

**WARSAW UNIVERSITY OF LIFE SCIENCES**

**WULS - SGGW**

**Study programme**

**field of study: Biotechnology**

**first cycle full-time studies**

**Warsaw, 2022**

## STUDY PROGRAMME – BIOTECHNOLOGY

1. Name of the field of study. **Biotechnology**
2. Cycle of the studies. **First cycle studies**
3. Profile of the studies. **General academic**
4. Form of the studies. **Full-time studies**
5. Duration of the studies. **3.5 years**
6. Number of ECTS credit points necessary to complete the studies. **210**
7. Professional title awarded to graduates. **Bachelor of Engineering**
8. ISCED code for the field of study. **0888**
9. Assignment of the field of study to a discipline

No.	Discipline	Leading discipline (YES/NO)	Percentage of effects of learning related to the discipline
1.	BIOLOGICAL SCIENCES	YES	100%
Total:			100%

## 10.EFFECTS OF LEARNING

taking into account universal characteristics of the first cycle defined in the act of 22 December 2015 on the Integrated Qualification System and the characteristics of the second cycle learning effects for **PRK level 6** qualifications, typical for qualifications acquired as part of the higher education and science system upon obtaining a full level 4 qualification.

**Field of study: BIOTECHNOLOGY**

**Cycle of the studies: first cycle studies**

**Profile of the studies: general academic**

Key to symbols:

**W** — category of knowledge

**U** — category of skills

**K** — category of social competences

**01, 02, 03 and higher** — number of the educational result

**\*indicates educational results which lead to acquiring engineering competences**

The universal characteristics of level 6 in PRK and second cycle characteristics of the effects of learning for qualifications at level 6 of PRK		Second cycle characteristics of the effects of learning for qualifications at level 6 of 6 PRK allowing the acquisition of an engineers' competences		Specialty Learning Outcomes	
				Symbol of the Specialty Learning Outcome	Specialty Learning Outcomes related to specific categories and scopes
<b>KNOWLEDGE – the graduate KNOWS AND UNDERSTANDS</b>					
<b>P6U_W</b>	to an advanced extent - facts, theories, methods and complex relationships between them				

	various, complex conditions of the performed activity			
<b>P6S_WG</b> <i>Scope and depth - completeness of the cognitive perspective and relationships</i>	to an advanced extent - selected facts, objects and phenomena as well as the related methods and theories explaining complex relationships between them, constituting basic general knowledge related to scientific or artistic disciplines forming theoretical bases and selected issues from detailed knowledge - proper for the study programme, and in the case of studies with a practical profile – also practical applications of this knowledge in professional activity related to their field of study	basic processes occurring in the life cycle of devices, objects and technical systems	K_W01*	technologies of performing biotechnological processes;
			K_W02*	basics related to the life cycle of a biotechnological product, as well as devices and their instrumentation (measurement sensors) used in biotechnological production
			K_W03	key aspects of biotechnology
			K_W04	the necessity to use proper simple computational techniques (including statistical analysis, computational tools and computer software suites) for biological data
			K_W05	the principles which define the three-dimensional structure of biological macromolecules, with the ability to explain and provide the examples of the relationship between structure and function
			K_W06	the functions of various cells (prokaryotic and eukaryotic), being able to critically explain, how their properties are related to varying biological functions, knowing how they can be tested experimentally
			K_W07*	experimental methods serving the examination of important areas in the field of biotechnology, chemistry, biochemistry, biophysics, molecular biology and the related sciences;
			K_W08	the features of cellular metabolism and its control, including the knowledge of certain experimental techniques;

			K_W09	living organisms and their place in the natural environment, and how they can be used for the good of humanity;
			K_W10	terms, principles and theories related to processes and mechanisms which have shaped the world of nature, knowing how they can be used efficiently;
			K_W11	the principles of OHS and ergonomics;
			K_W12	the principles of mathematics and statistics for assessing and interpreting phenomena and processes occurring in the environment;
P6S_WK Context / conditions, effects	fundamental dilemmas of today's civilisation  basic economic, legal, ethical and other conditions of various types of professional activity related to the field of study of study, including basic terms and principles related to the protection of industrial property and copyright  basic principles of creating and developing various forms of entrepreneurship	basic principles of creating and developing various forms of individual entrepreneurship	K_W13*	the importance of processes necessary to assess and initiate research in the field of biotechnology;
			K_W14	the significance of copyright protection, the protection of industrial property and patent right;
			K_W15*	the systems currently recommended for managing quality and safety in the biotechnological industry; the principles of creating and developing the forms of individual entrepreneurship;
<b>SKILLS – the graduate IS ABLE TO</b>				
P6U_U	innovatively perform tasks and solve complex and unusual problems under variable and not entirely fully predictable conditions  independently plan their own learning for their entire life  communicate with the surroundings, justify their standpoint			

<p><b>P6S_UW</b>  <i>Knowledge utilisation  / solved problems  and performed tasks</i></p>	<p>utilise the possessed knowledge  - formulate and solve complex and atypical problems and perform tasks under not completely predictable conditions by:  — proper selection of sources and information originating from them, performing an assessment, critical analysis and synthesis of this information,  — selection and application of proper methods and tools, including advanced information and communication techniques</p> <p>utilise the possessed knowledge  - formulate and solve problems and perform tasks typical for professional activity associated with the field of study - in the case of studies with a practical profile</p>	<p>plan and conduct experiments, including measurements and computer simulations, interpret the produced results and draw conclusions</p> <p>when identifying and formulating the specification of engineering tasks and while solving them:  — utilise analytical, simulational and experimental methods,</p> <p>— see their systemic and non-technical aspects, including ethical aspects,</p> <p>— perform an initial economic assessment of the proposed solutions and engineering actions taken</p> <p>perform a critical analysis of the manner of functioning of the existing technical solutions and assess these solutions</p> <p>design - according to a given specification - and prepare</p>	<p>K_U01*</p> <p>K_U02*</p> <p>K_U03</p> <p>K_U04*</p> <p>K_U05*</p> <p>K_U06*</p> <p>K_U07</p> <p>K_U08*</p> <p>K_U 09*</p>	<p>utilise proper techniques and knowledge related to biotechnology in practice, under the care of a supervisor;</p> <p>perform and present an independent experiment (a final diploma thesis), which reflects features such as: e.g. competences associated with the ability of proper time management, solving a research problem as well as performing tasks and interpreting the quality of results;</p> <p>provide and explain specific examples and apply proper experimental methods associated with the explanation of principles related to gene expression;</p> <p>present and discuss key principles of scientific interdisciplinary bases, as well as a multidisciplinary approach to the processes and mechanisms of life;</p> <p>understand and explain chemical processes forming a basis for explaining biochemical reactions, and able to apply proper techniques for their investigation;</p> <p>use laboratory equipment in order to gather observations and data</p> <p>follow proper principles of safety and work ethics during the execution of scientific research using various experimental methods under laboratory and field conditions</p> <p>assess the social, economic and legal conditions of the activities of a biotechnologist;</p> <p>preliminarily asses the economic effect of the proposed modifications of a biotechnological process;</p>
--	--	--	--	---

		simple devices, objects, systems typical in the field of study, or execute processes using properly selected methods, techniques, tools and materials	K_U10*	critically assess the functionality and validity of technical and technological solutions used in a biotechnological process;
			K_U11*	able to assess the usefulness of the available methods or devices and propose potentially the best solution when solving a practical problem related to the technological utilisation of biological material;
			K_U12*	plan and perform experiments related to the preparation, creation and utilisation of biological material in a production process;
			K_U 13*	propose analytical methods and plan an experiment for solving engineering tasks related to various stages of creating a biotechnological product;
			K_U14*	translate the results of experiments into practical solutions;
			K_U15*	design modification of the features of a biological organism and the conditions of a process associated with the multiplication of biological material in accordance with the adopted assumptions, select devices and unit operations related to the extraction, purification and preservation of a bioproduct;
P6S_UK <i>Communicating - receiving and formulating statements,</i>	communicate with the surroundings using specialised terminology		K_U16	choose and apply proper symbols, graphical signs and language forms for presenting scientific ideas, plans and experimental results (e.g. the utilisation of chemical formulas for biological molecules);
	participate in a debate - present and assess various opinions and standpoints and discuss them		K_U17	analyse topics from genetics and molecular biology, provide and explain certain detailed examples;

	use a foreign language at level B2 of the Common European Framework of Reference for Languages		K_U18	coherently communicate within the scope of the topics pertaining to biotechnology both with specialists and with outside receivers;
			K_U19	use a foreign language in speech and in writing within the scope of fields of science and scientific disciplines proper for the field of biotechnology, according to the requirements defined for level B2 of the Common European Framework of Reference for Languages;
P6S_UO Organisation of work/ planning and teamwork	plan and organise work, both individual and in a team		K_U20	plan and organise work, both individual and in a team
	cooperate with other people in teamwork (also with an interdisciplinary nature)		K_U21*	coping with understanding, planning and analysing; being able to interpret and report biological data acquired while working individually and in a group;
P6S_UU Learning/planning the development	independently plan and implement their own learning for their entire life		K_U 22	find and assess information from various sources, including from original research, and present in a well organised manner (e.g. essays, reports and laboratory reports);
<b>COMPETENCE – the graduate IS READY TO</b>				
P6U_K	cultivate and popularise patterns of proper behaviour in the environment of work and beyond it			
	independently make decisions, critically assess one's own actions, the actions of teams led by them, as well as organisations in which they participate, accepting responsibility for the results of these actions			
P6S_KK Assessments/critiques	critical assessment of the possessed knowledge and the received content		K_K 01	proper storage of data, updating and extending knowledge on topics related to biotechnology and the related sciences;



	recognition of the significance of knowledge in solving cognitive and practical problems, as well as seeking the opinions of experts in the case of difficulties with solving a problem by oneself		K_K 02	development and application of one's skills in practice (including communication, teamwork), which enable effective lifelong learning with respect to biological sciences;
<b>P6S_KO</b> <i>Responsibility/fulfilling social commitments for the public interest</i>	fulfilling social commitments, co-organising activities for the social environment  initiating actions for the public interest  thinking and acting in an entrepreneurial way		K_K03*	for safe work via the selection and application of a proper technique of handling, storing and disposing of laboratory materials (e.g. using proper techniques in terms of handling, storing and disposing of bacteria, chemical substances and dangerous bio-waste);
			K_K 04	initiating and actively participating in the development and implementation of research and social projects;
			K_K 05*	for thinking and acting in an entrepreneurial way
<b>P6S_KR</b> <i>The professional role/independence and development of the ethos</i>	responsible fulfilment of the professional roles, including: — abiding by the principles of professional ethics and requiring the same from the others, — caring for the heritage and traditions of the profession		K_K 06	presenting justified arguments supporting one's standpoint regarding scientific, ethical and social topics influencing the progress in biological sciences;
			K_K 07	recognising the scope and ethical nature of the effects of utilising biotechnology and its impact on the society; settling ethical dilemmas related to the work of a biotechnologist;

## **11. CONCEPT OF EDUCATION**

The purpose of teaching students in the field of Biotechnology is to achieve the effects of learning intended to lead to a high level of professional competences of the graduate. When pursuing their programme, the student is able to choose their future professional path. The programme of the studies consists of an abundant number of subjects, including a large number of selectable ones (facultative). The classes on individual subjects, including the specialised ones, are taught by the teaching staff of various Institutes, based on their scientific potential, equipment as well as lecture/exercise halls. Certain classes are taught by the employees of two, or even three departments (including from various Institutes), which enriches the content of the presented issues. In addition, first cycle students are obliged to complete professional internship.

Considerable potential of the teaching staff, scientific achievements and the research background of the Institute of Biology and other cooperating Institutes guarantee a modern offer at the engineering level.

The main objective in the process of education on the first cycle studies in the field of Biotechnology is to provide a high level of education, so that our graduates would have knowledge, skills as well as practical and social competences at the highest world level, and be prepared for competing on the modern labour market and functioning in a society based on knowledge.

Actions towards the fulfilment of these objectives include enrolling to the studies the best candidates who stand out, modernising the education programmes, adjusting them to the changing level of knowledge in the fields and discipline of teaching and to the needs of the market, putting an emphasis on the introduction of elements increasing creativity and operability into the classes, as well as harmonising the teaching programmes under agreements and international organisations.

In addition, we also care for building a proper professional attitude of students and graduates through satisfaction with the completed studies, examined, e.g. due to the process of surveying, improving the position of graduates on the labour market, as well as building a good image of the university which is friendly towards students, focused on practical education. The high quality of teaching is guaranteed by the positive evaluations of the field of study achieved in the process of external accreditation and parametric assessment.

An important aspect is the creation and involvement in the didactic process of teams with a high substantive level, having the skills of effective transfer of knowledge and characterised by ethical standards. The progress of students in the field of Biotechnology is supported by an increase in the internationalisation of education and mobility of the students (the possibility to use international exchange programmes). The striving to achieve a strong position of the graduates on the labour market is accomplished by taking into account suggestions from economy in educational programmes and diploma theses, increasing the number, scale and rank of the pursued research projects, enhancing the international visibility of the research results by increasing the share of publications with a high IF ( *Impact Factor*), involvement in the implementation of international projects, participation in scientific consortia and the development of contacts and good relations in the scientific environment, both domestic and international.

