

KAZAKH NATIONAL WOMEN'S TEACHER TRAINING UNIVERSITY
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CATALOG OF ELECTIVE DISCIPLINES

Almaty 2026

EDUCATIONAL PROGRAM: 6B01516 - Biology IP

Course title	Fundamentals of Legal Literacy and Anti-Corruption culture
Component	Subject component, Optional component
Cycle	Core disciplines
Module	General educational subjects module
Academic credits	5
Prerequisites	Basics Law (school cours)
Post-requisites	no
Course Description/ competencies	<p>The purpose of this course - formation of a legally competent, law-abiding person who knows his rights and duties, intolerant of any manifestations of corruption.</p> <ul style="list-style-type: none"> • Competence area for teachers' work environment (6) • Competence area for social, cultural, and civic development (6) • Competence area for interpersonal social and professional communication (9) <p>The course is aimed at forming a legally literate, law-abiding person. Students will be aware of their rights and responsibilities, and show zero tolerance for corruption. Students will be able to apply the social, legal and ethical norms of Kazakh society in their activities. The course develops an understanding of legality, ethical principles and principles of combating corruption in society.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • To know the importance and role of legal culture in the life of society, its relationship with the political culture of the individual and the main definitions of corruption; • Analyze the main obstacles on the way to ensuring the inalienable human rights; the role of human rights in personal life and in the life of society; • Apply the acquired knowledge in political analysis, in the activities of public authorities, political and public organizations, analyze problems related to corruption and countering it; • Be able to engage in dialogue as a way of relating to legal culture and society. <p>LOP 1 - Applies a variety of communication formats taking into account sociocultural diversity, adheres to the principles of equality and accessibility in education when creating a prosperous and inclusive environment, demonstrates leadership qualities and is able to apply them to develop collective potential.</p> <p>LOP 3 - Demonstrates knowledge of ethical and legal standards in conducting research and ensures the secure use and protection of data when working with digital technologies and artificial intelligence tools.</p>
Course title	Ecology and Sustainable Development
Component	Subject component, Optional component

Cycle	Core disciplines
Module	General educational subjects module
Academic credits	5
Prerequisites	Biology (school program)
Post-requisites	no
Course Description/ competencies	<p>The purpose of this course - To develop students' environmental skills, address modern ecological issues, strengthen the relationship between society and nature, and enhance environmental awareness and responsibility for protecting the environment, thereby ensuring their formation as active and responsible citizens.</p> <ul style="list-style-type: none"> • Competence area for conceptual and theoretical knowledge (3) • Competence area for conducting scientific research(6) • Competence area for application in science (11) <p>The course aims to develop students' environmental skills, solve modern environmental problems, form ways to develop relationships between society and nature, increase students' awareness of the environment, and their responsibility for protecting it. As a result, students will learn how to maintain vital balance by analyzing environmental trends and identifying priority areas for conserving nature. They will also be able to identify the main directions of modern environmental policy and practical approaches to addressing environmental issues at the global, regional and local levels. In addition, students will gain knowledge of various tools for managing environmental quality that can be used to achieve sustainable development objectives.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • Environmental Education and Skills: Students gain deep knowledge about environmental issues and principles of sustainable development, and acquire skills in environmental monitoring and data analysis. • Environmental Responsibility and Activism: Students recognize their responsibility for protecting the environment and strive to actively participate in environmental initiatives, aiming to make changes in society. • Understanding the Relationship between Society and Nature : Students comprehend the relationship between society and nature, develop environmental ethics and sustainable development strategies, enabling them to address social and environmental issues. <p>LOP 4 - To focus on a healthy lifestyle to ensure the sustainable development of society and nature, full-fledged social and professional activities</p> <p>LOP 9 - To use conceptual theories and laws of natural sciences to explain patterns, phenomena and processes in nature, to form a holistic view of the natural science picture of the world</p>
Course title	Fundamentals of Economics and Entrepreneurship
Component	Subject component, Optional component
Cycle	Core disciplines
Module	General educational subjects module

Academic credits	5
Prerequisites	Fundamentals of Entrepreneurship and business (school course)
Post-requisites	No
Course Description/ competencies	<p>The purpose of this course – familiarization of students with the basics of economics and entrepreneurship, mastering the conceptual apparatus and basic forms of doing business.</p> <ul style="list-style-type: none"> • Competence area for professional development (10) • Competence area for social, cultural, and civic development (6) • Competence area for interpersonal social and professional communication (9) <p>The discipline is focused on the formation of students' skills of entrepreneurship and business thinking. Through a comprehensive view of the laws of the functioning of the economy, the conditions for doing business, its internal and external environment, students will have the skills to develop a business plan, create and successfully run their own business.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • Know the basic concepts in the field of economics and entrepreneurship; • Be able to find and use the necessary economic information; determine the organizational and legal forms of organizations; • Determine the composition of the material, labor and financial resources of the organization; • Evaluation of a business idea and development of a business plan. <p>LOP 1 - Applies a variety of communication formats taking into account sociocultural diversity, adheres to the principles of equality and accessibility in education when creating a prosperous and inclusive environment, demonstrates leadership qualities and is able to apply them to develop collective potential.</p> <p>LOP 3 - Demonstrates knowledge of ethical and legal standards in conducting research and ensures the secure use and protection of data when working with digital technologies and artificial intelligence tools.</p>
Course title	Fundamentals of Leadership and receptivity to innovation
Component	Subject component, Optional component
Cycle	Core disciplines
Module	General educational subjects module
Academic credits	5
Prerequisites	No
Post-requisites	No
Course Description/ competencies	<p>The purpose of this course - in the process of studying the discipline, the student develops the skills of setting goals and objectives, timely planning of group work, problem solving, a sense of responsibility and effective communication.</p> <ul style="list-style-type: none"> • Competence area for pedagogy and didactics (2) • Competence area for professional development(9)

