

EDUCATIONAL PROGRAMME: 7M01505 - BIOLOGY

1. OPTIONAL COMPONENTS OF THE CYCLE OF GENERAL COURSES

Optional component 1

Course: Medicinal plants and their resources

Intensity of the Course: 5 academic credits

Module Code: **BB-4**

Module Name: Bioinformatics and Biodiversity

Prerequisites: BK 3210 Bioresources of Kazakhstan

Purpose: Formation of students' theoretical knowledge, practical skills and ideas about the botanical characteristics and biological features and resources of medicinal plants found on the territory of the Republic of Kazakhstan.

Short Description: Introduction to the main provisions on medicinal plants of the Republic of Kazakhstan; Formation of a common understanding of the characteristics and the main features of medicinal plant families in Kazakhstan; acquaintance with modern trends in the use of medicinal plants; Formation of the ability to independently understand the beneficial qualities of medicinal plants and their raw materials for domestic medicine. Know the morphological and anatomical diagnostic features of medicinal plants and their application in practice.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects;

LOP 2 – explores biological features, the reasons for organizing groups of medicinal and cultivated plants, algae, their patterns, possible ways of management and effective use.

Discipline Learning Outcomes (DLO):

DLO 1 – provides students with a general idea of the flora and stocks of medicinal plants found on the territory of the Republic of Kazakhstan;

DLO 2-development of practical, legal and communication skills of students on the basic rules for the use of medicinal plants in the territory of the Republic of Kazakhstan;

DLO 3- familiarize students with the main provisions on medicinal plants of the Republic of Kazakhstan;

DLO 4-formation of a holistic view of the main features and characteristics of families and related medicinal plants found on the territory of Kazakhstan;

DLO 5- an introduction to modern advanced trends in the use of medicinal plants;

DLO 6-formation of the ability to independently understand the use of medicinal plants and their raw materials suitable for domestic Medicine in the Republic of Kazakhstan;

DLO 7 - assistance in self-education of students, improvement of knowledge and skills of specialists about medicinal plants.

Post requisites: APMB 7203 Actual problems of modern botany

Optional component 1

Course: Fundamentals of phytocoenology

Intensity of the Course: 5 academic credits

Module Code: **BB-4**

Module Name: Bioinformatics and Biodiversity

Prerequisites: BK 3210 Bioresources of Kazakhstan

Purpose: Studying plant associations, identifying the reasons for their formation and development, as well as determining the methods and ways of their use in agriculture; phytocenology is also considering the possibility of restoring plant associations.

Short Description: Study of the reasons for the organization of plant groups, their patterns, possible methods of management and effective use. Plants created by nature and people. Determination of phytocenosis composition. Determination of the structure and structure of phytocenoses. V.V. Dokuchaev, G.F. Morozov, V.I. Vernadsky, V.N. Sukachev, their role in the development of science. Concepts of the biosphere. The planetary role of living organisms

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects;

LOP 2 – explores biological features, the reasons for organizing groups of medicinal and cultivated plants, algae, their patterns, possible ways of management and effective use.

Discipline Learning Outcomes (DLO):

DLO 1 – the master's student learns the scientific basis of the content of school biological education, focuses on the problems and achievements of modern biological science;

DLO 2 – the master's student is able to correlate the content of the studied theoretical disciplines with the content and problems of school biological education;

DLO 3 – able to compare the facts phytocenological science and the content subjects, finds examples of inconsistencies and contradictions;

DLO 4 – disclosure of patterns of relationships between organisms, the structure and dynamics of communities, mechanisms of population regulation, conditions for the formation and existence of phytocenoses;

DLO 5 – learns about biological macrosystems (populations, biocenoses, ecosystems) and their dynamics in time and space;

DLO 6 – apply the acquired knowledge in practice, to conduct independent research in the field of nature protection and rational use of natural resources;

DLO 7 – master the structure and composition of phytocenosis, the distribution of organisms by habitat.

Post requisites: APMB 7203 Actual problems of modern botany

Optional component 2

Course: Physiology of higher nervous activity

Intensity of the Course: 5 academic credits

Module Code: **SAB-2**

Module Name: Selected Areas of Biology

Prerequisites: HAP 3211 Human and animal physiology

Purpose: To give a full-fledged, high-quality professional education in the field of physiology of higher nervous activity, to study the laws of the higher nervous system and to familiarize them with the molecular-level features.

