory and conducting basic activities and 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	

Programme indicators

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	188.64/210 (89.83%)
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	2641