	<ul style="list-style-type: none"> • Competence area for interpersonal social and professional communication (9) The course contributes to the disclosure and development of leadership qualities in the personality of each student, the development of innovative susceptibility skills in him, as a process of adaptation to innovations caused by innovative processes, as well as the use of the results of scientific and technical processes in his life and professional activities. Studies the current state and prospects for the development of leadership qualities and the human factor in management.
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • Understands theoretical and applied research in the field of modern management achievements in Kazakhstan and abroad using modern scientific methods; • Knows how to work effectively individually and in a team; • Independently study and continuously improve their qualifications throughout the entire period of professional activity; • Applies professional knowledge in the field of organizational and managerial activities. <p>LOP 1 - Applies a variety of communication formats taking into account sociocultural diversity, adheres to the principles of equality and accessibility in education when creating a prosperous and inclusive environment, demonstrates leadership qualities and is able to apply them to develop collective potential.</p> <p>LOP 3 - Demonstrates knowledge of ethical and legal standards in conducting research and ensures the secure use and protection of data when working with digital technologies and artificial intelligence tools.</p>
Course title	Emotional Intellect
Component	Subject component, Optional component
Cycle	Core disciplines
Module	General educational subjects module
Academic credits	5
Prerequisites	no
Post-requisites	no
Course Description/competencies	<p>The purpose of this course - knowledge and ability to apply modern methods of diagnostics and development of emotional intelligence of students and soft skills, including in the format of distance learning.</p> <ul style="list-style-type: none"> • Competence area for professional development (10) • Competence area for interpersonal social and professional communication (9) <p>The discipline is aimed at mastering the role of a tutor by the teacher in the context of strategic guidelines and priority areas of the state educational policy of Kazakhstan. Students determine the place of emotional intelligence and "flexible competencies" in the educational process of the modern school. They apply modern methods and technologies for organizing educational activities, taking into account the development of soft skills, including in the digital</p>

	environment. They possess technologies for assessing and developing the emotional intelligence of students of different age groups.
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • Modern methods and technologies of organizing educational activities taking into account the development of soft skills, diagnostics and evaluation of flexible skills, the formation of individual educational directions and methods of organizing group activities; • Application of modern methods and technologies for organizing educational activities, taking into account the development of flexible skills, including in the digital environment; • Flexible skills on the skillfolio platform have the ability to carry out complex diagnostics of soft skills, interpret the results and develop them both in individual and group forms of training. <p>LOP 1 - Applies a variety of communication formats taking into account sociocultural diversity, adheres to the principles of equality and accessibility in education when creating a prosperous and inclusive environment, demonstrates leadership qualities and is able to apply them to develop collective potential.</p> <p>LOP 3 - Demonstrates knowledge of ethical and legal standards in conducting research and ensures the secure use and protection of data when working with digital technologies and artificial intelligence tools.</p>
Course title	Fundamentals of mathematical statistics
Component	Subject component, Optional component
Cycle	Core disciplines
Module	General educational subjects module
Academic credits	5
Prerequisites	Mathematics (school programme)
Post-requisites	no
Course Description/ competencies	<p>The purpose of this course - is to familiarize students with the forms and laws of consistent thinking, to teach students to think consistently, to contribute to the development of skills of sound argumentation.</p> <ul style="list-style-type: none"> • Competence area for professional development (10) • Competence area for application in science • Competence area for interpersonal social and professional communication (9) <p>Students understand the process of collecting, processing data and transmitting ideas, develop skills in using quantitative and qualitative data analysis in assessing the state of the object or phenomenon in question.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • The student summarizes the results of pedagogical and scientific research and learns to process them mathematically. • Learns to systematize, clarify and use statistical data using statistical and mathematical methods.

	<ul style="list-style-type: none"> • Effectively uses Chi-square, SSPP and Jamovi applications that statistically process the collected numbers. <p>LOP 3 - Demonstrates knowledge of ethical and legal standards in conducting research and ensures the secure use and protection of data when working with digital technologies and artificial intelligence tools.</p> <p>LOP 8 - To integrate knowledge of related sciences necessary for everyday professional activities and the formation of functional literacy of students</p>
Course title	Financial Literacy
Component	Subject component, Optional component
Cycle	Core disciplines
Module	General educational subjects module
Academic credits	5
Prerequisites	no
Post-requisites	no
Course Description/ competencies	<p>The purpose of this course - is to develop students' knowledge and practical skills in personal finance management, allowing them to make informed financial decisions and ensure their financial well-being.</p> <ul style="list-style-type: none"> • Competence area for professional development (10) • Competence area for social, cultural, and civic development (6) • Competence area for interpersonal social and professional communication (9) <p>The discipline is focused on the development of students' knowledge about the financial system, financial institutions and their products, and financial risks. As a result, students will be able to find, analyze, interpret, evaluate financial information from various sources and use it to solve financial problems. In general, the course forms students' competent rational financial behavior in conditions of increased risk of financial fraud</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • To know the basic financial concepts, the principles of financial markets, types of taxes, the basics of insurance, the possibilities of financial technologies. • Be able to make a personal budget, analyze financial proposals, choose suitable financial products and services, make informed financial decisions, and protect your financial interests. • Possess the skills of financial planning, investment, and risk management. • Demonstrate financial literacy in everyday life, make responsible decisions in the field of finance. <p>LOP 1 - Applies a variety of communication formats taking into account sociocultural diversity, adheres to the principles of equality and accessibility in education when creating a prosperous and inclusive environment, demonstrates leadership qualities and is able to apply them to develop collective potential.</p> <p>LOP 3 - Demonstrates knowledge of ethical and legal standards in conducting research and ensures the secure use and protection of data when working with digital technologies and artificial intelligence tools.</p>
Course title	Fundamentals of Ecology and Safe life

