



SZKOŁA GŁÓWNA
GOSPODARSTWA
WIEJSKIEGO

Study programme

Biotechnology

| | |
|---------------------------|--------------------------------------|
| Faculty: | Faculty of Biology and Biotechnology |
| Level of study: | first cycle (engineering degree) |
| Education profile: | General academic |
| Form of study: | full-time studies |
| Academic year: | 2024/25 |

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Basic information

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

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

| | |
|---------------------|------|
| Biological sciences | 100% |
|---------------------|------|

Major characteristics

Major characteristics

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

Learning objectives

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

Education concept

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

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

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

Graduate profile

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

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

Learning outcomes

Knowledge

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

Skills

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

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

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

Social competence

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

Study plan

Semester 1

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

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

Semester 2

| Subject | Number of hours | ECTS points | Form of verification | |
|-------------------------------|--|-------------|----------------------|---|
| Mathematics II | Lecture: 30 Auditorium exercises: 30 | 5 | Exam | O |
| Propedeutics of biotechnology | Laboratory exercises: 15 | 1 | Pass with grade | O |
| Organic chemistry | Lecture: 30 Laboratory exercises: 30 | 5 | Exam | O |
| Botany | Lecture: 30 Auditorium exercises: 3 Laboratory exercises: 21 Field exercises: 6 | 5 | Exam | O |

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

Semester 3

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

Semester 4

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

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

Semester 5

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

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

Semester 6

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

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

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

Semester 7

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

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

O - Obligatory subjects

G - Mandatory group

F - Elective subjects

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

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

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

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

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

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

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

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

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

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

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

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

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

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|---|----|--|---|
| Subject name: | | Botany | ECTS: 5 |
| Effects: | | The content of the effect assigned to the subject: | Directional effect reference: |
| Knowledge: (In terms of knowledge, the graduate knows and understands) | W1 | the general information on botany, adjusted to the field of study, and terminology used in botany | BTj_K3_W06, BTj_K3_W08, BTj_K3_W10 |
| | W2 | the position of plants in the Tree of Life, the systematics of land plants including characteristics of the main clades | BTj_K3_W09, BTj_K3_W10 |
| | W3 | the structure and functions of vegetative and generative organs of plants as well as the structural and functional adaptations of the ecological groups of plant to their habitat | BTj_K3_W05, BTj_K3_W06, BTj_K3_W08 |
| | W4 | the model plants and the most important plants supplying nutritional and industrial materials | BTj_K3_W09, BTj_K3_W10 |
| Skills: (In terms of skills, the graduate can) | U1 | perform microscopic observations of plant tissues and organs, followed by their analyses, especially in the context of linking the structure and the function, and can identify the most important, useful plants and determine their systematic positions | BTj_K3_U04_inz, BTj_K3_U06_inz, BTj_K3_U07, BTj_K3_U14_inz, BTj_K3_U20, BTj_K3_U21 |
| | U2 | individually find, critically analyze and utilize information related to botany, originating from various sources in the Polish language, also using the English language to an extent sufficient to use the sources of botanical knowledge in this language, also formulate their statements briefly, logically and clearly, properly using botanical terminology and indicate the connections of botany to other sciences, in particular physics and chemistry | BTj_K3_U07, BTj_K3_U10_inz, BTj_K3_U12_inz, BTj_K3_U18, BTj_K3_U19, BTj_K3_U22 |
| Social competences: (Within the scope of competence, the graduate is ready to) | K1 | work efficiently, both individually and in a team, manifesting this by adhering to the principles of the OHS, respecting copyrights, accepting responsibility for their own work as well as readiness to succumb to the principles of teamwork and accountability for the tasks executed in a group on an e-learning platform, as well as by developing and implementing a work schedule that ensures meeting the deadlines | BTj_K3_K02, BTj_K3_K03 |
| | K2 | perform the self-assessment of his or her own knowledge, skills, and competences as well as constantly deepen the knowledge | BTj_K3_K01, BTj_K3_K05 |
| Course content ensuring the achievement of learning outcomes: | | Meristems and their regulation. Cell differentiation as the basis of histogenesis. Tissues and their spatial organisation in primary and secondary structure of the plant body. Morphological structure of seedlings, juvenile, vegetative and generative stage of plants. Basics of plant embryology, including development of male and female gametophyte, mechanisms of pollination, fertilisation and embryogenesis in Angiosperms. Development of seeds and fruits, and their biological importance. Adaptations of plant structure and development to different habitats. Outline of systematics and evolutionary tendencies in seed plants. Characterization of commonly occurring families and plants with the greatest utilitarian importance. Plants as a source of raw materials. | |
| Examination methods: | | Written exam, Presentation, Report, Test (written or computer based) | |

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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| Subject name: | | Biopolymers in the production of food packaging | ECTS: 1 |
| Effects: | | The content of the effect assigned to the subject: | Directional effect reference: |
| Knowledge: (In terms of knowledge, the graduate knows and understands) | W1 | the student knows the basic division and characteristics of biopolymers used for the production of biodegradable including edible packaging | BTj_K3_W03, BTj_K3_W09 |
| | W2 | the student knows the basic functions of biopolymers and the possibilities of their use for the production of packaging as well as knows the methods and possibilities of modifying the raw material composition of biopolymers packaging in order to obtain their advantageous functional properties | BTj_K3_W09, BTj_K3_W10 |
| Course content ensuring the achievement of learning outcomes: | | The information on the construction and production techniques of biopolymers and their possible applications. Introduction to food packaging, and importance and benefit of biodegradable packaging. Types of biopolymers used in the production of packaging. Biodegradability of polymers. Characteristics and preparation of selected biopolymers of plant, animal and microbiological origin. Modification of biopolymers in order to give new or improve the already existing functional properties. Possibilities of using biopolymers as modern food packaging materials (edible packaging, active and intelligent packaging). | |
| Examination methods: | | Written credit | |

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

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

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

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

Programme indicators

2024/25/S_D/3/BBT/BTj/all

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