Short Description: Physiology of the functional features of the nervous system of the cerebral cortex and the study of the coordinated control of the function of the brain and spinal cord. The purpose of physiology is to study not only the performance of the functions of people and animals, also to find out with the help of what mechanisms the work of these functions is performed.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects;

Discipline Learning Outcomes (DLO):

DLO 1 – fundamentals of solving problems of physiology of the higher nervous system; the strategy of diagnosis of humans and animals using physiological methods; should be aware of the prospects for the development of physiology of higher nervous activity;

DLO 2 – systematization of lectures and information obtained from textbooks and scientific sources; to report theoretical materials on the main topics of the discipline competently and professionally;

DLO 3 – conducting preclinical tests of the biological properties of drugs prepared by the methods of physiology of the higher nervous system; ability to use physiological devices in the work;

DLO 4 – Know the evolutionary and phylogenetic development of the nervous system;

DLO 5 – conducting preclinical tests of the biological properties of drugs prepared by the methods of physiology of the higher nervous system; ability to use physiological devices in the work;

DLO 6 – apply the obtained theoretical knowledge to solve professional problems;

DLO 7 – Skills of using a physiological instrument; rational use of educational, laboratory and management equipment, special equipment and modern computer equipment.

Post requisites: Undergraduate research work, including internships and the implementation of a Master's thesis (MRW).

Optional component 2

*Course: **Anatomy of the nervous system***

Intensity of the Course: 5 academic credits

*Module Code: **SAB-2***

Module Name: Selected Areas of Biology

Prerequisites: HA 2213 Human anatomy

Purpose: to study the structure of the nervous system based on modern advances in anatomy.

Short Description: The anatomy of the nervous system is the basis of biological disciplines. The nervous system controls a person's psychological change. The mind, memory, thought, demand and many other things form various habits, adaptation to different life conditions, regulated by the nervous system. The study of the anatomy of the nervous system in the evolutionary process allows us to know the activities of the highest level of the nervous system.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects;

Discipline Learning Outcomes (DLO):

DLO 1 – know the solution to the problem of anatomy of the higher nerve; know the strategy of diagnosis of humans and animals using physiological methods. It is important to know about the prospects for the development of physiology of higher nervous activity, to apply in practice to preserve people's health;

DLO 2 – know society's need for medical products; systematization of lectures and other materials received from various sources; competently convey to the audience the meaning of theoretical materials on the subject of the discipline;

DLO 3 – conducting preclinical tests of the biological properties of drugs obtained by methods of anatomy and physiology of the higher nervous system; ability to use a physiological device;

DLO 4 – to give an idea of the most important structures of the Central nervous system, which combines the activities of all organs and systems of the body, with the principles of organization and functioning of the human nervous system;

DLO 5 – basic methods and approaches to the study of the anatomy and physiology of the nervous system;

DLO 6 – finding and using information about modern research in the field of anatomy and physiology of the nervous system;

DLO 7 – must demonstrate the ability and willingness to: - apply the acquired knowledge in practice.

Post requisites: Undergraduate research work, including internships and the implementation of a Master's thesis (MRW).

Optional component 3

Course: Evolutionary biology

Intensity of the Course: 5 academic credits

Module Code: SAB-2

Module Name: Selected Areas of Biology

Prerequisites: ES 4304 Evolutionary science

Purpose: to acquaint undergraduates with the origin of species from common ancestors and the ways of their biological evolution.

Short Description: The concepts of micro and macroevolution, and their mechanisms of occurrence, the problems of the origin of life. To study the first evolutionary teachings, to understand their progressive significance for the further development of science, to see the parallelism of the development of life and related teachings in combination. The section on modern concepts of biological evolution is connected with the achievements of biology in the XX and XXI centuries in the field of genetics and molecular biology. On the basis of these sciences, about ten modern theories of evolution have been created.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 – systematizes the natural-scientific essence, interdisciplinary connection of modern biological education with micro, macroevolution, evolution of bioenergetic processes;

LOP 2 –categorizes the taxonomic diversity of animals and plants, the process of interaction between bioenergy and environmental disasters in the world.