The purpose of the first cycle studies in the field of Biotechnology is to prepare the graduates to utilise their biological and chemical knowledge and the familiarity with technology in professional work, as well as individual deepening of the knowledge and its public presentation. During the studies, the student gains knowledge about specific fields which are the components of biotechnology, including: microbiology, cell biology, genetic engineering, molecular biology, genetics, biophysics, biochemistry, anatomy and physiology of plants and animals, bioprocess engineering, enzymology, tissue cultures, cytogenetics, law and ethics. The graduate is prepared to work in: units of the scientific and research background of the biotechnological industry and the related industries, research, control and diagnostic laboratories and design units handling biotechnological processes. The graduate is ready for continuing education and professional development, also being prepared to face research challenges and to initiate professional work.

## 12. Plan of studies from the year 2022/2023

Field of study: **Biotechnology**  
 Cycle of the studies: **First cycle**  
 Form of the studies: **full-time**  
 Profile of the studies: **general academic**

### Description of the symbols:

Status of the classes I: basic classes - P, specialist classes - K, human and social classes - HS;

Status of the classes II: obligatory classes - O, facultative classes - F

Status of the classes III: classes related to the scientific discipline / general academic profile /-N; classes with a practical character/practical profile/-U

No. of hours in the class, symbols: W - lecture; C - auditorium exercises; LC - laboratory exercises; PC - project exercises; TC - field exercises; ZP - professional internships

No. of hours in the classes in semesters W - lecture C - exercises (total hours for C, LC, PC, TC, ZP)

ECTS\_k - ECTS resulting from classes requiring direct contact

Type of credit: if there is an exam as a form for verifying the effects of learning - E; graded credit - Z\_o; credit - Z

No.	No. of the semester	Name of the subject	Code	Name of the item	Status of the field of study			No. of hours in the field of study						Total hours	Type of credit	ECTS	ECTS_k
					I	II	III	W	C	LC	PC	TC	ZP				
1	1	Język obcy I	BBT_BTa-1S-1Z-1	Foreign language I	P	F	U		60					60	Z_o	3	2.4
2	1	Matematyka I	BBT_BTa-1S-1Z-2	Mathematics I	P	O	N	30	30					60	E	6	2.4
3	1	Technologie informacyjne	BBT_BTa-1S-1Z-3	Information technologies	P	O	N			30				30	Z_o	1	1.2
4	1	Biologia komórki	BBT_BTa-1S-1Z-4	Cell biology	K	O	N	30		30				60	E	5	2.4
5	1	Chemia ogólna i fizyczna	BBT_BTa-1S-1Z-5	General and physical chemistry	P	O	N	45		30				75	E	7	3
6	1	Fizyka z biofizyką	BBT_BTa-1S-1Z-6	Physics and biophysics	P	O	N	45		45				90	E	7	3.6
7	1	Ekologia ogólna	BBT_BTa-1S-1Z-7	Ecology	P	O	U	15						15	E	1	0.6
8	1	Szkolenie biblioteczne	BBT_BTa-1S-1Z-8	Library training	P	O	U								Z	0	0

9	1	BHP	BBT_BTa-1S-1Z-9	Health and Safety	P	O	U								Z	0	0
		<b>Total semester 1</b>													E/Z_o	30	
10	2	WF I	BBT_BTa-1S-2L-10	Physical education I	P	F	N				30		30	Z	0	1.2	
11	2	Język obcy II	BBT_BTa-1S-2L-11	Foreign language II	P	F	U		60				60	E	4	2.4	
12	2	Matematyka II	BBT_BTa-1S-2L-12	Mathematics II	P	O	N	30	30				60	E	6	2.4	
13	2	Propedeutyka biotechnologii	BBT_BTa-1S-2L-13	Introduction to biotechnology	K	O	U		15				15	Z	1	0.6	
14	2	Chemia organiczna	BBT_BTa-1S-2L-14	Organic chemistry	P	O	N	30		30			60	E	6	2.4	
15	2	Botanika	BBT_BTa-1S-2L-15	Botany	K	O	N	30	4	20		6	60	E	3	2.4	
16	2	Anatomia zwierząt	BBT_BTa-1S-2L-16	Animal anatomy	K	O	N	10		15			25	E	2	1	
17	2	Histologia zwierząt	BBT_BTa-1S-2L-17	Animal histology	K	O	N	10		15			25	E	2	1	
18	2	Myślenie projektowe	BBT_BTa-1S-2L-18	Design thinking	HS	O	U	15	15				30	Z_o	2	1.2	
19	2	Przedmiot do wyboru - lista otwarta	BBT_BTa-1S-2L-19	Faculties - an open list of optional subjects	HS	F	N	60					60	Z_o	4	2.4	
		<b>Total semester 2</b>												E/Z_o	30		
20	3	WF II	BBT_BTa-1S-3Z-20	Physical education II	p	O	N				30		30	Z	0	1.2	
21	3	Podstawy inżynierii procesów biotechnologicznych	BBT_BTa-1S-3Z-21	Basic of engineering of biotechnological processes	K	O	N	30		30			60	E	6	2.4	
22	3	Biologia molekularna	BBT_BTa-1S-3Z-22	Molecular biology	K	O	N	30		30			60	E	6	2.4	
23	3	Mikrobiologia ogólna	BBT_BTa-1S-3Z-23	General microbiology	K	O	N	30		30			60	E	4	2.4	
24	3	Biochemia	BBT_BTa-1S-3Z-24	Biochemistry	K	O	N	30		30			60	E	4	2.4	
25	3	Fizjologia roślin	BBT_BTa-1S-3Z-25	Plant physiology	K	O	N	40		20			60	E	4	2.4	
26	3	Przedmiot do wyboru - lista otwarta	BBT_BTa-1S-3Z-26	Faculties - an open list of optional subjects	K	F	N	45		45			90	Z_o	6	3.6	
		<b>Total semester 3</b>												E/Z_o	30		
27	4	Inżynieria procesów biotechnologicznych	BBT_BTa-1S-4L-27	Engineering of biotechnological processes	K	O	N	30		30			60	E	6	2.4	
28	4	Genetyka ogólna	BBT_BTa-1S-4L-28	General genetics	K	O	N	30		30			60	E	5	2.4	
29	4	Podstawy genetyki i	BBT_BTa-1S-4L-29	Basics of animal genetics and	K	O	N	30		15			45	E	2	1.8	

		hodowli zwierząt		breeding													
30	4	Fizjologia zwierząt	BBT_BTa-1S-4L-30	Animal physiology	K	O	N	30						60	E	4	2.4
31	4	Fizjologia drobnoustrojów	BBT_BTa-1S-4L-31	Physiology of microorganisms	K	O	N	15						30	E	2	1.2
32	4	Enzymologia i techniki biochemiczne	BBT_BTa-1S-4L-32	Enzymology and biochemical techniques	K	O	N	15						45	E	3	1.8
33	4	Wirusologia ogólna	BBT_BTa-1S-4L-33	General virology	K	O	N	15						30	E	2	1.2
34	4	Przedmiot do wyboru - lista otwarta	BBT_BTa-1S-4L-34	Faculties - an open list of optional subjects	K	F	N	45						90	Z_o	6	3.6
		<b>Total semester 4</b>													E/Z_o	30	
35	5	Inżynieria genetyczna I	BBT_BTa-1S-5Z-35	Genetic engineering I	K	O	N	15						60	E	6	2.4
36	5	Podstawy bioinformatyki	BBT_BTa-1S-5Z-36	Basics of bioinformatics	P	O	N							45	Z_o	4	1.8
37	5	Metody biotechnologiczne w ochronie środowiska	BBT_BTa-1S-5Z-37	Biotechnological methods in environmental protection	K	O	N	15	7	6		2		30	E	2	1.2
38	5	Fizjonomia roślin I	BBT_BTa-1S-5Z-38	Physiomics	K	O	N	15						15	E	1	0.6
39	5	Podstawy projektowania i rozwoju linii technologicznych	BBT_BTa-1S-5Z-39	The design and development of technological lines – basic course	K	O	N	15				15		30	Z_o	3	1.2
40	5	Społeczne i prawne aspekty biotechnologii i ochrona własności intelektualnej	BBT_BTa-1S-5Z-40	Social and legal aspects of biotechnology, part I	HS	O	N	20						20	Z_o	2	0.8
41	5	Immunologia ogólna	BBT_BTa-1S-5Z-41	Immunology	K	O	N	30						45	E	4	1.8
42	5	Przedmiot do wyboru - lista otwarta	BBT_BTa-1S-5Z-42	Faculties - an open list of optional subjects	K	F		45						105	Z_o	8	4.2
		<b>Total semester 5</b>												350	E/Z_o	30	
43	6	Kultury komórkowe i tkankowe	BBT_BTa-1S-6L-43	Cell and tissue cultures	K	O	N	20						65	E	6	2.6
44	6	Statystyka	BBT_BTa-1S-6L-44	Statistics	P	O	N							30	Z_o	3	1.2
45	6	Inżynieria genetyczna II	BBT_BTa-1S-6L-45	Genetic engineering II	K	O	N	15						60	E	6	2.4
46	6	Przemysłowe procesy biotechnologiczne	BBT_BTa-1S-6L-46	Industrial biotechnology	K	O	N	30						45	E	3	1.8

47	6	Przedmiot do wyboru - lista otwarta	BBT_BTa-1S-6L-47	Faculties - an open list of optional subjects	K	F	N	45		90				135	Z_o	12	5.4
		<b>Total semester 6</b>													E/Z_o	30	
48	7	Bezpieczeństwo chemiczne w środowisku i szacowanie ryzyka chemicznego	BBT_BTa-1S-7Z-48	Chemical safety	K	O	N	30		15				45	E	4	1.8
49	7	Seminarium inżynierskie	BBT_BTa-1S-7Z-49	Seminar	K	F	N		30					30	Z_o	2	1.2
50	7	Pracownia dyplomowa	BBT_BTa-1S-7Z-50	Research project	K	F	N								Z	15	10
51	7	Praktyka zawodowa	BBT_BTa-1S-7Z-51	Professional practice	K	F	N							160	Z	4	6.4
52	7	Przedmiot do wyboru - lista otwarta	BBT_BTa-1S-7Z-52	Faculties - an open list of optional subjects	K	F	N	45						75	Z_o	5	3
		<b>Total semester 7</b>													E/Z_o	30	

	2	Przedmiot do wyboru lista otwarta	BBT_BTa-1S-2L-19	Faculties - an open list of optional subjects													
53	2	Etyka	BBT_BTa-1S-2L-19_1	Ethics	HS	F	N	30						30	E	2	1.2
54	2	Umiejętności interpersonalne	BBT_BTa-1S-2L-19_2	Interpersonal skills	HS	F	U	30						30	Z_o	2	1.2
55	2	Chemia fizyczna II	BBT_BTa-1S-2L-19_3	Physical chemistry II	P	F	N	15		15				30	E	2	1.2
56	2	Mikroskopowe analizy wizualizacji procesów i związków chemicznych	BBT_BTa-1S-2L-19_4	Methods of microscopic visualization of processes and molecules	P	F	N	15		15				30	Z_o	2	1.2
57	2	Chemia organiczna II	BBT_BTa-1S-2L-19_5	Organic chemistry II	P	F	N	15		15				30	E	2	1.2
	3	Przedmiot do wyboru lista otwarta	BBT_BT-1S-3Z-26	Faculties - an open list of optional subjects													
58	3	Finanse, bankowość, marketing	BBT_BTa-1S-3Z-26_1	Finance, banking, marketing	HS	F	N	30						30	Z_o	2	1.2
59	3	Biofizyka II	BBT_BTa-1S-3Z-26_2	Biophysics II	P	F	N	15	15					30	E	2	1.2
60	3	Grafika inżynierska	BBT_BTa-1S-3Z-26_3	Engineering graphics	P	F	U			15				15	Z_o	2	0.6