Component	Subject component, Optional component
Cycle	Core disciplines
Module	General educational subjects module
Academic credits	5
Prerequisites	Biology (school program)
Post-requisites	no
Course Description/ competencies	<p>The purpose of this course maintaining the stability of life by analyzing environmental processes, forming priority areas and setting specific tasks for nature conservation.</p> <ul style="list-style-type: none"> • Competence area for conceptual and theoretical knowledge (3) • Competence area for conducting scientific research(6) • Competence area for application in science (11) <p>The discipline forms students' modern environmental education and culture, develops skills in applying methods to improve the safety of technical means and technological processes for safe life. Reveals the basic laws of the functioning of ecosystems of various levels of organization, the biosphere, the contradictions that arise in the relationship between man and nature, as well as the need for respect for nature and ecology.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • Knows the terms and concepts that define the main features and features of ecosystems; • Has an idea of the complex relationships taking place in nature, as well as between society and nature; • Can give an environmental assessment of the situation in the region and promote the knowledge gained as a result of work in all areas of its activities; • It can analyze the main legislative documents on environmental safety and modern environmental problems. <p>LOP 4 - To focus on a healthy lifestyle to ensure the sustainable development of society and nature, full-fledged social and professional activities</p> <p>LOP 9 - To use conceptual theories and laws of natural sciences to explain patterns, phenomena and processes in nature, to form a holistic view of the natural science picture of the world</p>
Course title	Individual development of living organisms
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Genetics and Evolution 22 academic credits
Academic credits	5
Prerequisites	Structure and functions of plant organisms, <i>Structure and functions of animals 1</i>
Post-requisites	Human anatomy, Genetics and the basis of breeding

Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1) • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (9) <p>Pre-service teachers have a fundamental knowledge of the regularity ontogenetic development of organisms. They also build their understanding of macro- and micromorphological, physiological and biochemical processes, processes occurring in developing organisms, as well as about the factors and mechanisms governing the processes of development at all stages of the ontogenesis of animals and plant organisms.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • describe the patterns of reproduction and individual development of organisms; • understand the basic laws of the biology of animal reproduction, the main stages of ontogenesis, phases of embryonic development, mechanisms of growth, morphogenesis, and causes of developmental anomalies; • describe the morphology of gametes; spermatogenesis, fertilization; crushing, blastulation, gastrulation, neurulation; • compare features stages of ontogenesis and phylogeny; • use specialized terminology; • evaluate the features of the development of biological systems embryonic development of the digestive system, respiratory organs, skeleton, muscles, circulatory and genitourinary systems; • describe electrical processes in living organisms, photobiological processes, problems of stability and evolution of biological systems; • use in practice the acquired knowledge about the mechanisms of morphophysiological differentiation of the organism in ontogenesis; • apply the acquired knowledge to solve scientific and practical problems, and to work with embryonic objects.
Course title	Cytology, histology and embryology
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Genetics and Evolution 22 academic credits
Academic credits	5
Prerequisites	Structure and functions of plant organisms, <i>Structure and functions of animals 1</i>
Post-requisites	Human anatomy, Genetics and the basis of breeding
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1)

	<ul style="list-style-type: none"> • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (9) <p>Pre-service teachers have fundamental knowledge about the structure and principles of cell life, subcellular components, their structure, and functions, as well as the features of embryonic development. They develop their skills in working with optical devices, histopreparations, and fixed material. They also practice the technique of preparing micropreparations.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1) • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (9) • Pre-service teachers have fundamental knowledge about the structure and principles of cell life, subcellular components, their structure, and functions, as well as the features of embryonic development. They develop their skills in working with optical devices, histopreparations, and fixed material. They also practice the technique of preparing micropreparations.
Course title	Patterns of inheritance and variability
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Genetics and Evolution 22 academic credits
Academic credits	5
Prerequisites	Structure and functions of animals 1,2
Post-requisites	Evolutionary teaching, Biometrics
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (3) • Competence area for Development of practical and research skills (5, 6) • Competence area for Interdisciplinary interactions development (10, 11) <p>Pre-service teachers investigate the patterns of inheritance of traits, chromosomal theory of heredity, non-nuclear inheritance, natural and induced mutation process, fundamentals of genetic engineering, developmental genetics, population and evolutionary genetics, genetic foundations of breeding, and features of human genetics. Pre-service teachers determine the relationship between the influence of genotype and environmental factors on the development of organisms. Pre-service</p>

	teachers also consider heritability in the population, and the influence of various factors on the genetic structure of the population.
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • distinguish inheritance patterns in intraspecific and distant hybridization; • solve genetic problems of inheritance of traits and interpret the results obtained; • explain the role of environmental and hereditary factors in variability; • use modern research methods and information and communication technologies to model crosses; • analyze the types of inheritance of breeding traits, types of genetic variability arising under the influence of mutagenic factors; • explain the role of heredity and variability in the evolution of life on the planet, the main provisions of the chromosomal theory of heredity and the mechanism of inheritance of human diseases; • solve genetic problems of inheritance of traits and interpret the results obtained.
Course title	Genetics and the basis of breeding
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Genetics and Evolution 22 academic credits
Academic credits	5
Prerequisites	Structure and functions of animals 1,2
Post-requisites	Evolutionary teaching, Biometrics
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (3) • Competence area for Development of practical and research skills (5, 6) • Competence area for Interdisciplinary interactions development (10, 11) <p>Genetics includes ideas and methods that play an important role in medicine, agriculture, microbiological industry, as well as in genetic engineering. Pre-service teachers investigate the cytological foundations of heredity, the laws of heredity, and variability of traits at all levels of the organization of living matter. They also analyze the types of inheritance of breeding traits, the role of heredity, and the environment in the formation of the phenotype. Pre-service teachers consider the issues of modification and mutational variability, polyploidy, and distant hybridization. Pre-service teachers also analyze the patterns of transmission and realization of genetic information. Pre-service teachers examine the basics of breeding, genetic engineering, and methods of molecular genetic analysis.</p>

Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • analyze the types of inheritance of traits; • use genetic terms and conventions appropriately, contributing to an understanding of the nature, process, and results of the study; • apply in practice methods of hybridological, cytological and population analysis to solve genetic problems for all types of inheritance; • design and conduct genetic experiments; • process and analyze the measurement results of quantitative features; • distinguish the role of heredity and variability in the evolution of life on the planet, the main provisions of the chromosomal theory of heredity and the mechanism of inheritance of human diseases; • distinguish the causes and consequences of mutations for the vital activity of living organisms and the evolution of life on the planet; • combine the concepts of genetic processes in plants and animals; • perform calculations to determine the percentage of crossing between genes and design genetic maps for genes; • determine the genotypic structure of populations and the frequency of alleles and genotypes by phenotypic frequencies in populations; • distinguish the types of heredity (nuclear – chromosomal and extra-nuclear - cytoplasmic) and their causes; • determine the influence of factors on the type of variability; • make schemes of crosses according to the form accepted in genetics; • draw conclusions about the importance of induced mutations in the selection of microorganisms, plants and animals; • apply the knowledge and methods of genetics to solve the problems of breeding organisms; • model and design an intraspecific crossing experiment.
Course title	Comparative anatomy and evolution of living organisms
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Genetics and Evolution 22 academic credits
Academic credits	5
Prerequisites	Structure and functions of animals 1,2
Post-requisites	Ecology of plants, animals and humans
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1, 2) • Competence area for Development of practical and research skills (6)

	<ul style="list-style-type: none"> Competence area for Interdisciplinary interactions development (10) <p>Pre-service teachers explore the historical process of adaptive transformations of wildlife at different levels of organization – from the macromolecular to the biosphere as a whole. During the course, pre-service teachers analyze comparative anatomical evidence of the evolution of the main types of living organisms. They also pay special attention to the evolution of vertebrates as the most highly organized, studied and economically important group.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> classify organs by their origin in embryogenesis; compare the features of the structure of organs in connection with their functions performed; characterize the main stages of the evolution of organ systems; distinguish aromorphoses, idioadaptation and degeneration in the stages of evolution; understand the adaptive nature of the evolution of organ systems; identify the main directions of the evolution of living organisms; apply knowledge on the current state of evolutionary theory in the educational process; understand the content of the main provisions of the evolutionary theory; analyze scientific data to prove the provisions of the evolutionary doctrine; integrate the acquired knowledge on comparative anatomy and evolution of living organisms; use methods of comparative analysis of various groups of living organisms, considering their systematic position, phylogenetic relationships, ecology and biology; analyze the anatomical and morphological structure of organs, considering their functions; systematize research results, evaluate their reliability and significance; plan and conduct experiments, and process and analyze research results.
Course title	Evolutionary teaching
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Genetics and Evolution 22 academic credits
Academic credits	5
Prerequisites	Structure and functions of animals 1,2
Post-requisites	Ecology of plants, animals and humans

Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1, 2) • Competence area for Interdisciplinary interactions development (9, 10, 11) <p>Pre-service teachers investigate the basic laws of the development of the organic world at the macro- and microevolutionary levels, the features of speciation, and the mechanisms of natural selection. During the course, pre-service teachers gain knowledge in explaining the processes occurring in nature, as well as develop their skills in analyzing various data at an interdisciplinary level.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • describe the process and significance of the evolutionary process in wildlife; • apply knowledge about the basic laws and mechanisms of evolutionary changes in the life of plants and animals in pedagogical activity and in solving practical problems; • substantiate the role of the evolutionary idea in the biological worldview; • use the skills of interpreting changes occurring in ecosystems; • document, correctly formalize links to the used sources of information using the selected citation style; • argue the modern evolutionary approach to the study of biological objects; • apply the skills of scientific explanation of natural processes in professional activity.
Course title	Human biology
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Biology of living organisms 36 academic credits
Academic credits	5
Prerequisites	Structure and functions of animals 1,2
Post-requisites	Human and Animal Physiology
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1) • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (9) <p>During the course, pre-service teachers form a comprehensive understanding of the functioning of the human being as a biological object. They examine the features of the structure and functioning of organ systems, considering ontogenetic and phylogenetic features.</p>

Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • describe the features of topography and patterns of the structure of the human body at the micro- and macroscopic levels; • understand the relationship of the structure of organs with the functions performed; • systematize knowledge about the structure and function of organs and systems of the human body, their interrelation and mechanisms of regulation; • navigate the structure of the human body, find and determine the location and projection of organs and their parts on the surface of the body; • evaluate the structural and functional parameters of human body development; • design and conduct experiments to study the work of organs and organ systems; • apply anatomical and physiological knowledge in life, including as a prevention of various diseases.
Course title	Human anatomy
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Biology of living organisms 36 academic credits
Academic credits	5
Prerequisites	Structure and functions of animals 1,2
Post-requisites	Human and Animal Physiology
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1, 3) • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (9, 10) <p>Pre-service teachers build their understanding of the basic laws of the structure and function of the body, as well as individual organs and systems of a person. They are able to use correct terminology and develop their skills in working with laboratory devices.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • understand the general laws of the structure of the human body, the structural and functional relationships of parts of the body; • use conceptual apparatus and specialized terminology; • determine the location and relative position of organs in the body; • analyze information about the topography, structure of the human body, its systems, organs and tissues and their main functions; • describe morphological changes in the studied macroscopic preparations;

	<ul style="list-style-type: none"> • design and conduct simple experiments to study the work of individual organs and organ systems at school; • observe ethical standards when performing experiments.
Course title	Biogeocenology
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Biopedagogy and environment 9 academic credits
Academic credits	4
Prerequisites	Structure and functions of plant organisms, Structure and functions of animals 1,2
Post-requisites	no
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1, 3) • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (10) <p>Biogeocenology combines a number of disciplines that are related to biology, ecosystem ecology and geography. Pre-service teachers build their understanding of the basic laws of the organization and functioning of biogeocenoses. They are able to prove the essence of the complex of living, inanimate components of nature that are in causal interactions, and justify the totality of complex ecological systems in the biogeosphere. They also conduct studies of the structural components of biogeocenosis considering the forms of species coadaptation in different natural and geographical conditions using the skills of collaboration.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • understand the structure and methodology of biogeocenosis processes; • characterize the basic principles of the organization and functioning of biogeocenoses; • analyze the structural and functional organizations of biogeocenotic systems of various types; • evaluate production processes and efficiency of energy flow in food chains of biogeocenoses; • analyze the role of components of biogeocenoses as elementary environment-forming structural and functional blocks of the biosphere; • teach conducting safety-based research with phyto- and zoocenosis objects to determine the types and forms of coadaptations in different natural conditions, geographical location, and the impact of environmental factors.
Course title	Ecology of plants, animals and humans