Discipline Learning Outcomes (DLO):

DLO 1 – have an understanding of species, the origin of species as a result of evolution, their distribution, reproduction, diversity, and history of evolutionary development;

DLO 2 – use various methods of evolutionary biology to explain a particular factor in evolution;

DLO 3 – understand the principles and processes that arranged life on Earth;

DLO 4 – in questions of hereditary changes in the properties and characteristics of living organisms in a number of generations;

DLO 5 – determine the diversity of species forms during their biological evolution;

DLO 6 – know the common ancestors of organisms;

DLO 7 – know the basic methods of evolutionary biology.

Post requisites: Undergraduate research work, including internships and the implementation of a Master's thesis (MRW).

Optional component 3

Course: Evolution of bioenergetic processes

Intensity of the Course: 5 academic credits

Module Code: SAB-2

Module Name: Selected Areas of Biology

Prerequisites: ME 4312 Mutagenesis and environment

Purpose: Undergraduates consider one of the main problems of evolutionary biochemistry, the emergence and development of bioenergetic processes

Short Description: The influence of environmental factors on energy exchange. Bioenergy and metabolic disorders. Bioenergy levels. Bioenergy and environmental disasters. Bioenergy is the main part of biochemistry. The value of biological free energy. Energy and work of living organisms. The main stages

of energy production in plants. Release of energy in a redox reaction. The mechanism of aerobic respiration. Krebs cycle. Energy efficiency of anaerobic respiration. Energy coefficient of photosynthesis.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 – systematizes the natural-scientific essence, interdisciplinary connection of modern biological education with micro, macroevolution, evolution of bioenergetic processes;

LOP 2 – categorizes the taxonomic diversity of the animal world and plants, the process of interaction between bioenergy and environmental disasters in the world.

Discipline Learning Outcomes (DLO):

DLO 1 – have an idea about the origin and development of bioenergetic processes;

DLO 2 – the skill of studying biochemical and bioenergetic phenomena of various levels is being formed;

DLO 3 – understands the basic laws of the processes of anabolism and catabolism of proteins, carbohydrates, and lipids;

DLO 4 – studies with the mechanisms of formation and use of energy in the living system of proteins, lipids and carbohydrates;

DLO 5 – studies and knows the role of bioenergetic processes in the adaptation of living organisms to extreme environmental influences and changes in environmental conditions, the mechanism of phosphorylation of oxides, the formation of ATP in anaerobic and aerobic conditions.

Post requisites: Undergraduate research work, including internships and the implementation of a Master's thesis (MRW).

2. OPTIONAL COMPONENTS OF THE CYCLE OF CORE COURSES

Optional component 1

Course: **Medical Microbiology**

Intensity of the Course: 5 academic credits

Module Code: **SAB -2**

Module Name: Selected Areas of Biology

Prerequisites: MBV 3213 Microbiology with basics of virology

Purpose: studies microorganisms that cause diseases in humans, their interaction with organisms, considers laboratory diagnostics and special methods of treatment and prevention of infectious diseases.

Short Description: Medical microbiology studies the biological properties of pathogens, pathogenic factors, their mechanisms of action at the cellular and molecular genetic levels, and also contributes to the improvement of methods of diagnosis, prevention and treatment, as well as the laws of their interaction with the human and animal bodies.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 – identifies theoretical foundations and applied research in the field of biochemistry and microbiology using modern information technologies;

LOP 2 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects.

Discipline Learning Outcomes (DLO):

DLO 1 – basic concepts and definitions from the field of microbiological research;

DLO 2 – methods of microbiological diagnostics, application of the main antibacterial, antiviral and biological drugs, the principles of their preparation and application;

DLO 3 –development of new methods for identification of microorganisms;

DLO 4 –sampling methods for microbiological analysis;

DLO 5 –basic skills of working with material containing pathogenic and opportunistic microorganisms;

DLO 6 – conduct microbiological control of biotechnological productions;

DLO 7 – manage methods of cultivation of microorganisms.

Post requisites: Undergraduate research work, including internships and the implementation of a Master's thesis (MRW).

Optional component 1

Course: **Sanitary microbiology**

Intensity of the Course: 5 academic credits

Module Code: **SAB -2**

Module Name: Selected Areas of Biology

Prerequisites: MBV 3213 Microbiology with basics of virology

Purpose: Mastering the methods of studying the normal microflora of the human body and the methods of sanitary-bacteriological study of air, water, soil. Acquaintance with the use of drugs during dysbiosis.