61	3	Biochemia proteomu	BBT_BTa-1S-3Z-26_4	Proteome biochemistry	P	F	N	15		15				30	Z_o	2	1.2
	4	Przedmiot do wyboru lista otwarta	BBT_BTa-1S-4L-34	Faculties - an open list of optional subjects													
62	4	Mikrobiologia weterynaryjna	BBT_BTa-1S-4L-34_1	Veterinary microbiology	K	F	N	15		15				30	Z_o	2	1.2
63	4	Anatomia preparacyjna	BBT_BTa-1S-4L-34_2	Preparative anatomy				10		20				30	Z_o	2	1.2
64	4	Mikrobiologia żywności	BBT_BTa-1S-4L-34_3	Food microbiology	K	F	N	15		15				30	E	2	1.2
65	4	Biotechnologiczne wykorzystanie drobnoustrojów	BBT_BTa-1S-4L-34_4	The biotechnological use of microorganisms	K	F	N	15		10		5		30	E	2	1.2
66	4	Fizjologia roślin II	BBT_BTa-1S-4L-34_5	Plant physiology II	K	F	N	15		15				30	Z_o	2	1.2
67	4	Biologia chloroplastów	BBT_BTa-1S-4L-34_6	Chloroplasts' biology	P	F	N	15		15				30	Z_o	2	1.2
	5	Przedmiot do wyboru lista otwarta	BBT_BTa-1S-5Z-42	Faculties - an open list of optional subjects													
68	5	Wirusologia weterynaryjna	BBT_BTa-1S-5Z-42_1	Veterinary virology	K	F	N	15		15				30	E	2	1.2
69	5	Związki bioaktywnie czynne w żywieniu człowieka i zwierząt	BBT_BTa-1S-5Z-42_2	Bioactive substances in human and animal nutrition	K	F	N	20		10				30	E	2	1.2
70	5	Biotechnologiczne wykorzystanie bakterii	BBT_BTa-1S-5Z-42_3	Biotechnological use of bacteria	K	F	N	15		15				30	E	2	1.2
71	5	Biotechnologiczne wykorzystanie pleśni	BBT_BTa-1S-5Z-42_4	Biotechnological use of moulds	K	F	N	15		15				30	E	2	1.2
72	5	Podstawy higieny w produkcji żywności	BBT_BTa-1S-5Z-42_5	Basic of hygiene in food processing	K	F	N	30						30	E	2	1.2
73	5	Zielona synteza nanocząstek	BBT_BTa-1S-5Z-42_6	Green synthesis of metal nanoparticles	K	F	N	15		15				30	E	2	1.2
74	5	Biologia oddziaływań roślina-mikroorganizmy	BBT_BTa-1S-5Z-42_7	Biology of plant-microbe interactions	K	F	N	30						30	Z_o	2	1.2
75	5	Roślinożerne bezkręgowce i ich wrogowie	BBT_BTa-1S-5Z-42_8	Herbivorous invertebrates and their enemies	K	F	N	15		15				30	E	2	1.2
	6	Przedmiot do wyboru lista otwarta	BBT_BTa-1S-6L-47	Faculties - an open list of optional subjects													
76	6	Język programowania R	BBT_BTa-1S-6L-47_1	R programming language	K	F	U			30				30	Z_o	2	1.2
77	6	Nanotechnologia i neurobiologia	BBT_BTa-1S-6L-47_2	Nanotechnology and neurobiology	K	F	N	15	15					30	E	2	1.2



78	6	Metody produkcji i praktyczne wykorzystanie przeciwciał monoklonalnych	BBT_BTa-1S-6L-47_3	Monoclonal antibodies – production and use	K	F	N	15		30				45	E	4	1.8
77	6	Podstawy immunopatologii	BBT_BTa-1S-6L-47_4	Fundamentals of immunopathology	K	F	N	15		30				45	E	4	1.8
79	6	Technologia żywności	BBT_BTa-1S-6L-47_5	Food technology	K	F	N	30						30	Z_o	2	1.2
80	6	Biotechnologiczne wykorzystanie drożdży	BBT_BTa-1S-6L-47_6	Biotechnological use of yeast	K	F	N	15		15				30	E	2	1.2
81	6	Biopolimery w produkcji opakowań do żywności	BBT_BTa-1S-6L-47_7	Biopolymers in the production of food packaging	K	F	N	15						15	Z_o	1	0.6
82	6	Herbologia	BBT_BTa-1S-6L-47_8	Weed science	K	F	U	15	25			5		45	E	4	1.8
83	6	Odporność roślin na szkodliwe stawonogi – wczoraj, dziś, jutro	BBT_BTa-1S-6L-47_9	Plant resistance to harmful arthropods - yesterday, today, tomorrow	K	F	N	10		5				15	Z_o	1	0.6
84	6	Metody biostatystyczne w zarządzaniu zasobami genowymi	BBT_BTa-1S-6L-47_10	Biostatistical methods in management of genetic resources	K	F	N	15		15				30	Z_o	2	1.2
	7	Przedmiot do wyboru lista otwarta	BBT_BTa-1S-7Z-52	Faculties - an open list of optional subjects													
85	7	Metody wizualizacji danych	BBT_BTa-1S-7Z-52_1	Data visualization methods	K	F	N			15				15	Z_o	1	0.6
86	7	Biotechnologiczne wykorzystanie odpadów	BBT_BTa-1S-7Z-52_2	Biotechnological use of waste	K	F	N	15						15	Z_o	1	0.6
87	7	Biotechnologia rozrodu zwierząt	BBT_BTa-1S-7Z-52_3	Biotechnology of animal reproduction	K	F	N	15		15				30	Z_o	2	1.2
88	7	Drobnoustroje chorobotwórcze przenoszone przez żywność i wodę	BBT_BTa-1S-7Z-52_4	Foodborne and waterborne pathogenic microorganisms	K	F	N	15						15	Z_o	1	0.6
89	7	Roślinne związki aktywne w życiu człowieka	BBT_BTa-1S-7Z-52_5	Plant active compounds in human life	K	F	N	15						15	Z_o	1	0.6

## Summary of the plan of studies:

### a) Basic (P) and specialist (K) classes

Semester	Hours			ECTS		
	Basic classes (P)	Specialist classes (K)	Total basic and specialist classes (P and K)	Basic classes (P)	Specialist classes (K)	Total basic and specialist classes (P and K)
1	330	60	390	25	5	30
2	210	125	335	16	8	24
3	30	390	420	0	30	30
4	0	420	420	0	30	30
5	45	285	330	4	24	28
6	30	305	335	3	27	30
7	0	310	310	0	30	30
<b>Sum</b>	645	1895	2540	48	154	202

### b) Obligatory (O) and facultative (F) classes

Semester	Hours			ECTS		
	Obligatory classes (O)	Facultative classes (F)	Total obligatory and facultative classes (O and F)	Obligatory classes (O)	Facultative classes (F)	Total obligatory and facultative classes (O and F)
1	330	60	390	27	3	30
2	275	150	425	22	8	30
3	330	90	420	24	6	30
4	330	90	420	24	6	30
5	245	105	350	22	8	30
6	200	135	335	18	12	30
7	235	75	310	4	26	30
<b>Sum</b>	1945	705	2650	141	69	210

### c) All subjects in total

Semester	Hours	ECTS
1	390	30
2	425	30
3	420	30
4	420	30
5	350	30
6	335	30
7	310	30
<b>Sum</b>	2650	210

### 13. List of subjects

<b>Name of the subject:</b>		Foreign language I	<b>ECTS credit points:</b>	3
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the vocabulary and structures needed to achieve the described effects	K_W10 K_W14	2 1
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to understand spoken statements on general and selected professional topics	K_U18 K_U19	3 3
	<b>U2</b>	able to speak about general and selected professional topics	K_U18 K_U19	3 3
	<b>U3</b>	able to understand the sense of papers, articles, document and correspondence	K_U18 K_U19	3 3
	<b>U4</b>	able to manage correspondence and prepare selected types of documents	K_U18 K_U19	3 3
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to utilise knowledge and skills related to foreign languages in the professional life and to gain and extend knowledge	K_K02	3
<b>Programme content providing the achievement of the effects of learning:</b>		Prepare to master a foreign language to an extent which helps reaching level B2 with respect to four skills (listening, speaking, writing and reading ) in professional and scientific communication, taking into account a specialised language for the field of study. Vocabulary related to education, work, science, technique, exchange of information, the environment, and from a specialised scope related to the field of study. Language functions: describing phenomena, processes, procedures, managing correspondence and discussions, preparing notes, preparing and giving presentations. Grammar: proper use of word forms and sentence constructions, word formation. Exercising communication, pronunciation and spelling.		
<b>Means of verifying the effects of learning:</b>		ongoing evaluation, test/presentation during exercises,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Mathematics I</b>	<b>ECTS credit points:</b>	<b>6</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows how to solve equations and inequalities with an absolute value and quadratic equations	K_W12	3
	<b>W2</b>	knows how to calculate the derivatives of one variable functions and knows the necessary and sufficient condition for the extrema of such functions	K_W04	3
	<b>W3</b>	knows how to examine the course of variation for simple one variable functions	K_W12	3
	<b>W4</b>	knows how to use Taylor's formula or a power series for approximate calculations	K_W12	3
	<b>W5</b>	knows the uses of integral calculus for simple practical problems	K_W12	3
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to apply computational methods	K_U01	3
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to initiate joint work in terms of applying mathematics to biotechnology and the related sciences	K_K01 K_K02	2 2
<b>Programme content providing the achievement of the effects of learning:</b>		Selected terms, theorems and methods from the basics of further mathematics, and their application to solving specific tasks and problems related to the field of study. Topics such as: number sets, absolute value, infima and suprema of sets, algebraic transformation, solving equations and inequalities; function and its properties, elementary functions, defining the limit of a sequence and a function, continuity of a function, derivative of a one variable function and its application to examining the course of variance of a function, numerical and power series, Taylor's polynomial and their application; indefinite integral, various methods of integration, definite integral and its applications to calculate the areas of flat shapes and the volumes of solids of revolution.		
<b>Means of verifying the effects of learning:</b>		tests, written homework, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Information technologies</b>	<b>ECTS credit points:</b>	<b>1</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows proper methods for performing calculations	K_W04	3
	<b>W2</b>	knows how to verify the correctness of calculations by means of the entered formulas	K_W02 K_W14	2 1
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to propose a proper graph for graphical presentation of the data	K_U21 K_U16	1 1
	<b>U2</b>	able to prepare a multi-page hierarchical document	K_U22	1
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	is ready for the preparation and storage of knowledge	K_K01	3
<b>Programme content providing the achievement of the effects of learning:</b>		Advanced methods of using a spreadsheet: formatting cells, generating formulas using references to cells and names, creating graphs, creating and modifying pivot charts and graphs, data management. Methods of using a text editor: editing text, creating multi-page documents, mail merge. Assumptions for using the application for handling relational databases. Alternative solutions – using the R environment.		
<b>Means of verifying the effects of learning:</b>		project, test,		

<b>Name of the subject:</b>		<b>Cell biology</b>	<b>ECTS credit points:</b>	<b>5</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the terminology used to describe cellular structures, their function and chemical composition	K_W06 K_W08	2 1
	<b>W2</b>	understands 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	K_W10	2
	<b>W3</b>	has knowledge about the cellular and tissue-based organisation of plants and animals as well as the processes occurring in organelles and compartments of a eukaryotic cell	K_W05 K_W08 K_W09	1 2 2
	<b>W4</b>	knows the empirical interpretation of the variability of cellular structures, being able to extend the knowledge related to cell biology, using the available sources of electronic information	K_W07 K_W08 K_W09	3 1 2
	<b>W5</b>	knows how to observe the occupational safety of oneself and the others, and how to behave in emergencies	K_W11 K_W14	3 1
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to utilise the techniques of microscopic examinations and cytochemical methods used in cell biology	K_U03 K_U05 K_U06 K_U07 K_U15 K_U21 K_U22	2 1 2 2 1 3 2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to solve cognitive and practical problems	K_K01	2
	<b>K2</b>	ready to perform safe work in a laboratory	K_K03	1
<b>Programme content providing the achievement of the effects of learning:</b>		Cellular structure of animal and plant organisms, ultrastructure of animal and plant cells, functions of cell 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.		
<b>Means of verifying the effects of learning:</b>		tests during exercises, a mark for the work performed during classes, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>General and physical chemistry</b>	<b>ECTS credit points:</b>	<b>7</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows and understands terms and laws related to general and physical chemistry, discussed during the classes, knowing how to use them to describe chemical processes	K_W07 K_W10	2 2
	<b>W2</b>	is aware of the dangers resulting from working in a chemical laboratory, knowing the principles of OHS and following them	K_W11	2
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to use the recognised laws and relationships for chemical calculations (in particular related to the concentrations of solutions, stoichiometry, pH of solutions, thermochemistry, solubility equilibria, kinetics of reactions, electrochemistry, spectroscopy)	K_U05	2
	<b>U2</b>	knows how and is able to select and perform simple chemical reactions serving the qualitative analysis of selected salts	K_U06 K_U16 K_U20	2 1 3
	<b>U3</b>	uses simple laboratory equipment, utilising it to perform and interpret simple complexometric, redox, potentiometric and conductometric titration, as well as colorimetric assays	K_U06	2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to cooperate in a team preparing chemical assays and reports on the performed experiments	K_K02 K_K03	1 1
<b>Programme content providing the achievement of the effects of learning:</b>		Structured knowledge of general and physical chemistry needed for further studying of specialist subjects. Basic laboratory equipment and the principles of unassisted work in a laboratory. Processing and reporting results produced in an experiment, drawing conclusions based on these results. Measurement uncertainty.		
<b>Means of verifying the effects of learning:</b>		written exam, tests during laboratory exercises, practical control tasks performed during the classes/reports on the performed control tasks, a mark resulting from observations during the classes,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Physics and biophysics</b>	<b>ECTS credit points:</b>	<b>7</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the general laws of physics which constitute a basis for understanding the phenomena taught under other natural and technical subjects	K_W07	2
	<b>W2</b>	knows the units of physical quantities and understands the record of their multiplicities defined by prefixes	K_W12	1
	<b>W3</b>	knows and properly uses primary techniques for measuring physical quantities	K_W07 K_W10	2 2
	<b>W4</b>	knows the laws of biophysics, which constitute a basis understanding the functioning of plant and animal organisms	K_W03 K_W07	3 2
	<b>W5</b>	knows the physical imaging methods in organisms	K_W08	2
	<b>W6</b>	knows statistical laws related to the measurements of physical quantities in organisms	K_W12	1
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to use simple mechanical (a calliper, a weighing scale, a stopwatch), electrical (a voltmeter, an ammeter) and optical devices (a refractometer, a polarimeter)	K_U01 K_U06 K_U20	2 1 2
	<b>U2</b>	able to process the results of measurements, estimate their inaccuracy, being able to assess them critically using various sources	K_U10 K_U14	2 2
	<b>U3</b>	able to solve the simplest physical and biophysical problems, necessary for the quantitative determination of the effects of phenomena and processes	K_U16	2
	<b>U4</b>	able to distinguish between scientific and non-scientific theorems	K_U04	2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to develop their skills and use them in practice	K_K02	1
<b>Programme content providing the achievement of the effects of learning:</b>		The laws of physics and biophysics allowing for understanding the mechanisms of phenomena observed in nature, necessary for further education as part of specialised natural and technical subjects. Issues such as: Newton's laws, the law of conservation of momentum, angular momentum, energy, properties of matter, fluid physics, thermodynamics, mechanical waves, electricity and magnetism, Coulomb's law, Ohm's law, electromagnetic wave, reflection and refraction, spectroscopy, biothermodynamics, thermokinetics, the regulation and control theory, molecular biophysics, cell biophysics, active and passive transport, transport proteins, resting potential, electrical model of the membrane, tissue biophysics, biophysics of vision, biophysics of the respiratory system, biophysics of the circulatory system, imaging of cells, tissues and organs.		
<b>Means of verifying the effects of learning:</b>		theoretical knowledge exam, written reports on the performed laboratory exercises,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,