Component	Subject component, Optional component
Cycle	Core disciplines
Module	Biopedagogy and environment 9 academic credits
Academic credits	4
Prerequisites	Structure and functions of plant organisms, Structure and functions of animals 1,2
Post-requisites	no
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1, 3) • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (10) <p>The discipline of plant, animal and human ecology is associated with the disciplines of ecology, botany, zoology, and human anatomy. Pre-service teachers analyze the fundamental concepts of the organism and biological diversity in nature, as well as biogeocenosis as special levels of organization of life. Pre-service teachers evaluate the relationship of organisms and the environment considering the characteristics of the structure and vital activity of organisms in various environmental conditions of the Earth. They teach planning and monitoring of biological objects and the state of their own body under the influence of environmental factors. They also assess the consequences of anthropogenic activities in relation to the natural environment and the health of other people.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • determine the type of interaction of different species in the ecosystem and the features of the structure of cells, tissues, organs, organ systems in accordance with the effects of environmental factors and anthropogenic impact; • understand the importance of the activity of living organisms in the circulation of ecosystem substances in human life and economy; • identify essential features of biological objects and processes and compare them; • identify the variability of living organisms under anthropogenic influences and environmental factors; • teach safe research to study the adaptations of organisms to the environment and explain their meanings.

Course title	Bioresources of Kazakhstan
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Biopedagogy and environment 9 academic credits

Academic credits	5
Prerequisites	Structure and functions of plant organisms, <i>Structure and functions of animals 1</i>
Post-requisites	Genetics and the basis of breeding, Molecular Biology
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1, 3) • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (8) <p>Bioresources of Kazakhstan are interconnected with biology, geography and ecology. Pre-service teachers understand the geographical distribution and placement of living organisms and their communities on the territory of Kazakhstan. They determine the most important patterns of the structure and dynamics of the flora and fauna in certain regions. They also compare the main stages of the history and economic development of certain groups and species of useful plants and animals in the Republic of Kazakhstan. Pre-service teachers distinguish the locations of specially protected natural areas of Kazakhstan and assess the role of the state and society in the conservation of landscape and biological diversity.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • systematize the position of the main types of biological resources; • list biological resources on the territory of the Republic of Kazakhstan; • specify categories and criteria of endangered species of biological resources; • determine the importance of the environment in increasing the productivity of Kazakhstan's bioresources; • present modern conceptual approaches to the problem of conservation of biological diversity of Kazakhstan; • name the main ways to increase the productivity of biological resources; • teach the assessment of the role of specially protected natural territories of the Republic of Kazakhstan in preserving and increasing the productivity of biodiversity.

Course title	Flora and fauna of the world
Component	Subject component, Optional component
Cycle	Core disciplines
Module	Biopedagogy and environment 9 academic credits
Academic credits	5
Prerequisites	Structure and functions of plant organisms, Structure and functions of animals 1

Post-requisites	Genetics and the basis of breeding, Molecular Biology
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (1, 3) • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (8) <p>The flora and fauna of the world are integrated with botany, zoology, geography, and ecology. Pre-service teachers have knowledge of the biological diversity of flora and fauna in different habitats of the Earth, according to faunal and floral zoning. Pre-service teachers distinguish and evaluate faunal and floral kingdoms. Identify the processes of speciation and the state of species and subspecies of flora and fauna at the global level. Substantiate measures to preserve the natural habitat of plants and animals and propose measures to protect them from overexploitation by humans.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • describe the main faunal complexes: tundra, taiga, forest, steppe, semi-desert, desert, pantropical, paleotropical, and faunal zoning; • separate types of fauna: mainland, island, marine; • identify zoogeographic regions and kingdoms and floristic complexes; • characterize the endangered species of flora and fauna and to focus on the scale and importance of endangered flora and fauna. • train in planning and organizing activities aimed at protecting existing species, including endangered and endemic plant and animal species.

Course title	Environmental Chemistry
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Applied and Integrated Sciences 26 academic credits
Academic credits	5
Prerequisites	Structure and functions of plant organisms, structure and functions of animals 1,2
Post-requisites	Biochemistry
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (2) • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (11) <p>This course is aimed at acquiring knowledge about the basic principles of environmental chemistry and their actions on a local and global scale. During the course, pre-service teachers discuss and predict the effects of</p>

	pollution on the environment, and use knowledge in physics, chemistry, Earth sciences and biology to scientifically substantiate the processes occurring in the environment. Pre-service teachers analyze the main physical and chemical processes taking place with the participation of pollutants in the atmosphere, hydrosphere and soil. They form a civic position and are responsible for their decisions and actions in the context of Sustainable Development.
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • describe the properties of simple and complex substances and the patterns of chemical processes; • apply basic physico-chemical and chemical methods of analysis in professional activity; • conduct chemical and biological experiments and use the results in teaching students; • argue the role of the development of natural science knowledge in solving the problems of modern society; • form students' environmental literacy through the integration of basic knowledge in the field of physics, chemistry, Earth sciences and biology in search of solutions to global and local environmental problems; • document information sources using the accepted citation style; • predict possible ways of migration and transformation of chemical compounds in environmental objects and their impact on ecosystems; • evaluate anthropogenic changes in environmental objects.
Course title	Theoretical foundations of inorganic chemistry
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Applied and Integrated Sciences 26 academic credits
Academic credits	5
Prerequisites	Structure and functions of plant organisms, structure and functions of animals 1,2
Post-requisites	Biochemistry
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (2) • Competence area for Development of practical and research skills (6) • Competence area for Interdisciplinary interactions development (11) <p>The course forms pre-service teachers' knowledge of the basic concepts and laws of chemistry, the basics of atomic and molecular theory, the structure of matter, the Periodic law, chemical bonding, laws of the chemical process, the doctrine of solutions, exchange reactions in electrolyte solutions, and redox reactions. Pre-service teachers investigate the basics of chemical thermodynamics, kinetic principles of describing chemical reactions, methods</p>