Short Description: Sanitary Microbiology is a branch of medical Microbiology that studies the microflora of the environment and its impact on human health and the state of its habitat. In this subject, students study microbiological indicators of hygienic rationing, study methods for monitoring the effectiveness of disinfection of environmental objects, pathogenic, opportunistic and sanitary-indicative microorganisms.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 – identifies theoretical foundations and applied research in the field of biochemistry and microbiology using modern information technologies;

LOP 2 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects.

Discipline Learning Outcomes (DLO):

DLO 1- knowledge of the degree of indicators of microbial contamination of milk and meat products;

DLO 2 – familiarity with the methods of disinfection of various objects, control personal hygiene of workers working in the food industry;

DLO 3 -knowledge of the microbiology of skin, wool and food;

DLO 4 – development of sanitary and microbiological methods of microbial contamination of milk, dairy products, meat and meat products, eggs, bee products, canned meat and fish;

DLO 5 – viewing with a light microscope using immersion; microscopic methods of research;

DLO 6 – be able to monitor the sanitary and hygienic state of food products using laboratory methods, solve sanitary and hygienic problems, and understand the level of air, soil, and food sanitation;

DLO 7 – microscopic research methods; isolation of pure microbial cultures.

Post requisites: Undergraduate research work, including internships and the implementation of a Master's thesis (MRW).

Optional component 2

Course: **Current issues of flora and fauna of the world**

Intensity of the Course: 5 academic credits

Module Code: **BB-4**

Module Name: Bioinformatics and Biodiversity

Prerequisites: BK 3210 Bioresources of Kazakhstan

Purpose: the study of the peculiarities of the distribution of flora and fauna of the world, types of habitats, stability and formation, patterns of distribution of plants of the globe, regions of the flora region, the location of kingdoms and the main endemic species of animals and plants characteristic of them, and familiarization with modern problems of fauna and flora of the world.

Short Description: In the modern 21st century, the following serious environmental problems can be identified: destruction of flora and fauna; deforestation; the problem of forest fires; depletion of minerals; lack of clean air, saturated with oxygen without any kind of impurities and harmful components; violation of the ozone layer that protects all life on our planet from the destructive cosmic radiation and radiation; pollution of the land landscape.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 – explores biological features, reasons for organizing groups of medicinal and cultivated plants, algae, their patterns, possible ways of management and effective use;

LOP 2 – categorizes the taxonomic diversity of animals and plants, the process of mutual influence of bioenergy and environmental disasters in the world.

Discipline Learning Outcomes (DLO):

DLO 1 – description, classification and systematization of the diversity of flora and fauna depending on the characteristics;

DLO 2 – formation of knowledge about the place and importance of biodiversity, economic and professional importance of ecological systems;

DLO 3 – formation of skills for self-determination of plants and animals to species;

DLO 4 – ability to perform research in laboratory and field conditions;

DLO 5 – draw conclusions based on the knowledge gained;

DLO 6 – develops the ability to use the necessary tools, devices and methods;

DLO 7 – organizes ways to solve environmental problems.

Post requisites: APMB 7203 Actual problems of modern botany

Optional component 2

Course: Conservation of plants and animals biodiversity

Intensity of the Course: 5 academic credits

Module Code: **BB-4**

Module Name: Bioinformatics and Biodiversity

Prerequisites: BK 3210 Bioresources of Kazakhstan

Purpose: Introduce standards of life on Earth, preserve and protect biodiversity, teach every citizen to love their homeland, nature and protect nature.

Short Description: Diversity of the animal world: past and present, problems of preservation. Taxonomic diversity of the animal world on earth. Plant diversity, theoretical and practical importance Algae, fungi, lichens, mosses, clubmosses, seed plants. Factors affecting biological diversity. Biological diversity of animals and plants of Kazakhstan. Laws of Kazakhstan on conservation of biological diversity.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 – explores biological features, reasons for organizing groups of medicinal and cultivated plants, algae, their patterns, possible ways of management and effective use;

LOP 2 – categorizes the taxonomic diversity of animals and plants, the process of mutual influence of bioenergy and environmental disasters in the world.