<b>Name of the subject:</b>		<b>Ecology</b>	<b>ECTS credit points:</b>	<b>1</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the ecological terminology, the patterns and mechanisms related to the phenomena of succession, the circulation of matter and biological diversity	K_W07 K_W09 K_W10	2 1 2
	<b>W2</b>	knows the basics of the methodology of ecological research and practical applications of ecology	K_W07 K_W09 K_W10 K_W14	2 1 2 1
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to explain the essence of ecological impacts at the level of population, biocoenosis, ecosystem, landscape and biosphere	K_U04	2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to recognise the value of animate nature and identify the anthropogenic sources of threats to species and habitat diversity	K_K04 K_K07	1 3
<b>Programme content providing the achievement of the effects of learning:</b>		Phenomena occurring in ecological systems (natural and anthropogenic), the relationship between animate and inanimate elements in the environment.		
<b>Means of verifying the effects of learning:</b>		written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Foreign language II</b>	<b>ECTS credit points:</b>	<b>4</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the vocabulary and structures needed to achieve the described effects	K_W10 K_W14	2 1
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	understands statements in a foreign language related to field of study at the B2 level	K_U18 K_U19	3 3
	<b>U2</b>	able to speak precisely and give presentations on topics related to the field of study at the B2 level	K_U18 K_U19	3 3
	<b>U3</b>	understands papers, articles, documents and correspondence related to the field of study at the B2 level	K_U18 K_U19	3 3
	<b>U4</b>	able to prepare correspondence, documents and papers related to detailed topics connected to the field of study at the B2 level	K_U18 K_U19	3 3
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to utilise knowledge and skills related to foreign languages in the professional life and to gain and extend knowledge	K_K02	3
<b>Programme content providing the achievement of the effects of learning:</b>		Mastering a foreign language at the B2 level of the Common European Framework of Reference for Languages, reaching language independence allowing for efficient use of the foreign language with respect to four skills (listening, speaking, writing and reading) in professional and scientific communication, taking into account the specialised language for the field of study.		
<b>Means of verifying the effects of learning:</b>		final exam, the possibility to utilise remote education in necessary cases,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Mathematics II</b>	<b>ECTS credit points:</b>	<b>6</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the methods of solving a system of linear equations and understands the term of linear independence of vectors	K_W12	3
	<b>W2</b>	knows the elements of a qualitative analysis of a differential equation	K_W04	3
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to determine the extremum of a differentiable function of two variables	K_U01	3
	<b>U2</b>	able to use Lagrange multipliers to determine the lowest and the highest value of a function of multiple variables	K_U01	3
	<b>U3</b>	able to build a simple growth model and solve a simple differential equation	K_U13	3
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to use computational methods in practice	K_K02	2
<b>Programme content providing the achievement of the effects of learning:</b>		Selected terms, theorems and methods of further mathematics and mathematical modelling, and their application to solving specific tasks and problems related to the field of study. Topics such as: an improper integral and its application; matrices and their application in solving sets of linear equations; linear independence of vectors; elements of analytic geometry in $\mathbb{R}^n$ ; functions of multiple variables; partial derivatives; local and conditional extrema as well as establishing the lowest and highest value of a function; ordinary differential equations; various growth models of a population; the application of differential equations to biology and physics; examples of mathematical modelling.		
<b>Means of verifying the effects of learning:</b>		tests, written homework, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		Introduction to biotechnology	ECTS credit points:	1
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
<b>Knowledge:</b> (the graduate knows and understands)	<b>W1</b>	knows definitions related to biotechnology, the history and scope of biotechnology	K_W03 K_W14	2 1
	<b>W2</b>	has the knowledge about the possibilities of utilising biotechnology in plant and animal production	K_W09 K_W13	2 2
	<b>W3</b>	knows the most important aspects of biotechnology used in plant and animal production	K_W01 K_W13 K_W03	3 2 2
	<b>W4</b>	knows the principles of breeding laboratory animals	K_W09 K_W13	2 2
	<b>W5</b>	knows important biochemical processes used in the water treatment technology	K_W01	3
	<b>W6</b>	knows biochemical processes used in the water treatment technology	K_W09 K_W01	3 3
	<b>W7</b>	knows the wine production process, knows wine products compliant with the valid legislature,	K_W09 K_W01	3 3
<b>Skills:</b> (the graduate is able to)	<b>U1</b>	able to design a commercial laboratory handling the micropropagation of plants	K_U12 K_U17	2 2
	<b>U2</b>	able to assess the usefulness of biotechnological methods for achieving a specific product effect	K_U12 K_U17 K_U09 K_U08	2 2 1 1
	<b>U3</b>	able to interpret the biological and physicochemical results of a water analysis and assess whether the controlled process occurs properly or not	K_U15	3
	<b>U4</b>	able to characterise the raw materials used in the production of beer, knows the beer and malt production technologies	K_U12	2
<b>Competences:</b> (the graduate is ready to)	<b>K1</b>	ready to recognise the ethical dilemmas of breeding laboratory animals	K_K07	3
	<b>K2</b>	expands and utilises the acquired knowledge	K_K02	3
<b>Programme content providing the achievement of the effects of learning:</b>		The application of biotechnology to plant and animal production, with particular emphasis on: - methodical bases of in vitro plant cultures, micropropagation and producing planting materials free of viruses; familiarising the students with the most important achievements and development directions of biotechnology, genetic engineering, animal breeding and improvement, diagnostics and therapy. Familiarising the students with the technology of brewery and winemaking, as well as topics related to biotechnological methods which are used in environmental protection, with particular emphasis on biotechnological methods used in the water treatment technology.		
<b>Means of verifying the effects of learning:</b>		written reports from field exercises, presentations, exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Organic chemistry</b>	<b>ECTS credit points:</b>	<b>6</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the functional groups (formulas and names) present in organic compounds, being able to assign the compound to a given class of compounds on this basis, being able to assess the reactivity as well as solubility in water and non-polar solvents based on the structure of the molecule	K_W07	2
	<b>W2</b>	knows the types of biomolecules, their general formulas and reactivity	K_W05	1
	<b>W3</b>	knows and understands the essence of intermolecular interactions, being able to interpret the structure of proteins, sugars and fats on their basis	K_W05 K_W10	1 2
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to use laboratory techniques which constitute a basis for further scientific work	K_U06 K_U04 K_U16 K_U20	2 2 2 2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to use laboratory tools and techniques in practice	K_K02	1
<b>Programme content providing the achievement of the effects of learning:</b>		Relations between the structure of a compound and its properties, as well as reactions important from the perspective of changes in living organisms. The connection between intermolecular interactions, chemical reactions and biochemistry and physiology. Topics such as: The structure of organic compounds taking into account stereochemistry; the principles of organic nomenclature. Discussing the properties and reactions of main groups of organic compounds, alcohols, halogen derivatives, carbonyl and carboxyl compounds, amines as well as multifunctional compounds, with particular emphasis of the relations between the structure and properties of organic substances. Biomolecules – fats, saccharides, peptides.		
<b>Means of verifying the effects of learning:</b>		tests, final written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		Botany	ECTS credit points:	3
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	has general knowledge on botany adjusted to the field of study, knowing in particular: Polish and English terminology used in botany	K_W06 K_W08 K_W09 K_W10 K_W14	1 1 1 2 1
	W2	knows the position of plants in the Tree of Life, the systematics of land plants and life cycles characteristic for their main clades	K_W09 K_W10	2 1
	W3	knows the structure and functions of the vegetative and generative organs of a plant as well as structural and functional adaptations of the ecological groups of plants to their habitat	K_W06 K_W08 K_W09	1 1 2
	W4	knows model plants and the most important plants supplying nutritional and industrial materials	K_W03 K_W09 K_W10	1 2 1
Skills: (the graduate is able to)	U1	performs microscopic observations of plant tissues and organs, followed by their analyses, especially in the context of linking the structure and the function, also identifying the most important useful plants and determining their systematic position	K_U04 K_U06 K_U07 K_U12 K_U21	1 2 2 1 2
	U2	individually finds, critically analyses and utilised information related to botany, originating from various sources in the Polish language, also using the English language to an extent sufficient to use the sources of botanical knowledge in this language, also formulating their statements briefly, logically and clearly, properly using botanical terminology in them and indicating the connections of botany to other sciences, in particular physics and chemistry	K_U04 K_U10 K_U11 K_U16 K_U19 K_U22	1 1 1 1 1 2
Competences: (the graduate is ready to)	K1	works efficiently individually and in a team, manifesting this by adhering to the principles of OHS, respecting copyrights, responsibility for their own work as well as readiness to succumb to the principles of teamwork and accepting responsibility for tasks executed in a group on an e-learning platform, as well as the ability to develop and implement a work schedule which ensures meeting the deadlines	K_K02 K_K03	2 1
	K2	performs self-assessment of their own knowledge, skills and competences; understands the need for continuous professional development	K_K01 K_K05	1 1
Programme content providing the achievement of the effects of learning:		The structure and functions of tissues as well as the vegetative and generative organs of plants. Characteristics of the processes leading to the differentiation of tissues and organs. Structural and developmental adaptation of plants to various habitats. Embryology. Selected development cycles of contemporary representatives of main clades of the phylogenetic tree. Systematics and the evolutionary tendencies of major taxonomic groups of land plants, their identification and the ability to utilise in practice as a source of raw materials.		
Means of verifying the effects of learning:		tests during exercises, a mark for a report from observations performed during the classes, a mark for a presentation during exercises, analysis of the students' activity on an e-learning platform, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Animal anatomy</b>	<b>ECTS credit points:</b>	<b>2</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	has knowledge on the macroscopic structure of organs and inter-species differences	K_W09	3
	<b>W2</b>	understands the relationship between the morphology and the function of organs as well as the adaptation of an animal organism to the living environment	K_W03 K_W05 K_W09	3 3 3
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to analyse and combine information related to the individual levels of organisation of an animal organism and its functioning	K_U04 K_U13 K_U21	2 3 1
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to plan and conduct a biological experiment	K_K06 K_K01 K_K07 K_K02	2 2 1 3
<b>Programme content providing the achievement of the effects of learning:</b>		Macroscopic general anatomical structures of domestic and farm animals, logical correlation between the macroscopic structure and the primary functions served by specific organs and systems of the animal body. Topics such as: The locomotor system: the skeleton, bone connections, the muscular system, anatomy of the respiratory system, the digestive system, the genitourinary system, anatomy of the cardiovascular and lymphatic system, the somatic and autonomic nervous system, endocrine organs, sensory organs, elements of bird anatomy.		
<b>Means of verifying the effects of learning:</b>		activity when discussing a defined issue, written test,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Animal histology</b>	<b>ECTS credit points:</b>	<b>2</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	has knowledge on the microscopic structure of cells, tissues and organs	K_W05 K_W06	3 2
	<b>W2</b>	understands the relationship between the morphology and the function of organs as well as the adaptation of an animal organism to the living environment	K_W03 K_W09	3 3
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to analyse and combine information related to the individual levels of organisation of an animal organism and its functioning	K_U04	2
			K_U13	2
			K_U21	2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to analyse histological specimens	K_K06	2
			K_K01	1
			K_K07	1
			K_K02	2
<b>Programme content providing the achievement of the effects of learning:</b>		General microscopic histological structures of animals. Logical correlation between the microscopic structure and the basic functions served by specific cells, tissues and organs. Topics such as: Histological structure of the lymphatic system, Histology of the digestive system, Histology of the male and female reproductive system, Histology of the nervous system, Histology of the urinary tract.		
<b>Means of verifying the effects of learning:</b>		theoretical knowledge exam, written reports on the performed laboratory exercises,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,