	and mechanisms of their acceleration, the doctrine of chemical equilibrium and methods of its displacement, the basics of the theory of solutions, and elements of electrochemistry. The course is practice-oriented: all concepts, laws, and theories, as well as the most important processes, substances and materials are introduced in terms of their practical significance and use in everyday life as well as their role in living and inanimate nature.
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • predict the possibilities of chemical processes and the factors affecting the equilibrium of chemical reactions and determine the direction of the process under these conditions; • classify reactions occurring in aqueous solutions and offer optimal conditions for conducting reversible reactions; • compare the thermodynamic, and redox activity of substances; • apply the academic language of chemical concepts and terms; • formulate the basic laws of chemistry with reasoned judgments; • understand the properties of substances and the mechanism of chemical processes and discuss chemical phenomena with a thermal effect occurring in nature, in a living organism; • apply the acquired theoretical knowledge and skills with general scientific and special disciplines in their teaching activities; • teach conducting experiments using elementary methods of chemical research of substances and compounds for the formation of research skills; • collect, process and interpret research data.
Course title	Biochemistry
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Applied and Integrated Sciences 26 academic credits
Academic credits	5
Prerequisites	Environmental Chemistry
Post-requisites	Evolutionary teaching
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (2) • Competence area for Development of practical and research skills (5, 6) • Competence area for Interdisciplinary interactions development (9) <p>Biochemistry is an integrated discipline and covers a number of natural science disciplines, including chemistry, genetics, microbiology, forensic science, crop production, and medicine. Pre-service teachers investigate chemical processes in living organisms occurring at the molecular level. They determine the causal relationships between the structure of the molecule and its function allowing them to predict the mechanisms of interaction of</p>

	<p>molecules by analyzing the structure and properties of proteins, nucleic acids, fats, carbohydrates, as well as cellular organelles. Pre-service teachers also consider the processes of cell interaction during growth or disease control and explore the achievements of science in the field of biochemistry. Pre-service teachers plan and conduct research to determine the influence of various factors (temperature, pH, substrate concentration on enzyme activity).</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • understand the structure and functions of bioorganic substances in living organisms; • establish causal relationships between the metabolism in a living organism and the biochemical functions of cellular organelles; • draw conclusions on the relationship between the structures of bioorganic molecules and their function in living organisms; • determine the ways of transformation of nutrients; • compare the features of the course of biochemical reactions in the human body, animals and plants, such as the biosynthesis of vital compounds; • apply chemical knowledge and methods in their teaching activities; • give a scientific justification of the proposed assumption (formulation of the hypothesis) and design an experiment to determine the influence of various factors (temperature, pH, substrate concentration on enzyme activity); • conduct a safe experiment to investigate the chemical structure, properties and function of carbohydrates, fats, proteins and nucleic acids; • collect, process and interpret research data; • document reliable sources of information used following the established (selected) citation system (ARA style or others.); • evaluate the strengths and weaknesses of the study, such as the limitations of data and the sources of errors and inaccuracies of the experiment; • formulate a reasoned and detailed conclusion on the research topic and make a structured and clear report on all stages of the study; • use scientific language, subject terminology and conventions appropriately and correctly.
Course title	Bioorganic chemistry
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Applied and Integrated Sciences 26 academic credits
Academic credits	5
Prerequisites	Environmental Chemistry
Post-requisites	Evolutionary teaching

Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (2) • Competence area for Development of practical and research skills (5, 6, 7) • Competence area for Interdisciplinary interactions development (8, 9, 13) <p>During the course, pre-service teachers examine the issues and problems of bioorganic chemistry and develop their skills in obtaining and identifying organic substances in a living organism. During lectures and laboratory classes, pre-service teachers analyze the relationship between the structure of organic substances and their biological functions, and conduct laboratory studies of the structure, properties and functions of biologically important natural (biopolymers, vitamins, hormones, antibiotics) and synthetic compounds (drugs, pesticides, etc.). Pre-service teachers practice skills in working with devices and materials and choose ways and methods of conducting individual and group research. They solve creative tasks and offer new non-standard solutions to problems. They also demonstrate practical application of the results of a biological experiment for their professional development, and evaluate experimental and calculated data, as well as prepare research reports and pass an exam.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • classify organic compounds by nomenclature when composing names and writing formulas of biologically active substances; • conduct experiments to study the chemical structure and properties of biologically important substances; • demonstrate the skills of conducting a biological experiment using chemical, physical, physico-chemical, mathematical and biological methods; • evaluate the importance of biopolymers, enzymes, hormones, vitamins, signaling substances, antibiotics, and others in the vital activity of living organisms; • conduct small projects: formulation of hypotheses and conclusions, planning, assessment of strengths and weaknesses, preparation of a report; • collect, process and interpret research data on design and laboratory work; • use scientific language, subject terminology and conventions appropriately; • offer creative non-standard solutions to problems in the field of bioorganic chemistry; • apply the results of biological research for their professional development; • organize project activities of students to develop their interdisciplinary and research competencies.
Course title	Biophysics and bioinformatics
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Applied and Integrated Sciences 26 academic credits