Discipline Learning Outcomes (DLO):

DLO 1 – uses the acquired knowledge to solve scientific and practical problems;

DLO 2 – performs basic methods of studying biodiversity;

DLO 3 – can use their knowledge and prove their point of view in solving problems related to biodiversity and environmental protection;

DLO 4 – complies with the rules of environmental protection and biodiversity conservation when conducting research and interpreting the results obtained;

DLO 5 – demonstrate the ability to use the necessary tools, equipment, and methods;

DLO 6 – studies the structure of plants and animals, the basic laws of their formation, their role in the ecosystem and their importance in the economy.

Post requisites: APMB 7203 Actual problems of modern botany

Optional component 3

Course: **Algology**

Intensity of the Course: 5 academic credits

Module Code: **SAB -2**

Module Name: Selected Areas of Biology

Prerequisites: BB 3301 Basics of biotechnology

Purpose: The aim of the Algology training course is: to form an integrated knowledge system about algae among the postgraduates, taking into account modern scientific achievements.

Short Description: Algology studies the morphology, anatomy, biochemistry, physiology, genetics, ecology, and geographical distribution of algae. Systematics and Floristics of algae – the study of species and subspecies taxa, the creation of their system, the study of the flora of different regions and patterns of their distribution. Scientific bases of rational use of algae in various sectors of the national economy, conservation of biodiversity of reservoirs and soils, nature protection measures.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects;

LOP 2 – explores biological features, reasons for organizing groups of medicinal and cultivated plants, algae, their patterns, possible ways of management and effective use.

Discipline Learning Outcomes (DLO):

DLO 1 – able to plan biological research, draw up a scheme of experience, select suitable methods;

DLO 2 – knows how to work with living objects in nature and the laboratory conditions;

DLO 3 – is able to adapt scientific knowledge and skills for future professional activities;

DLO 4 – possesses various research methods: anatomical-morphological, cytological, geobotanical, floristic, herbarization and collecting methods;

DLO 5 – demonstrates the ability to navigate the phylogeny, classification, role of algae and fungi in the biosphere and human life;

DLO 6 – demonstrates knowledge of morphology of the investigated objects, considering their characteristics in unity with the performed functions and conditions of the habitat;

DLO 7 – uses the main methods of Algology in practical work and experimental research.

Post requisites: APMB 7203 Actual problems of modern botany

Optional component 3

Course: **Cultural plants**

Intensity of the Course: 5 academic credits

Module Code: **SAB -2**

Module Name: Selected Areas of Biology

Prerequisites: BK 3210 Bioresources of Kazakhstan

Purpose: Argumentation and presentation of methods of economically, environmentally and technologically supported land use; studying the methods of soil fertility improvement to obtain optimal parameters of cultivated plants' growing; to teach the undergraduates to apply science-based technologies for cultivating crops that allow them to obtain maximum yields per unit area.

Short Description: The centers of distribution of cultivated plants (Chinese, Indian, Indian-Malay, Central, old Asia, the Mediterranean, Western, Central Mexico, South America and the Chilean Andes). The classification of the Russian scientist P. M. Zhukovsky (1888 - 1975) (China, Japan, Indonesia, India, Australia, India, Central, Central Asia, the Mediterranean, Africa, Europe, Siberia, Central, South, North America).

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects;

LOP 2 – explores biological features, reasons for organizing groups of medicinal and cultivated plants, algae, their patterns, possible ways of management and effective use.

Discipline Learning Outcomes (DLO):

DLO 1 – knows the meaning, morphology and biological characteristics of cultivated plants;

DLO 2 – possesses the main modern technologies of crops cultivation, ways of quality improvement of agricultural products, reduce their losses, as well as reduce labor costs and funds for obtaining the guaranteed harvest;

DLO 3 – knows how to organize the implementation of production processes in field husbandry.

DLO 4 – can use agricultural machinery, chemical and agrotechnical means of plant protection;

DLO 5 – knows the types of cultivated plants, types and doses of fertilizers used, irrigation methods;

DLO 6 – applies knowledge and skills to determine the types of agricultural crops, the forms and doses of fertilizers used on them, the types of irrigation, varieties, agricultural machinery and to create microclimates;

DLO 7 – expresses own opinion and formed judgments on issues of modern technologies for growing cultivated plants.