<b>Name of the subject:</b>		Design thinking	<b>ECTS credit points:</b>	2
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	W1	knows how to solve complex problems	K_W01 K_W02 K_W03 K_W04 K_W06 K_W07 K_W09 K_W12 K_W14 K_W15	3 3 3 2 3 2 2 3 3 2
<b>Skills: (the graduate is able to)</b>	U1	able to perform the process of solving complex problems	K_U01 K_U02 K_U05 K_U06 K_U07 K_U08 K_U09 K_U13 K_U14 K_U17 K_U19 K_U20	3 3 3 2 2 2 2 2 2 2 2 3
<b>Competences: (the graduate is ready to)</b>	K1	ready to work in a team, both as its leader or a member	K_K01 K_K02 K_K03 K_K04 K_K05	3 3 3 2 2
<b>Programme content providing the achievement of the effects of learning:</b>		Planning and implementing projects as well as solving complex problems utilising the design thinking method. Topics such as: Developing the skills of teamwork and design work, practical application of prototyping and the achievements of cognitive sciences in solving technical and complex problems. Brainstorm, the Six Thinking Hats method, body storming. Empathy, definition of a problem, generation of ideas, prototyping, testing solutions. Practical application of the studied rules to solving the arising problems. Creativity. Management of time, management of tasks. Motivation and habits. Leadership. Team building. Team work. Planning the development path, planning the career.		
<b>Means of verifying the effects of learning:</b>		credit based on a project,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Basics of engineering of biotechnological processes</b>	<b>ECTS credit points:</b>	<b>6</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	understands the processes (the exchange of heat, momentum, mass) occurring during a biotechnological process	K_W02	1
	<b>W2</b>	understands the impact of process conditions on the biological material	K_W07	2
	<b>W3</b>	has knowledge about the devices and their instrumentation (measurement sensors) used in biotechnological production	K_W04 K_W07 K_W14 K_W15 Engineering of biotechnological processes	2 2 3 3
	<b>W4</b>	knows the principles of OHS	K_W11	3
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to conduct an experiment according to the instruction and process the collected results	K_U04 K_U06 K_U11 K_U13 K_U12 K_U10 K_U15 K_U08 K_U09 K_U14	1 2 1 2 2 1 1 2 3 2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to work in a team	K_K02	3
<b>Programme content providing the achievement of the effects of learning:</b>		Processes occurring in the course of a biotechnological process, indication of the possibilities of willing design of process conditions taking into account the requirements of both the process engineering and the biological material, as well as explaining mutual interactions between the process and the biological material.		
<b>Means of verifying the effects of learning:</b>		a mark for written papers examining the theoretical preparation, a mark for reports on the performance of experiments, exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Molecular biology</b>	<b>ECTS credit points:</b>	<b>6</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the molecular bases for the functioning of organisms; the relationships between the structure and the function at the level of macromolecules (nucleic acids, proteins, polysaccharides, lipids); the principles of transferring and manifesting (expressing) genetic information	K_W03 K_W05 K_W06 K_W13	3 3 2 3
	<b>W2</b>	knows and understands the technical principles of molecular biology	K_W07 K_W04 K_W14	3 3 1
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to perform a comparative analysis of gene expression in prokaryotic and eukaryotic organisms	K_U01 K_U03 K_U05 K_U21	3 3 2 2
	<b>U2</b>	able to execute basic techniques of molecular biology, perform necessary calculations when preparing reaction conditions	K_U01 K_U03 K_U04 K_U05 K_U17 K_U21	3 3 1 2 3 2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to apply the gained knowledge to develop research projects related to molecular biology	K_K07 K_K05 K_K03 K_K04	2 1 3 2
<b>Programme content providing the achievement of the effects of learning:</b>		Topics related to the molecular biology of the cell, regulating gene expression and methods of genetic engineering with examples of applying these methods to diagnostics, therapy, prevention and epidemiology of diseases.		
<b>Means of verifying the effects of learning:</b>		tests at the beginning of exercises final test ending the exercises, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>General microbiology</b>	<b>ECTS credit points:</b>	<b>4</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the taxonomic, morphological and physiological diagnostics criteria for the prokaryotes and eukaryotes	K_W06 K_W09 K_W10	2 3 3
	<b>W2</b>	understands the specifics of growth of microorganisms and the impact of external environmental factors on their development	K_W03 K_W07 K_W08 K_W09 K_W14	2 2 3 3 1
	<b>W3</b>	understands mutual relations between microorganisms	K_W08	3
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to identify the groups of microorganisms	K_U01 K_U04 K_U05 K_U06	2 2 2 2
	<b>U2</b>	able to quantitatively characterise the microbiological quality of the environment	K_U01 K_U04 K_U05 K_U06	2 2 2 2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to consciously distinguish benefits and dangers related to the presence of microorganisms in the environment	K_K01 K_K02 K_K03	3 3 2
<b>Programme content providing the achievement of the effects of learning:</b>		The significance of microorganisms in shaping the natural environment, and the possibilities of utilising their biochemical potential. Topics such as: Microbiology as a science. The place of microorganisms in a world of living organisms. Particular features of microorganisms. Taxonomic, morphological and physiological characteristics of the prokaryotes and eukaryotes Microorganisms of extreme environments. Conjugation, transduction and transformation as the sources of variability among microorganisms. Impact of the factors of the external (physical, chemical, biological) environment on the growth of microorganisms, and the impact of microorganisms on changes in the environment. Mutual relations between microorganisms. Microorganisms as an indicator of environmental safety. Characteristics of major saprophytes and pathogens and the paths of their transmission. Methods of inactivation of microorganisms. Benefits and dangers resulting from the metabolic activity of microorganisms.		
<b>Means of verifying the effects of learning:</b>		tests, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		Biochemistry	ECTS credit points:	4
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	knows the principles of cell metabolism	K_W04 K_W05 K_W07 K_W08	2 3 2 3
	W2	understands the strategic purposes of metabolism	K_W04 K_W06 K_W07 K_W08	2 2 2 3
	W3	knows the methods of regulation of main metabolic pathways	K_W04 K_W05 K_W06 K_W07 K_W08 K_W14	2 3 2 2 3 1
	W4	knows the principles of occupational safety of oneself and others	K_W11	1
Skills: (the graduate is able to)	U1	able to explain the process being the basis of a biochemical reaction	K_U05 K_U16	1 1
	U2	able to propose proper techniques in order to examine biochemical processes	K_U05 K_U06 K_U07 K_U20	1 1 1 1
	U3	able to describe the performed experiments	K_U07 K_U12 K_U21	1 2 2
Competences: (the graduate is ready to)	K1	ready to perform laboratory work	K_K02 K_K03	3 3
Programme content providing the achievement of the effects of learning:	Principles of cell metabolism and its regulation as well as integration of metabolic pathways; mechanisms for transferring and storing energy; the molecular response of organisms to changes in environmental conditions, along with the use of the achievements of biochemistry in clinical research. Getting acquainted with the structure, properties and function of primary organic compounds existing in cells, as well as with the methods of modern biochemistry.			
Means of verifying the effects of learning:	marks for a laboratory experiment, preparation of written reports, test, written exam on the lecture material,			

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		Plant physiology	ECTS credit points:	4
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	knows the pattern and understands the relationships between physiological processes	K_W04 K_W05 K_W06 K_W07	2 1 2 2
	W2	knows the mechanisms regulating physiological processes at the level of cells, tissues and the entire body, taking into account internal and external factors	K_W05 K_W06 K_W07	1 2 2
	W3	knows how to define and classify the reactions of plants to disadvantageous environmental factors, also knowing how to propose methods which lead to improving the tolerance of plants to stressors	K_W03 K_W13 K_W14	3 2 1
Skills: (the graduate is able to)	U1	able to use methods measuring selected parameters describing physiological processes	K_U01 K_U02 K_U05 K_U06 K_U16	3 1 2 1 1
	U2	performs simple experiments, compiles and interprets their results	K_U04 K_U05 K_U06 K_U16 K_U17 K_U20 K_U21	3 2 1 1 3 2 2
Competences: (the graduate is ready to)	K1	is ready for teamwork when performing exercises and preparing presentations	K_K01 K_K02 K_K06	3 2 3
	K2	ready to apply safety rules to laboratory work and take responsibility for the used equipment and devices	K_K03	3
Programme content providing the achievement of the effects of learning:		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. Topics such as: 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.		
Means of verifying the effects of learning:		written test during the exercises, observation and a mark for speeches and the presentations of the defined problem during classes, observation of activity during laboratory classes, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		Engineering of biotechnological processes	ECTS credit points:	6
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	knows the conditions of specific processes of separation and purification allowing for an increase in the efficiency of a given process	K_W01 K_W02 K_W03 K_W04 K_W08 K_W13 K_W14 K_W15	3 3 3 3 3 3 3 3
	W2	knows and understands the action of bioreactors	K_W01 K_W02 K_W04 K_W08 K_W13 K_W14 K_W15	3 3 3 3 3 3 3
Skills: (the graduate is able to)	U1	able to select the proper construction of a bioreactor and a monitoring method for a specified type of process	K_U06 K_U10 K_U11 K_U12 K_U13	3 3 2 2 3
	U2	able to rationally select proper methods for extracting and purifying a biotechnological product	K_U06 K_U10 K_U11 K_U12 K_U13 K_U20	3 3 2 2 3 3
	U3	able to critically address the results of the performed experiments and the possible methodological errors.	K_U02 K_U08 K_U09 K_U14 K_U21	2 2 2 3 2
Competences: (the graduate is ready to)	K1	ready to commence work with bioreactors	K_K05	2
Programme content providing the achievement of the effects of learning:		Construction and the operating principles of bioreactors as well as their instrumentation enabling control and monitoring of a biotechnological process; explaining the essence of specific methods for separating and purifying the products of a biotechnological process. Topics such as: 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 and purifying 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, Solution thickening processes, evaporation and cryoconcentration. Precipitation and crystallisation. Extraction, membrane and electrokinetic processes, filtration on gels. Distillation. Convective drying, freeze drying, chromatographic methods.		
Means of verifying the effects of learning:		reports, a mark for written papers examining the theoretical preparation for conducting experiments, oral exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		General genetics	ECTS credit points:	5
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	understands the mechanisms of inheriting traits, genetic variation as well as the origin and biology of reproduction of model species of microorganisms, plants and animals	K_W03 K_W06 K_W10	3 3 3
	W2	knows how to utilise interdisciplinary knowledge to design and present one's own concept of improving plant and animal organisms	K_W03 K_W06 K_W07 K_W10 K_W14	3 3 3 3 1
	W3	knows the principles of introducing changes to genomes, knowing how to predict the effects of these changes	K_W03 K_W06 K_W07 K_W10	3 3 3 3
	W4	is capable of analysing important topics from genetics and molecular biology, also being able to provide and explain various detailed examples	K_W03 K_W06 K_W10	3 3 3
	W5	knows and understands the principles related to gene expression	K_W03 K_W06 K_W07 K_W10	3 3 3 3
Skills: (the graduate is able to)	U1	able to analyse topics from genetics and molecular biology, also being able to provide and explain various detailed examples	K_U03 K_U17 K_U18 K_U22	3 3 2 3
	U2	able to provide and explain specific examples, also being able to provide and implement proper experimental methods	K_U03 K_U17 K_U22	3 3 3
Competences: (the graduate is ready to)	K1	is aware of the social significance of understanding the principles of inheriting traits as well as genetic improvement of organisms for producing food with high quality and technological value, with consideration for copyright protection	K_K01 K_K02 K_K07	2 2 2
	K2	ready to broaden, deepen and update the knowledge and its practical use	K_K01 K_K02 K_K07	2 2 2
Programme content providing the achievement of the effects of learning:		Genetic and epigenetic conditions of phenotypic and functional variance of organisms along with modern methods used for breeding plants and animals. Topics such as: basic genetic concepts, the structure of a gene and genome, traits versus variance and development, transposons, natural and induced genetic variance, epigenetics, the basics of a genetic analysis, inheritance and heritability, genetic bases of plant and animal resistance, application of genetics to plant and animal breeding.		
Means of verifying the effects of learning:		tests during exercises, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,