Academic credits	6
Prerequisites	Methodology of biological research
Post-requisites	STEM education in biology
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (2) • Competence area for Development of practical and research skills (5, 7) • Competence area for Interdisciplinary interactions development (9, 10, 11) <p>The course focuses on the use of theoretical knowledge and practical skills in biology in integration with physics and computer science, applying basic knowledge in the field of molecular biology and genomics, as well as the basics of statistics and mathematics. During lectures, practical and laboratory classes, pre-service teachers analyze the impact of natural phenomena (photobiological, electrical, sound, etc.) on living organisms, the principles of structured bioinformatics to reveal the essence of biological phenomena, a database search algorithm (BLAST), and the basics of gene mapping. During the course, pre-service teachers develop their interdisciplinary competencies (BTEAM) to solve creative tasks as well as their practical skills in biological physics in solving problems of biomedicine, and biomechanics. The course promotes the development of pre-service teachers' practical skills in working with databases of biological data (DNA, RNA, proteins), and modeling biological processes. Pre-service teachers can write a good scientific report and use biophysical and bioinformatic methods to solve research issues, working independently and in groups. At the end of the course, pre-service teachers defend the project and the scientific report, and pass the exam.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • describe the application of biomechanical processes in robotics and medicine; • analyze the physical foundations of the study of heart automatics using an electrocardiogram, the functioning of muscle tissue (electrophysiology); • evaluate the thermodynamic feature of biological systems and electrical processes in living organisms, problems of stability and evolution of biological systems; • investigate the effects of electromagnetic and sound waves on the organism of living beings; • simulate photobiological processes, ultrastructure of the cell and cell membrane, etc.; • explain how information is transferred from genes to proteins in living organisms; • describe the technology of the neurocomputer interface, the system of information exchange between the brain and the computer; • apply modern methods of obtaining, analyzing, storing, organizing and visualizing biological data; • evaluate the advantages and disadvantages of using computer systems and tools for solving biological problems;

	<ul style="list-style-type: none"> • use of the most important databases and software (for example, OMIM, PubMed, UniProt, Cosmic, BioMart) for the extraction, analysis and interpretation of data at the level of DNA, RNA and protein; • perform BLAST-search, alignment of DNA and protein sequences; • critically interpret the results, visualize the protein and evaluate the differences created by sequence variations; • create computer modeling of the genome (gene mapping), and phylogenetic trees on databases of biodata.
Course title	Scientific foundations of natural science
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Applied and Integrated Sciences 26 academic credits
Academic credits	6
Prerequisites	Methodology of biological research
Post-requisites	STEM education in biology
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (2) • Competence area for Development of practical and research skills (5) • Competence area for Interdisciplinary interactions development (9) <p>The course forms pre-service teachers' knowledge about the modern natural-scientific world view and the methods of natural sciences. They also develop their skills in applying the acquired knowledge to explain the phenomena of the surrounding world, and the perception of natural-scientific information.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • understand the natural science method of cognition, the main ideas and achievements of natural science, determining influence on the development of technology; • navigate modern scientific concepts and information of natural science; • understand the applied significance of the most important achievements in the field of natural sciences; • critically analyze the phenomena, perception and interpretation of natural science; • apply natural science knowledge in their professional activities.
Course title	Biometrics
Component	Subject component, Optional component

Cycle	Major disciplines
Module	Applied and Integrated Sciences 26 academic credits
Academic credits	5
Prerequisites	Genetics and the basis of breeding
Post-requisites	Ecology of plants, animals and humans
Course Description/ competencies	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (2) • Competence area for Development of practical and research skills (7) • Competence area for Interdisciplinary interactions development (11) <p>Pre-service teachers have basic knowledge in the field of mathematics and natural sciences and apply methods of mathematical analysis and modeling, as well as theoretical and experimental research in the field of biology. During the course, pre-service teachers acquire the basics of practical knowledge and skills in the field of biometrics understanding its relationship with other sciences.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • use the knowledge of mathematical statistics, the principle and various methods of analysis in professional activity; • apply statistical processing methods in practice; • identify trends in the patterns of the studied objects; • perform correct statistical processing of experimental data; • organize experimental work and analyze the observations and the results of the experiments; • work with biological objects in natural and laboratory conditions; • make reports, reviews, analytical maps and explanatory notes; • present and critically analyze the information received to present the results of field and laboratory biological studies.
Course title	Experimental biology
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Applied and Integrated Sciences 26 academic credits
Academic credits	5
Prerequisites	Genetics and the basis of breeding
Post-requisites	Ecology of plants, animals and humans
Course Description/ competencies	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Development of practical and research skills (7) • Competence area for Interdisciplinary interactions development (11) <p>Pre-service teachers analyze the principles and structure of the organization of a scientific activity, the methodology of scientific knowledge, and the methods of setting goals and objectives for the scientific research. The discipline is aimed at developing pre-service teachers' skills in conducting experimental research, as well as processing and analyzing the results.</p>

Learning outcomes	Pre-service teachers demonstrating competence can: <ul style="list-style-type: none"> • apply scientific methods in their professional activity; • understand and solve problems in new or unfamiliar situations in contexts and within broader (or interdisciplinary) fields related to the field being studied; • adapt modern scientific achievements to their educational process; • collect, process and interpret research data; • formalize the research results into various forms of scientific products; • conduct a scientific discussion using the evidence based on the results of theoretical and experimental research.
Course title	Microbiology with the basics of biotechnology
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Applied and Integrated Sciences 26 academic credits
Academic credits	5
Prerequisites	Bioresources of Kazakhstan
Post-requisites	Research, Development, and Innovation
Course Description/ competencies	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (2) • Competence area for Development of practical and research skills (5, 6, 7) • Competence area for Interdisciplinary interactions development (9, 11, 13) <p>During the course, pre-service teachers examine morphology, physiology, biochemistry, genetics and systematics of microorganisms. They also investigate the principles of using bacterial, yeast, animal and plant cell cultures, metabolism and biosynthetic capabilities in genetic engineering and biotechnological production by using knowledge of chemistry and physics. After the course, pre-service teachers have a good basic knowledge of the prospects for the development of biotechnology: the methods of obtaining recombinant DNA and DNA cloning, the use of plasmids, the stages of microclonal reproduction, and the use of enzymes in various fields. The knowledge gained serves as the basis not only for individual laboratory work and small group studies in microbiology and biotechnology, but also for all other research in biology. Completion of the course includes a report on laboratory work and an exam.</p>
Learning outcomes	Pre-service teachers who demonstrate competence can: <ul style="list-style-type: none"> • compare morpho-physiology, biochemistry, genetics of microorganisms with the use of modern molecular genetic methods; • use disinfection and sterilization methods when working with biotechnological objects, and preparing nutrient media and coloring by using the Gram method to identify microorganisms; • check the parameters of growth and development of microbial cultures, and correctly identify microorganisms by cultural and morphological characteristics;