Post requisites: APMB 7203 Actual problems of modern botany

Optional component 4

Course: Modern concepts of biological education

Intensity of the Course: 6 academic credits

Module Code: **EP-3**

Module Name: Education paradigms

Prerequisites: MTB 3301 Methods of teaching in Biology

Purpose: The aim of the discipline is to determine the purpose, objectives and structure of the subject “Biology”, as well as determining the scientific basis of the updated content of General biological education, preparing a biologically and environmentally literate person.

Short Description: The problem of optimal combination of basic education and professional training. Basic concepts of biological knowledge reflecting the problems of human evolution and interaction with the environment: anthropocentrism, ecology, ecological integrity, biocentrism. "Basic training" and special training. The problem of identity and use of knowledge of undergraduates in a certain field of science, education, production and management.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects;

LOP 2 – designs methodological achievements and current biology problems using modern methods of scientific research, processing and interpretation of experimental data.

Discipline Learning Outcomes (DLO):

DLO 1 – understands the practical importance of biological knowledge as a scientific basis for nature management and conservation;

DLO 2 – makes environmentally correct decisions;

DLO 3 – adheres to the idea of optimizing relations between human and nature;

DLO 4 – demonstrates own understanding of human as a species, living organism, personality, conditions of existence, survival and development, healthy lifestyle;

DLO 5 – understands the practical importance of biological knowledge about human in solving problems of health care, human ecology and nature conservation;

DLO 6 – understands fundamental biological theories and concepts on the social and cultural background of their formation, development and change;

DLO 7 – understands the importance of biological ideas for scientific worldview and practice.

Post requisites: ITBESR 7302 Innovation technologies in biological education and scientific research

Optional component 4

Course: Methodology and methods of pedagogical research

Intensity of the Course: 6 academic credits

Module Code: **EP-3**

Module Name: Education paradigms

Prerequisites: MTB 3301 Methods of teaching in Biology

Purpose: The aim of the course is to form a system of competencies for undergraduates that provide an understanding of the nature, principles and logic of scientific and pedagogical research, and knowledge of the methodology of its organization in the context of developing the ability to successfully solve research tasks in various educational environments.

Short Description: Pedagogical education, process of its development, ways of interpretation (drawing up the concept), means and procedures of practical application for transformation or improvement of a system of education, upbringing and personal development. An ordered set of methods and ways of organizing and regulating pedagogical research, the order of interpretation and use of the obtained results in achieving certain scientific goals.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 - presents the theoretical and methodological foundations of the development of the science of pedagogy and psychology, the processes of management and ownership of teaching methods, the essence and content of psychological and pedagogical research;

LOP 2 – designs methodological achievements and current biology problems using modern methods of scientific research, processing and interpretation of experimental data.

Discipline Learning Outcomes (DLO):

DLO 1 – can logically and correctly formulate and express their thoughts, argue their point of view;

DLO 2 – conduct a theoretical analysis of psychological and pedagogical literature;

DLO 3 – highlights the current problems of the development of the modern system of education, training and development of children;

DLO 4 – assesses the adequacy of methods for solving the problem under study;

DLO 5 – uses modern scientific methods to solve research problems;

DLO 6 – owns the methodology of cultural-historical and activity approaches;

DLO 7 – knows the theoretical foundations of the methodology of scientific research organization.

Post requisites: ITBESR 7302 Innovative technologies in biological education and scientific research

Optional component 5

Course: Educational methodology for integrating STEM in teaching biology

Intensity of the Course: 6 academic credits

Module Code: **EP-3**

Module Name: Education paradigms

Prerequisites: Educational disciplines of the module "Selected Areas of Biology" of cycles UC, OC, UK.

The aim of the subject of the integrated educational methodology STEM in the teaching of biology is the integration of the fields of science, technology, engineering and mathematics in the development of the scientific qualifications of biologists. As a result of the organization of project work in connection with the integration of STEM into the learning process, obtaining a product and developing research skills among specialists.

Brief description: Education in biology is carried out as a scientific– technical, engineering and mathematical education or STEM education. In the learning process, students can develop skills in engineering design of biological objects, obtaining products and mastering the skills of the XXI century. According to the results of the research, interest in science, motivation for learning, self-confidence, comprehensive search and research competencies of students are formed.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects;

LOP 2 – designs methodological achievements and current biology problems using modern methods of scientific research, processing and interpretation of experimental data.