<b>Name of the subject:</b>		<b>Basics of animal genetics and breeding</b>	<b>ECTS credit points:</b>	<b>2</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	possesses coherent knowledge on the mechanisms of inheriting traits, genetic variance and animal biology	K_W06 K_W10 K_W07 K_W03	1 1 1 1
	<b>W2</b>	understands the issues of genetics and molecular biology, being able to describe and explain them based on examples	K_W06 K_W10 K_W07 K_W03	1 1 1 1
	<b>W3</b>	knows the principles of breeding and using animals, preserving their welfare	K_W06 K_W10 K_W07 K_W03 K_W14	1 1 3 1 1
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to utilise knowledge related to genetics and molecular biology in animal breeding and husbandry	K_U03 K_U17 K_U18 K_U22	2 2 2 2
	<b>U2</b>	able to utilise knowledge related to genetics and molecular biology in experiments using animals	K_U03 K_U17 K_U18 K_U22	2 2 2 2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	is aware of the social significance of understanding the principles of inheriting traits as well as genetic improvement of organisms for producing food with high quality and technological value	K_K01 K_K06 K_K07	1 1 1
	<b>K2</b>	ready to broaden, deepen and update the knowledge, knowing its practical application	K_K01 K_K06 K_K07	1 1 1
<b>Programme content providing the achievement of the effects of learning:</b>		The inheritance of qualitative and quantitative traits among various animal species, population genetics, aspects of breeding work using the latest knowledge on molecular genetics, selected topics on the welfare of livestock, the rules of experimenting on animals.		
<b>Means of verifying the effects of learning:</b>		tests, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		Animal physiology	ECTS credit points:	4
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	has knowledge about excitability, the functioning of the central and autonomic nervous system, skeletal and smooth muscles	K_W05 K_W06 K_W10	2 3 3
	W2	knows how to interpret the performance of the heart, the circulatory and respiratory system	K_W05 K_W06 K_W10	2 3 3
	W3	knows how to characterise and compare the digestion processes of the monogastrics and the ruminants; has the knowledge on the impact of plant anti-nutritional factors on the body, disrupting the course of digestion and absorption processes in the small intestine	K_W05 K_W06 K_W08 K_W10	2 3 3 3
	W4	knows how to characterise the mechanisms of the impact of hormones originating from endocrine glands or/and from the gastrointestinal tract, being able to determine the role of hormones in digestion processes, metabolism and reproduction	K_W05 K_W06 K_W08 K_W10	2 3 3 3
Skills: (the graduate is able to)	U1	able to assess the existing relationships between the structure and the function at a cellular level	K_U05 K_U21	2 1
	U2	able to interpret the composition of the morphotic elements in the blood; analyses the physiological parameters related to physiological processes occurring in healthy and ill animals, being able to determine the role of enzymes and bile in the digestion and absorption processes in the small intestine	K_U05 K_U06 K_U07 K_U21	2 2 2 1
	U3	utilises computer software (PhysioEx, SIM) used for simulating the course of physiological processes, within the scope specified in the full description of the subject	K_U01 K_U21	2 1
Competences: (the graduate is ready to)	K1	ready to interpret and present the results produced during computer training, as well as to actively participate in the discussion of the results, work independently and in small teams cooperating with each other during exercises	K_K05 K_K02 K_K04	1 1 1
Programme content providing the achievement of the effects of learning:		Physiological processes occurring at the level of cells, tissues, systems and selected organs. Mechanisms regulating the course of physiological processes with consideration for the role of the nervous and endocrine system. The course of physiological processes using computer simulations in the PhysioEx software, as well as the SIM series software. Topics such as: cell excitability, physiology of the nervous system, presentation of the structure and function of the autonomic nervous system, heart and circulatory system physiology, discussion of the haematopoiesis process, the functions of blood and the role of its components, discussion of the digestive processes in the stomach of the monogastrics and the mechanisms of their regulation, the specifics of digestion in the stomach of the ruminants, synthesis of the protein of microorganisms in the rumen and the methods of its assessment, the role of the pancreas and the liver in the digestion and absorption processes in the small intestine, as well as the impact of plant anti-nutritional factors, the mechanisms and the regulation of hormone secretion and their role in maintaining homeostasis in the body, in the reproduction processes of the females and the males as well as during lactation.		
Means of verifying the effects of learning:		written exam, activity during discussions when performing computer exercises,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		Physiology of microorganisms	<b>ECTS credit points:</b>	2
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the impact of environmental factors on the growth of microorganisms	K_W04 K_W08 K_W09 K_W14	2 3 3 1
	<b>W2</b>	knows the relations between microorganisms, being able to shape them in the biotechnological processes	K_W01 K_W07 K_W09 K_W10 K_W12 K_W13	3 3 3 3 1 3
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to interpret the results of the performed experiments	K_U06 K_U07 K_U10 K_U12 K_U13 K_U21	2 2 2 2 2 1
	<b>U2</b>	able to assess the usefulness of microorganisms for the production of the desired metabolites	K_U11 K_U12 K_U21 K_U22	1 2 1 2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	is aware of the benefits and dangers related to the utilisation of microorganisms in biotechnological processes	K_K01 K_K02 K_K03	2 1 3
<b>Programme content providing the achievement of the effects of learning:</b>		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. Topics such as: 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.		
<b>Means of verifying the effects of learning:</b>		tests, reports, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		Enzymology and biochemical techniques	ECTS credit points:	3
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	knows the chemical, physical, molecular and thermodynamic relationships of the action of enzymes	K_W05 K_W07	3 3
	W2	understands the operating mechanisms of inhibitors	K_W05 K_W07 K_W08	3 3 3
	W3	knows how to purify enzymes and measure their activity	K_W04 K_W05 K_W07 K_W08 K_W14	3 3 3 3 1
	W4	knows the instruments required for working with enzymes	K_W04 K_W07 K_W14	3 3 1
Skills: (the graduate is able to)	U1	able to study the kinetics and inhibition of an enzymatic reaction	K_U05 K_U06 K_U21 K_U20	3 3 3 3
	U2	able to calculate the concentrations of solutions used for enzymatic assays	K_U09 K_U16 K_U21 K_U20	3 3 3 3
Competences: (the graduate is ready to)	K1	ready for cooperation	K_K02 K_K05	1 1
Programme content providing the achievement of the effects of learning:	The structure, specificity and action of enzymes as well as their mechanisms for catalysis, regulation and kinetics. The phenomena of enzymatic inhibition and the methods of their determination. Techniques for purifying and measuring the activity of enzymes and the significance of enzymes in metabolism, along with the application of enzymatic systems to biotechnological processes.			
Means of verifying the effects of learning:	written test during laboratory classes, a mark for the completed exercises, written reports from the completed exercises, written exam,			

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>General virology</b>	<b>ECTS credit points:</b>	<b>2</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the properties of viruses distinguish them from microorganisms	K_W06	3
	<b>W2</b>	knows and understands the difference in the manner of replication of viruses compared to microorganisms	K_W09 K_W10	2 2
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to choose a proper virus multiplication method depending on the needs and possibilities	K_U02 K_U01	3 3
	<b>U2</b>	able to use proper methods of virological diagnostics	K_U02 K_U01	3 3
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to convey their knowledge related to virology in a way which is understandable for an average receiver	K_K01 K_K02 K_K06	3 3 3
<b>Programme content providing the achievement of the effects of learning:</b>		Information related to general virology, allowing for understanding the nature of viruses as intracellular infectious factors, different from microorganisms. Topics such as: data and definitions describing the features of a virus as a subcellular, infectious biological microstructure; the differences between viruses and microorganisms as well as the morphology and chemical composition of virions. The structure and functions of a viral genome, the replication of viruses - types of infections and their consequences for the cell, including a productive infection, a non-productive infection along with the mechanisms and consequences of the virus-cell interaction, taking into account viral oncogenesis. Infectious subviral agents and modern problems of dangers related to viral infections.		
<b>Means of verifying the effects of learning:</b>		final written test, a mark resulting from observations during the classes,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Genetic engineering I</b>	<b>ECTS credit points:</b>	<b>6</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	understands the analysis of genetic material and its manipulation	K_W01 K_W02 K_W05 K_W15	3 3 2 1
	<b>W2</b>	has competences related to molecular research and molecular diagnostics	K_W01 K_W02 K_W05 K_W14 K_W15	3 3 2 1 3
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to work with genetic material able to transform plants	K_U01 K_U02 K_U10 K_U12 K_U13 K_U20	3 2 3 3 3 3
	<b>U2</b>	able to seek out information from various sources and use it creatively	K_U01 K_U02	3 2
	<b>U3</b>	Understands the activity of a biotechnologist, gaining the ability to prepare a scientific poster related to genetic engineering	K_U01 K_U02 K_U08 K_U09 K_U14	3 2 2 2 3
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	Understands the social significance of genetic manipulations	K_K01 K_K03	3 3
<b>Programme content providing the achievement of the effects of learning:</b>		Genetic engineering, introduction; Tools of genetic engineering; Vectors; Libraries. Omic analyses – the role of NGS; Molecular maps; Gene construction; Genome modifications; Basics of variance generation; Planning and creating genetic constructions, Advanced use of PCR, colony PCR; DNA elution from gel and AMPure XP purification; Recombinational cloning, Golden gate and TEDA, subcloning; Arabidopsis transformation by means of A.tumefaciens		
<b>Means of verifying the effects of learning:</b>		tests during exercises, poster, exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Basics of bioinformatics</b>	<b>ECTS credit points:</b>	<b>4</b>			
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>			
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows and skilfully uses the databases of biological sequences and the scientific literature	K_W04 K_W05 K_W07 K_W13 K_W14	3 3 3 3 2			
		<b>Skills: (the graduate is able to)</b>	<b>U1</b>	skilfully uses the databases of biological sequences and the scientific literature	K_U17 K_U15 K_U22	3 3 3	
				<b>U2</b>	edits and describes newly sequenced molecules of a nucleic acid as well as a sequence of a nucleic acid and a protein from the database, also designing starters for a PCR reaction	K_U15 K_U17 K_U22	3 3 3
					<b>U3</b>	draws conclusions about the presumed function of an unknown biological sequence based on personally made comparisons to other sequences in databases	K_U12 K_U17 K_U18 K_U22 K_U14
		<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to solve simple bioinformatical problems and deepen the knowledge based on databases		K_K01	1
<b>Programme content providing the achievement of the effects of learning:</b>		The terms related to an analysis of dramatically growing sequential, structural and functional data. Comparing and analysing one's own results in the context of other data on genomes (transcriptomes, proteomes, metabolomes). Databases and computer software. Utilisation of proper bioinformatical tools and the interpretation of the produced results.					
<b>Means of verifying the effects of learning:</b>		credit - theoretical test and practical tests,					

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Biotechnological methods in environmental protection</b>	<b>ECTS credit points:</b>	<b>2</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the processes and devices used in the mechanical and biological part of a treatment plant	K_W01 K_W03 K_W13 K_W15 K_W14 K_W15	3 3 3 3 1 3
	<b>W2</b>	knows the processes and devices used when processing sewage sludge	K_W01 K_W03 K_W13 K_W15 K_W14	3 3 3 3 1
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to balance out technological parameters in selected devices of a treatment plant	K_U10 K_U11 K_U16 K_U14 K_U18	3 2 2 1 2
	<b>U2</b>	able to calculate the required efficiency of devices in a wastewater treatment plant	K_U08 K_U09 K_U10 K_U13 K_U14 K_U18	2 2 3 2 1 2
	<b>U3</b>	able to test the qualitative parameters of domestic wastewater	K_U05 K_U06 K_U13 K_U14 K_U18 K_U20	2 2 2 1 2 2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to perform tests related to a treatment plant	K_K02 K_K04	1 1
<b>Programme content providing the achievement of the effects of learning:</b>		Processes and devices used to treat wastewater and process sludge; advanced and modern wastewater treatment technologies; performing the laboratory tests of wastewater and wastewater sludge, calculating the necessary capacity of wastewater treatment and calculating the mass balances of selected devices in a treatment plant		
<b>Means of verifying the effects of learning:</b>		written exam, reports, activity and a written tests about the work in the laboratory and calculation classes,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,



Name of the subject:		Physiomics	ECTS credit points:	1
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	has knowledge about the structure of a plant and animal cell as well as about physiological processes occurring inside them	K_W04 K_W05 K_W06	2 2 2
	W2	understands that the physiomic approach integrates the entire plant metabolism at all levels of its organisation into a single network of mutual relationships	K_W04 K_W05 K_W06 K_W07 K_W08 K_W10 K_W12	2 3 3 2 2 3 1
	W3	completely understands the significance of a holistic and systemic approach to the functioning of plants, starting from the molecular level, through cells, tissues and organs, ending with a complete plant organism	K_W03 K_W04 K_W05 K_W06 K_W07 K_W08 K_W09 K_W10 K_W12 K_W13	2 2 3 3 3 2 2 3 1 2
	W4	knows the gene expression mechanisms	K_W08 K_W10	2 2
Skills: (the graduate is able to)	U1	able to comprehensively assess the complexity of biochemical signals occurring in plants	K_U01 K_U02 K_U03 K_U04 K_U05 K_U06 K_U07 K_U08 K_U09 K_U10 K_U11 K_U12 K_U13 K_U14 K_U15 K_U16 K_U17 K_U19 K_U21 K_U22	2 1 2 2 2 1 2 2 2 2 2 2 3 3 1 1 2 2 2 2 1
Competences: (the graduate is ready to)	K1	ready to indicate important mechanisms influencing the physiology of plants worthy of a deeper analysis in the examined systems	K_K02 K_K06 K_K07	2 2 2
	K2	prepared to see the complexity of mechanisms related to the conductivity of signals in plants	K_K01	2
Programme content providing the achievement of the effects of learning:		A comprehensive (holistic) approach to the functioning of a plant organism; the adaptation of the living strategies of plants to the changing conditions of the surroundings, resulting from the evolutionary processes. Specialised terminology used in plant physiomic. Topics such as: Differences in the structure and function between a plant and an animal cell. Photosynthesis, structure and function of the photosynthetic apparatus, mechanism of operation and regulation of the photosynthetic electron transport chain, quenching and dispersing the surplus of excited state energy (NPQ). Breathing and the respiratory electron transport chain. Mutual relationships between breathing and photosynthesis. Regulation of plant temperature and NPQ, the role of NPQ in the mechanism of light-based cellular memory and the acclimatisation of plants, regulation of growth and crops. The role of retrosignals from chloroplasts in coordinating the responses of plants to environmental stresses and regulation of gene expression, the role of regulator elements of the cis and trans type. Molecular physiology of the biotic and abiotic stress of plants. Cellular automaton and intelligent signal network in plants, regulation of transpiration and water consumption efficiency. Electrical signals in plants and their role.		
Means of verifying the effects of learning:		written exam following the lectures,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		The design and development of technological lines – basic course	ECTS credit points:	3
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	has coherent knowledge in terms of designing and developing technological lines with respect to the food / biotechnological industry	K_W01 K_W02 K_W03 K_W04 K_W14 K_W15	2 2 2 3 3 2
	W2	understands the need to recognise the conditions related to designing technological lines or plants depending on the location, raw material base, situation on the market, assessment of the magnitude and type of production waste, methods of their utilisation or neutralisation and identifying the possibilities of implementing selected quality standards with consideration for the adaptation to the guidelines included in valid standards and legal regulations of the country	K_W01 K_W03 K_W04 K_W11 K_W15 K_W14	2 2 3 2 2 3
Skills: (the graduate is able to)	U1	able to design a technological line or a production plant	K_U08 K_U09 K_U10 K_U14 K_U15 K_U20	2 2 2 2 2 2
Competences: (the graduate is ready to)	K1	ready to use software for computer-aided design, e.g. AutoCAD, and search for information and news available in libraries, the Internet, etc., and use it creatively for achieving the pursued objective	K_K01 K_K05 K_K04	1 1 3
	K2	ready to cooperate with other specialists when designing technological lines or industrial plants	K_K02 K_K05 K_K04	1 1 2
Programme content providing the achievement of the effects of learning:		Principles of technological design of food industry plants. Topics such as: Technical aspect and principles of designing processes in biotechnology and food technology. Material balances. Standards recommended for a selected production profile. Computer-aided design; examples of applications and CAD suites. Construction issues; the land development concept. Safety and quality of biotechnological products (GMP, HACCP, etc.). Hygienic, sanitary and ecological aspects.		
Means of verifying the effects of learning:		test after lectures and preparing the design of a plant, activity when discussing a defined issue,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Social and legal aspects of biotechnology, part I</b>	<b>ECTS credit points:</b>	<b>2</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows national and international legal regulations related to the application of biotechnology	K_W10 K_W14 K_W15	3 3 2
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to understand the issues of biosafety of biotechnologies	K_U07 K_U12 K_U13	2 3 3
	<b>U2</b>	able to discuss the possibilities of protecting intellectual property rights in biotechnology	K_U08 K_U08 K_U13 K_U18	2 3 3 2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	knows the issues related to the social perception and the acceptance of biotechnology in Poland and in the world	K_K06 K_K07 K_K08	3 3 3
<b>Programme content providing the achievement of the effects of learning:</b>		The most important topics related to the public perception of biotechnology, regulations forming a legal framework used in biotechnology, with particular emphasis on GMO. Topics such as: Biotechnology and the conditions of its development. Social perception of biotechnology. Biological safety and biohazards. International law related to biotechnology. Domestic law related to biotechnology, with particular emphasis on GMO. Forms of intellectual property in biotechnology. The essence and role of the protection of intellectual property, institutions active in this field and regulations valid in this regard; Patenting in biotechnology.		
<b>Means of verifying the effects of learning:</b>		mark for a written test, mark for an essay,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		Immunology	ECTS credit points:	4
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	understands the structure and functions of the individual parts of the immune system in the context of physiology of the remaining systems in the body	K_W02 K_W06	2 2
	W2	knows and describes the mechanisms of congenital and acquired immunity	K_W02 K_W06 K_W08	1 2 2
	W3	knows and describes the methods of inducing and assessing a general and localised immune response	K_W06 K_W08	2 2
	W4	understands the mechanisms regulating the immune response induced by an infectious agent and tumours	K_W06 K_W08 K_W10	1 2 2
	W5	knows the types of vaccines, understands their operating mechanisms and the need for artificial induction of immunity to infectious diseases of humans and animals	K_W02 K_W08 K_W10 K_W14	1 2 2 2
	W6	knows mechanisms related to the transfer of passive immunity from the mother and understands the causes of immunological disorders related to maternal antibodies	K_W05 K_W06 K_W08 K_W10	1 2 2 2
	W7	knows the mechanisms and describes the generation of all types of hypersensitivity and the consequences resulting from these mechanisms	K_W05 K_W06 K_W08 K_W10	1 2 2 2
	W8	knows and describes the causes and effects of the deficiencies of congenital and acquired immunity	K_W02 K_W05 K_W06	1 2 2
	W9	knows the background of immune mediated diseases among humans and animals	K_W05	2
	W10	understands the significance of the application of serological tests (qualitative and quantitative) to the diagnostics of infectious diseases and the connections between the selected disciplines in the fields of natural sciences	K_W04 K_W07 K_W10 K_W14	2 2 2 2
Skills: (the graduate is able to)	U1	able to prepare a serum for serological tests	K_U01 K_U03	2 3
	U2	able to individually perform a simple serological test (a quantitative and qualitative test using the method of agglutination, passive immunodiffusion and neutralisation) and to interpret the results of serological tests in the context of diagnostics of infectious diseases	K_U01 K_U03	2 3
	U3	able to use monoclonal antibodies tagged with markers in the context of diagnostics of infections and the assessment of the patient's health condition (immunofluorescent, immunoenzymatic and radioimmunological assays) – detecting antibodies in the patient's serum or identifying the infectious factor	K_U01 K_U03	1 2
	U4	able to isolate specific populations of immunocompetent cells based on the acquired knowledge, determine their activity using the immunoenzymatic, immunofluorescent techniques, as well as molecular biology	K_U01 K_U14	2 3
Competences: (the graduate is ready to)	K1	formulates opinions in the context of the significance of immunology and serological tests in the diagnostics of infectious diseases, immune mediated diseases and the identification of immunological deficiencies	K_K01	2
	K2	is aware of the necessity to use artificial induction of immunity to infectious diseases of humans and animals	K_K02	2
	K3	ready to use the possessed knowledge and skills during further stages of education	K_K02	2
	K4	is aware of the possessed knowledge and the benefits resulting from exchanging points of view, being ready to share one's competences with the co-workers	K_K06	3
	K5	is aware of the necessity to constantly deepen the knowledge and perfect one's skills using scientific sources	K_K02	3
Programme content providing the achievement of the effects of learning:		The mechanisms of congenital and acquired defence as well as their mutual connections and relationships in health and disease. Development of immunity in the course of infectious diseases, the pathways of avoiding an immune response, both specific and non-specific, by infectious agents. Morphology and phylogeny of the immune system. Types of immunity; congenital immunity. Characteristics of receptors recognising infectious agents/ molecular patterns related to microorganisms and their role in initiating an immune response. Cytokines, chemokines and their role in coordinating the functions of immune cells. Cells of non-specific immunity (mast cells, granulocytes, macrophages,		

	<p>dendritic cells, NK cells) and their role in developing an immune response; humoral and cellular mechanisms of congenital immunity – inflammation. Humoral and cellular mechanisms of congenital immunity, continued: inflammation, phagocytosis and its significance, the complement system and other humoral factors. Induction of a specific response: the role of antigen-presenting cells (macrophages, dendritic cells, B lymphocytes); antigen-presenting mechanisms in the context of the major histocompatibility complex, class I and II, and in the context of CD1. The terms antigen and superantigen; immunological synapses. Acquired immunity – humoral mechanisms. Generation and maturation of B lymphocytes, the role of the BcR receptor. The structure and classes of immunoglobulins. B lymphocytes as the effector cells of a humoral immune response. Acquired immunity – cellular mechanisms. Generation and maturation of T<math>\gamma\delta</math> and T <math>\alpha\beta</math> lymphocytes (CD4+ and T CD8+), NKT cells. Induction and effector mechanisms of a cellular immune response. Regulation of the immune response. Creation of an immunological memory pool. Vaccines and the role of vaccinations in the prevention of infectious diseases. Humoral and cellular mechanisms of localised immunity: immune system of the skin and mucous membranes. Infection response – viral, bacterial and fungal diseases, immune system escape mechanisms of pathogens, immunomodulating properties of infectious agents. Generation of central and peripheral immunological tolerance, its significance and mechanisms for actively suppressing the responses to the host's own antigens. Types and mechanisms of hypersensitivity; selected topics related to autoimmune diseases. Transplant immunology; types of transplants, mechanisms related to transplant rejection/survival. Transfer of immunity from the mother to the child; acquiring natural passive immunity and the results of its deficiencies; serotherapy. Immunodeficiency: primary and secondary immunodeficiency. Tumour immunology; effector mechanisms of an immune response to tumour cells.</p>
<b>Means of verifying the effects of learning:</b>	test, final exam,

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Cell and tissue cultures</b>	<b>ECTS credit points:</b>	<b>6</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the current state of knowledge about cell and tissue cultures	K_W01 K_W02 K_W03 K_W06 K_W14	1 2 1 2 2
	<b>W2</b>	knows the structure, equipment and the principles of functioning (along with the OHS regulations) of a laboratory of plant and animal cultures	K_W07 K_W08 K_W11 K_W14	2 2 2 2
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to work in a sterile chamber with a vertical laminar air flow with class II biological safety, having the ability to use basic (and some advanced) techniques of in vitro cultures	K_U07 K_U10 K_U12 K_U14 K_U20 K_U22	1 1 1 2 2 2
	<b>U2</b>	able to use optical devices for in vitro observation of cells, tissues and organs: a fluorescence stereomicroscope and an inverted microscope with a fluorescence tool cooperating with an image analyser	K_U06 K_U08 K_U12 K_U15	2 1 1 1
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	understands the need for constant deepening of knowledge about in vitro cultures, important for the development of modern plant biotechnology, being able to seek out information extending this knowledge from various sources, organise and present it	K_K01 K_K02 K_K03 K_K07 K_K04	1 1 1 3 3
<b>Programme content providing the achievement of the effects of learning:</b>		Modern biotechnology of plants and animals. Theoretical fundamentals of the in vitro culture, application of the most important techniques of plant and animal cultures, practical execution of specific experiments in chambers with a vertical laminar air flow fulfilling the requirements of class II biological safety (Biohazard).		
<b>Means of verifying the effects of learning:</b>		tests, reports, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		Statistics	<b>ECTS credit points:</b>	3
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	has the knowledge related to the distributions of random variable, being able to estimate the distribution parameters	K_W04 K_W07 K_W12	3 3 3
	<b>W2</b>	understands the need for statistical conclusion about the population based on the results of a sample	K_W04 K_W07 K_W12 K_W13	3 3 3 3
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to choose a proper method for a statistical analysis of data	K_U02 K_U04 K_U07	2 3 3
	<b>U2</b>	performs basic statistical analyses	K_U21	3
	<b>U3</b>	able to describe the performed statistical analyses and draw conclusions	K_U08 K_U09 K_U21	3 3 3
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	utilises the studied statistical methods in practice	K_K02	2
<b>Programme content providing the achievement of the effects of learning:</b>		The fields of mathematical statistics and their practical application to biotechnology; tools allowing for the performance of analyses useful for preparing and writing an engineering thesis. Topics such as: descriptive statistics (frequency distribution, data presentation, specific statistical measures) and the fundamentals of the probability theory (events, random variables, theoretical distributions of the random variable), statistical inference (point and interval estimation) and testing statistical hypotheses (assumptions of the hypothesis testing theory, parametric and non-parametric hypotheses, errors, selected statistical tests), regression and correlation analysis (types of relationships, correlation coefficient).		
<b>Means of verifying the effects of learning:</b>		final test, activity during classes,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Genetic engineering II</b>	<b>ECTS credit points:</b>	<b>6</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	understands the analysis of genetic material and its manipulation	K_W01 K_W02 K_W05 K_W14	3 3 2 1
	<b>W2</b>	has competences related to molecular research and molecular diagnostics	K_W01 K_W07 K_W14	3 2 1
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to work with genetic material and able to transform plants	K_U01 K_U02 K_U10 K_U13 K_U20	3 2 3 3 3
	<b>U2</b>	able to seek out information from various sources and use it creatively, as well as to modify a specified biotechnological process related to GE	K_U08 K_U09 K_U12 K_U13	3 3 3 3
	<b>U3</b>	Understands the activity of a biotechnologist, gaining the ability to develop a scientific project related to genetic engineering	K_U14 K_U16 K_U17 K_U18 K_U21	3 2 2 2 2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	understands the social significance of genetic manipulations, being ready to prepare a research project using GE methods	K_K01 K_K03 K_K04 K_K06 K_K07	3 3 3 3 1
<b>Programme content providing the achievement of the effects of learning:</b>		Fundamentals of generating variance using methods based on the ligand evolution processes, Introduction to gene therapy, CRISP-Casp technologies, mRNA isolation and reverse transcription, expression assessment by means of qPCR; hybridisation methods in genetic engineering; Generation of recombinant proteins, Assessment of transgenic plants. GUS and GFP.		
<b>Means of verifying the effects of learning:</b>		tests during exercises, written final project, exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,