Discipline Learning Outcomes (DLO):

DLO 1- To give students a general idea of the STEAM design of biological research objects;

DLO 2 - Development of practical skills of students in engineering design for biological research facilities;

DLO 3 - Organization of group research in obtaining effective products from objects of biological research;

DLO 4 - To promote independent learning of students, to involve them in the search for various scientific databases and literature sources, scientific library sites;

DLO 5 - Formation of research competencies based on the results of STEM education.

Post requisites: MSR 7202 Methods of scientific research

Undergraduate research work, including internships and the implementation of a Master's thesis (MRW).

Optional component 5

Course: **Methodological aspects biological research**

Intensity of the Course: 6 academic credits

Module Code: **EP-3**

Module Name: Education paradigms

Prerequisites: Educational disciplines of the module "Selected Areas of Biology" of cycles UC, OC, UK.

Purpose: formation of a system of basic knowledge and skills in future specialists for organizing and conducting scientific and biological research. Systematization, expansion and consolidation of professional knowledge, the formation of undergraduates' skills to conduct independent scientific work, research and experimentation in biology.

Short Description: Studies methodological aspects of biology in a historical retrospective, methodological and world outlook problems of modern biology, methodology of scientific knowledge of biology, experimental methods, description methods, comparative methods, statistical methods, modeling, historical methods. Control, description, identification, classification, breeding of biological objects.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 - adapts innovative technologies, methods and tools, principles and patterns in selected areas of biology and teaching of natural science subjects;

LOP 2 – designs methodological achievements and current biology problems using modern methods of scientific research, processing and interpretation of experimental data.

Discipline Learning Outcomes (DLO):

DLO 1 – understands the role of scientific and biological research in personality development and educational organization;

DLO 2 – owns the principles and patterns of methodology and technology for conducting scientific research and scientific forums in biology;

DLO 3 – conducts research work in biology in the organization of education;

DLO 4 – writes and presents scientific publications on the topic of scientific and biological research.
Post requisites: ITBESR 7302 Innovative technologies in biological education and scientific research

Undergraduate research work, including internships and the implementation of a Master's thesis (MRW).

Optional component 6

Course: **Bioinformatics**

Intensity of the Course: 5 academic credits

Module Code: **BB-4**

Module Name: Bioinformatics and Biodiversity

Prerequisites: GBS 3216 Genetics with basics of selection

Purpose: The aims of the Bioinformatics discipline is to master the bioinformatics skills needed in academic, biotechnological and pharmaceutical laboratories to analyze individual DNA and protein sequences.

Short Description: Bioinformatics is a science dynamically developing at the junction of biology, mathematics, chemistry, physics, and computer technology. The purpose of bioinformatics is to determine the reliability of information on the systematization and analysis of extensive data on wildlife. This requires the use of biometric methods, the study of the interaction between living organisms, the evolution of the main features of homology and the method of mathematical analysis.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 – designs methodological achievements and current biology problems using modern methods of scientific research, processing and interpretation of experimental data;

LOP 2 – forms the concept of biological catalysts, the genome of prokaryotes and eukaryotes and interactions between living organisms, the evolution of the main features of homology.

Discipline Learning Outcomes (DLO):

DLO 1 – demonstrates basic knowledge of the diversity of biological objects, their structure, principles of functioning and interaction with the environment;

DLO 2 – has basic ideas about the patterns of individual development of biological objects and their reproduction;

DLO 3 – has basic knowledge of the structure and function of DNA and proteins;

DLO 4 – has a strong understanding the bioinformatic sequence analysis and many topics from molecular biology;

DLO 5 – has a good set of skills and extensive experience in using common sequence and database analysis tools;

DLO 6 – is well versed in the various problems of sequence analysis and understands how to solve them;

DLO 7 – is able to solve problems of sequence analysis or develop software for sequence analysis.

Post requisites: MBGE 7301Molecular biology and genetic engineering

Optional component 6

Course: **Enzymology**

Intensity of the Course: 5 academic credits

Module Code: **BB-4**

Module Name: Bioinformatics and Biodiversity

Prerequisites: Bio 3214 Biochemistry

Purpose: The aim of the Enzymology training discipline is to form a holistic system of knowledge about the activity of enzymes, kinetics and the mechanisms of their action, as well as about the methods of enzymes' application.