Name of the subject:		Industrial biotechnological	ECTS credit points:	3
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	knows, lists and characterises the strains microorganisms and the working conditions of a bioreactor for selected examples of the production of biopolymers, names the examples of the production of biopolymers on an industrial scale	K_W03 K_W01 K_W02 K_W09 K_W14 K_W15	1 2 2 2 3 3
	U1	describes the processes occurring in a bioreactor, being able to characterise the individual stages of the process and specify the parameters of a biopolymer production process	K_U05 K_U13 K_U15 K_U16 K_U18 K_U21 K_U22	2 2 1 2 2 2 3
Skills: (the graduate is able to)	U2	designs the production process of a selected biological material in a group, performs its detailed technological analysis	K_U08 K_U09 K_U10 K_U12 K_U13 K_U21 K_U20	3 3 3 2 2 2 3
	U3	describes and explains the principles of performing an economical analysis of a biotechnological process	K_U08 K_U10 K_U14 K_U21 K_U22	2 2 3 2 3
	U4	argues the sense of using microorganisms for manufacturing bioproducts	K_U10 K_U11 K_U18 K_U21 K_U22	2 2 2 2 3
	Competences: (the graduate is ready to)	K1	ready to use the literature in the Polish and English language in order to prepare a bioproduction project of a selected biological material	K_K02 K_K03 K_K04
Programme content providing the achievement of the effects of learning:		Topics related to the combination of engineering and biotechnological processes for the production of selected food ingredients as well as pharmaceutical and chemical components. Topics such as: characteristics of a biotechnological process combined with process engineering. Organisation and economic analysis of bioprocesses. 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, medicines and vaccines).		
Means of verifying the effects of learning:		written exam, project, presentation,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Chemical safety</b>	<b>ECTS credit points:</b>	<b>4</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows and understands the principles of chemical safety in the environment	K_W02	2
			K_W06	3
			K_W07	2
			K_W08	3
			K_W09	2
			K_W10	3
			K_W11	2
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	able to discuss and categorise the methods of a toxicological analysis and interpret its results	K_U01	2
			K_U02	2
			K_U21	2
	<b>U2</b>	able to name environmental contaminations as well as the systems and modern methods of monitoring xenobiotics with their legal conditions, presenting them in the form of a presentation	K_U01	2
			K_U10	2
	<b>U3</b>	able to distinguish between and describe biomarkers allowing for an assessment of the extent of environmental contamination, estimating the risk of threat to human and animal health on the basis of their values	K_U21	2
			K_U05	2
			K_U12	2
	<b>U4</b>	able to name and describe the principles and the range of toxicometric tests required when commercially introducing xenobiotics (including biotechnological products)	K_U21	2
			K_U05	2
			K_U07	2
			K_U08	3
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	ready to use the knowledge in practice	K_U09	3
			K_U14	2
<b>Programme content providing the achievement of the effects of learning:</b>		Topics related to environmental contamination: contamination sources, the fate of toxic compounds in the environment, biological impact on living organisms, systems and scopes of monitoring the presence of xenobiotics in the environment. Assessment of the risk resulting from the exposure to toxic compounds already present and newly introduced into the environment.		
<b>Means of verifying the effects of learning:</b>		oral test, written exam,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		Seminar	<b>ECTS credit points:</b>	2
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	understands and discusses the problems related to modern biotechnology	K_W03 K_W09 K_W12	2 2 2
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	prepares and presents scientific reports	K_U01 K_U02 K_U16 K_U18 K_U19 K_U20 K_U21	2 2 2 2 3 2 3
	<b>U2</b>	uses the professional and scientific literature to prepare a diploma thesis	K_U02 K_U22	2 3
	<b>U3</b>	presents and discusses the problems related to modern biotechnology	K_U18	2
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	able to work in a group	K_K01 K_K02 K_K03 K_K06 K_K07	2 3 2 2 2
<b>Programme content providing the achievement of the effects of learning:</b>		Aspects of food, plant or animal biotechnology based on the current scientific literature. Getting acquainted with the principles of writing a diploma thesis and its presentation. Developing the ability to present a subject in an organised and logical way, with case for the correctness of language, originality of work, and adhering to all formal requirements. The significance and the manner of carrying out a scientific discussion.		
<b>Means of verifying the effects of learning:</b>		credit based on a presentation,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

<b>Name of the subject:</b>		<b>Research project</b>	<b>ECTS credit points:</b>	<b>15</b>
<b>Effects of learning:</b>		<b>content of the effect attributed to the subject:</b>	<b>Reference to the Specialty Learning Outcome</b>	<b>Strength for the SLO*</b>
<b>Knowledge: (the graduate knows and understands)</b>	<b>W1</b>	knows the principles of OHS	K_W11	3
	<b>W2</b>	presents and discusses the problems related to modern biotechnology	K_W03 K_W04 K_W09 K_W12 K_W14 K_W15	2 2 2 2 2 2
<b>Skills: (the graduate is able to)</b>	<b>U1</b>	use the professional and scientific literature related to the performed tasks	K_U01 K_U16 K_U19 K_U22	3 2 3 3
	<b>U2</b>	prepares a final report performs the entrusted tasks under the care of a supervisor	K_U01 K_U02 K_U06 K_U07 K_U14 K_U16 K_U21 K_U22	3 2 2 3 3 2 2 3
<b>Competences: (the graduate is ready to)</b>	<b>K1</b>	Work with research projects and work safety in a laboratory	K_K02 K_K03 K_K04	3 3 3
<b>Programme content providing the achievement of the effects of learning:</b>		Planning and executing research as part of an engineering thesis. Topics such as: Executing research planned as part of a diploma thesis. Developing the student's ability to use their knowledge related to biotechnology as part of the selected educational path, the ability to use research infrastructure, analytical methods, utilise various sources of information, their critical and creative application. Discussing the principles of processing the results of the performed research; processing the results and preparing a diploma thesis.		
<b>Means of verifying the effects of learning:</b>		project, diploma thesis, practical exercises,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

Name of the subject:		Professional practice	ECTS credit points:	4
Effects of learning:		content of the effect attributed to the subject:	Reference to the Specialty Learning Outcome	Strength for the SLO*
Knowledge: (the graduate knows and understands)	W1	knows problems related to modern biotechnology	K_W03 K_W04 K_W09 K_W12 K_W14 K_W15	2 2 2 2 2 3
	W2	knows the principles of OHS	K_W11	3
Skills: (the graduate is able to)	U1	use the professional and scientific literature related to the performed tasks	K_U19 K_U22	2 2
	U2	prepares a final report	K_U06 K_U22	2 2
	U3	performs the entrusted tasks under the care of a supervisor	K_U01 K_U02 K_U06 K_U07	3 2 2 3
Competences: (the graduate is ready to)	K1	ready to work in a group	K_K02 K_K03 K_K04 K_K05	3 3 3 2
<b>Programme content providing the achievement of the effects of learning:</b>		The functioning of a workplace/laboratory and the performance of basic experiments (analyses) at the place of the internship.		
<b>Means of verifying the effects of learning:</b>		a mark for the performed work,		

\*) 3 - advanced and detailed, 2 - considerable, 1 - basic,

#### **14. Principles of the implementation of professional internships**

The purpose of the internship is to learn about various job positions related to biotechnology and confront the knowledge acquired during university classes with a laboratory and industrial internship. The student chooses a place for completing the internship: a university/ company/ institute – getting acquainted with the scientific environment as well as organisational and economical conditions of the functioning of science institutes, biotechnological companies and other research units. The internship lasts 4 weeks, which translates into 160 hours of the student's work, which have been assigned 4 ECTS credit points. The general time for completing the internship are the summer holiday months after the end of the 3rd year of the studies. In justified cases, upon receiving written consent from the Deputy Dean of the Faculty, the student can complete their internship at another time, provided it will not collide with educational classes. It is recommended for the professional internship to take place in unit such as: biotechnological laboratories and technological lines in industrial plants, e.g. in the pharmaceutical and food industry (breweries, dairy processing, etc.), plant cultivation stations and horticultural plants, municipal plants, e.g. wastewater treatment plants, science and research centres related to biotechnology; analytical, forensic and microbiological laboratories, genetics clinics. The main objective of the professional internship is to familiarise the students with the functioning of institutions utilising various biotechnological techniques, as well as practically prepare them to seek and pursue a profession after completing the studies. Not only should the professional internship enable the students to supplement their theoretical knowledge, but also to show them how to use this knowledge in practice. The internship is completed based on the rules of the internship. Before beginning the internship, the student is obliged to present information about the place of the planned internship for its approval, and as well as deliver to the internship supervisor a signed declaration about being committed to following the regulations effective in the workplace, resulting from the work regulations, OHS standards, the protection of confidential and personal information, as well as due diligence when performing the entrusted activities. This is followed by signing a contract with the employer. On the premises of the Workplace, the student must follow the rules laid down in this unit. Upon completing the internship, the student is obliged to deliver full internship documentation to the Internship Supervisor, constituting a report on the course of the professional internship, as well as an opinion of a supervisor from the workplace with a suggested mark. The Internship Supervisor gives credit for the internship, entering it into the

HMS

system.



18	Design thinking	3	3	3	2		3	2		2			3	3	2	3	3			3	2	2	2	2			2	2		2	2	3		3	3	3	2	2												
19	Faculties - an open list of optional subjects																																																	
20	P.E. II																																																	
21	Basics of engineering of biotechnological processes		1		2			2				3			3	3				1		2		2	3	1	1	2	2	2	1					3														
22	Molecular biology			3	3	3	2	3				3	1	3		3	1	2												3			2					3	2	1			2							
23	General microbiology			2			2	2	3	3	3			1	2			2	2	2																3	3	2												
24	Biochemistry				2	3	2	2	3			1		1				1	1	1								2			1			1	2			3	3											
25	Plant physiology			3	2	1	2	2					2	1	3	1		3	2	1										1	3		2	2		3	2	3	1			3								
26	Faculties - an open list of optional subjects																																																	
27	Engineering of biotechnological processes	3	3	3	3				3				3	3	3		2			3		2	2	3	2	2	3	3				3	2										2							
28	General genetics			3			3	3			3			1			3													3	2			3	2	2											2			
29	Basics of animal genetics and breeding			1			1	1			1			1			2													2	2			2	1									1	1					
30	Animal physiology					2	3		3		3					2			2	2	2												1			1		1	1											
31	Physiology of microorganisms	3			2			3	3	3	3		1	3	1					2	2				2	1	2	2						1	2	2	1	3												
32	Enzymology and biochemical techniques				3	3		3	3					2				3	3			3							3			3	3			1				1										
33	General virology					3			2	2					3	3																		3	3													3		
34	Faculties - an open list of optional subjects																																																	
35	Genetic engineering I	3	3			2							1	3	3	2							2	2	3		3	3	3				3			3		3		3	2									
36	Basics of bioinformatics				3	3		3					3	2															3		2	3		3	3			3	1											
37	Biotechnological methods in environmental protection	3		3									3	2	3					2	2		2	2	3	2		2	3		2		2					1		1										
38	Physiomics			2	2	3	3	3	2	2	3		1	2			2	1	2	2	2	2	2	2	2	2	2	2	2	2	3	3	1	1	2		2		2	1	2	2					2	2		
39	The design and development of technological lines – basic course	2	2	2	3						2			3	3									2	2	2				2	2				2			1	1		3	1								
40	Social and legal aspects of biotechnology, part I									3			3	2						2	2	3			3	3					2																3	3		
41	Immunology		2		2	2	2	2	2				3	2		3																		3															3	
42	Faculties - an open list of optional subjects																																																	
43	Cell and tissue cultures	1	2	1			2	2	2			2			3									2	1	1	1		1		2	1						2		2	1	1	1	3				3		





## 16. QUANTITATIVE INDICATORS

1. The teaching of classes from the field of human and/or social sciences:

2nd semester - 6 ECTS

5th semester - 2 ECTS

therefore, the condition of minimum 5 ECTS for these classes is fulfilled.

2. The ability to choose classes which have jointly been assigned a number of ECTS credit points no lower than 30% of ECTS defined for the programme of these studies:

1st semester - 3 ECTS

2nd semester - 8 ECTS

3rd semester - 6 ECTS

4th semester - 6 ECTS

5th semester - 8 ECTS

6th semester - 12 ECTS

7th semester - 24 ECTS

Total - 67 ECTS (which constitutes 31.9% out of 210 ECTS); therefore, the condition of minimum 30% ECTS for facultative classes has been fulfilled

3. At least 50% of the number of ECTS credit points defined for the programme of these studies are granted for classes taught with direct participation of academic teachers or other people who teach the classes:

Contact-based ECTS – 116 ECTS (which constitute 55.23% out of 210 ECTS)

4. Classes related to the scientific activity pursued at the university in the discipline of biological sciences, to which the Biotechnology field of study is attributed, in a number larger than 50% of the number of ECTS credit points, defined for the programme of these studies, and taking into account the participation of students in classes preparing them to pursue scientific activity or participate in this activity: Total – 141 ECTS (which constitute 67.14% out of 210 ECTS)

5. The number of ECTS credit points scored in the programme of the studies by pursuing classes using the methods and techniques of remote education is no larger than 75% of the total number of ECTS credit points in the programme of the studies.

6. The programme of the studies provides 7 ECTS credit points to be granted to a student for classes leading to reaching the effects of learning in terms of knowing a foreign language at level B2 of the Common European Framework of Reference for Languages.

7. The student achieves the effects of learning in terms of protecting intellectual property when pursuing the subject: Social and legal aspects of biotechnology and protection of intellectual property, amounting to 1 ECTS credit point – therefore, the condition of minimum 1 ECTS credit point for this type of classes is fulfilled.