Short Description: The concept of biological catalysts. Chemical nature of enzymes. Coenzymes-NAD, NADP, FAD. FMN, TPP, pyridoxine and cobamide coenzymes. Linden furosemide, coenzyme, metal ions. Kinetics and mechanism of the reactions taking place using enzymes. The Michaelis Menten constant and its graph. Active and allosteric center of enzymes. The concept of Pro-enzymes and isoenzymes, multi-enzymes. Immobilized enzymes. Practical significance of enzymes.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 – designs methodological achievements and current biology problems using modern methods of scientific research, processing and interpretation of experimental data;

LOP 2 – forms the concept of biological catalysts, the genome of prokaryotes and eukaryotes and interactions between living organisms, the evolution of the main features of homology.

Discipline Learning Outcomes (DLO):

DLO 1 – is able to plan biological research, draw up the experimental schemes, select suitable methods;

DLO 2 – knows how to work with living objects in nature and in laboratory conditions;

DLO 3 – is able to adapt scientific knowledge and skills to future professional activities;

DLO 4 – possesses methods of enzyme purification and isolation;

DLO 5 – demonstrates the ability to navigate the biochemical structure of living systems;

DLO 6 – demonstrates knowledge of the structure and functions of enzymes controlling various reactions and exchange processes occurring in living systems;

DLO 7 – uses basic methods of enzymology in practical work and experimental research.

Post requisites: MBGE 7301Molecular biology and genetic engineering

Optional component 7

Course: **Genomics**

Intensity of the Course: 6 academic credits

Module Code: **BB-4**

Module Name: Bioinformatics and Biodiversity

Prerequisites: GBS 3216 Genetics with basics of selection

Purpose: Study of the structure and function of the genome of living organisms. Viruses and phages: viruses – formations as a form of molecular genetics.

Short Description: The prokaryotic genome. Structure and size of the prokaryotic genome. E. Coli. The eukaryotic genome. Drosophila melanogaster. Features of the gene of higher plants. The human genome. Mapping of the human genome. Characteristics of living organisms, Biology and its goals, Structural levels of life; basic principles of cell theory; cell features of prokaryotic and eukaryotic organisms; cell division; fertilization, fetal development; The main role of chemical and organic substances of the cell; laws of individual development.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 – designs methodological achievements and current biology problems using modern methods of scientific research, processing and interpretation of experimental data;

LOP 2 – forms the concept of biological catalysts, the genome of prokaryotes and eukaryotes and interactions between living organisms, the evolution of the main features of homology.

Discipline Learning Outcomes (DLO):

DLO 1 – knows the methods and forms of biology research, analyzes the results of biological experiments;

DLO 2 – create and solve genetic problems;

DLO 3 – defines the role of genetics in the prevention and treatment of hereditary diseases;

DLO 4 – analyzes data on the genome structure of various organisms at the molecular level;

DLO 5 – generates an analysis of previously unknown genes, comparing the similarity of structural and functional functions of genes and genomes.

Post requisites: MBGE 7301Molecular biology and genetic engineering

Optional component 7

Course: **Biometric processing of experimental data**

Intensity of the Course: 6 academic credits

Module Code: **BB-4**

Module Name: Bioinformatics and Biodiversity

Prerequisites: Educational disciplines of the module "Selected Areas of Biology" of cycles UC, OC, UK.

Purpose: Developing skills in biometric processing of experimental data

Short Description: Studies methods of data processing obtained during the formulation of an experiment by means of mathematical calculations, application of modern methods of scientific research, processing and interpretation of experimental data, methods of carrying out statistical processing using various programs, methodological achievements and current problems of modern science.

Learning Outcomes:

Learning Outcomes in EP (LOP):

LOP 1 – designs methodological achievements and current biology problems using modern methods of scientific research, processing and interpretation of experimental data;

LOP 2 – forms the concept of biological catalysts, the genome of prokaryotes and eukaryotes and interactions between living organisms, the evolution of the main features of homology.

Discipline Learning Outcomes (DLO):

DLO 1 – owns methods of mathematical processing of data obtained during the experiment;

DLO 2 – develops methods of statistical processing using various programs;

DLO 3 –uses various experimental data programs;

DLO 4 – owns methods of statistical processing.

Post requisites: Undergraduate research work, including internships and the implementation of a Master's thesis (MRW).