	<ul style="list-style-type: none"> • evaluate the use of living organisms in biotechnological production: production of microbial protein, enzyme preparation, biogas, bioethanol; • practice the skills of cultivation and cloning of living organisms, experimentation of microclonal reproduction, microscopy of preparations of cells of living organisms; • analyze the ethical issues of the use of GMOs, the principles of genetic engineering manipulations, and the importance of molecular genetic approaches in taxonomy, medicine and criminology; • investigate the influence of various factors (temperature, pH, nutrient content) on the growth and development of microorganisms, the use of enzymes (pectinase, protease, etc.), the influence of antiseptic and disinfectants; • design experiments for obtaining a cumulative and pure culture of microorganisms, obtaining callus tissues by microclonal reproduction; • conduct a safe experiment to study the microflora of water, air, and dairy products; • organize small projects: formulation of hypotheses and conclusions, planning, assessment of strengths and weaknesses, preparation of a report; • collect, process and interpret research data on design and laboratory work; use scientific language, subject terminology and conventions appropriately.
Course title	Applied biology with the basics of soil science
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Applied and Integrated Sciences 26 academic credits
Academic credits	5
Prerequisites	Bioresources of Kazakhstan
Post-requisites	Research, Development, and Innovation
Course Description/ competencies	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for Cognitive skills development (2) • Competence area for Development of practical and research skills (5, 6, 7) • Competence area for Interdisciplinary interactions development (9, 11, 13) <p>During the course, pre-service teachers examine the topics of soil science, agrochemistry, and crop production: the process of soil formation, soil morphology, structure and properties of soil, tillage, chemistry of agriculture, and cultivated plants. The course consists of lectures and laboratory classes, during which pre-service teachers develop their skills in working with laboratory equipment, materials, tools in the organization of educational and research activities. They also develop their interdisciplinary competencies during laboratory work and small scientific projects. Pre-service teachers critically choose the methods and techniques of research, academically conduct and evaluate experimental and calculated data, prepare research reports and pass the exam.</p>

Learning outcomes	Pre-service teachers who demonstrate competence can: <ul style="list-style-type: none"> • classify soil by mechanical composition; • analyze the relationship of soil science with biological, chemical and other sciences; • conduct safe experiments to study the influence of various factors on soil formation, the influence of living organisms on soil formation; • identify morphological, biological and economic features of cultivated plants; • assess the soil-ecological and bioecological condition of the territory of Kazakhstan; • practice the skills of cultivating soil microorganisms, microscoping preparations of cells of living organisms; • design experiments to determine the composition and properties of the soil (physical, physico-mechanical, rheological); • investigate the use of organic and mineral fertilizers in crop production; • plan and carry out projects: formulation of hypotheses and conclusions, assessment of strengths and weaknesses, preparation of a report; • collect, process and interpret research data on design and laboratory work; use scientific language, subject terminology and conventions appropriately.
Course title	STEM education in biology
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Research in Biology 20 academic credits
Academic credits	5
Prerequisites	Assessment and development
Post-requisites	Ecology of plants, animals and humans
Course Description/ competencies	<p>The purpose of this course is to improve the following areas of pedagogical and subject competence:</p> <ul style="list-style-type: none"> • Competence area in Pedagogy and Didactics (1,2) • Competence area for professional development (8,9) • Conceptual and theoretical knowledge competences (3) • Competences in conducting scientific research (7,8) • Competences in the science application (10, 13) <p>During the course, pre-service teachers practice pedagogical methods and technologies based on the activation and intensification of students' educational activities, diagnostics, and assessment in biology teaching using STEM approach. Pre-service teachers master the subject content through projects in which scientific knowledge and design, information technology and mathematical calculations are naturally integrated. Pre-service teachers explore the methodology of the organization of STEM learning, discuss the stages, apply various research methods in the practice of teaching STEM learning, and design STEM research. Pre-service teachers form their skills in integrating research into teaching practice in various types of learning environments.</p>
Learning outcomes	Pre-service teachers who demonstrate competence can:

	<ul style="list-style-type: none"> • carry out the selection of pedagogical STEM–learning technologies and effectively implement them in the practice of teaching school academic disciplines in the classroom and in extracurricular activities; • design STEM learning, considering the diversity of students; • apply various methods and technologies of pedagogical diagnostics used in evaluation of the quality of results and content of the educational process; • perform consistent, planned actions to improve the practice of teaching and STEM learning; • develop their research skills, direct them to improve the quality of education and their functional literacy; • develop a plan for the implementation of research on the practice of teaching STEM learning; • conduct systematic evaluation of the results during STEM training; evaluate the strengths and weaknesses of STEM education.
Course title	Digital technologies in biology and artificial intelligence
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Research in Biology 20 academic credits
Academic credits	5
Prerequisites	Assessment and development
Post-requisites	Ecology of plants, animals and humans
Course Description/ competencies	<p>The purpose of this course is to improve the following areas of pedagogical and subject competence:</p> <ul style="list-style-type: none"> • Competence area in Pedagogy and Didactics (2) • Competence area for professional development (8,9) • Competences in conducting scientific research (7) • Competences in the science application (8,10, 12) <p>Pre-service teachers investigate the possibilities of using digital equipment and software in the educational process in biology, and plan effective ways of teaching using IT technologies, including in distance learning. They also create digital educational resources in biology.</p> <p>The course is aimed at studying modern methods of analyzing biological data using digital tools and artificial intelligence. As part of the course, students learn methods of applying AI to solve current issues in biology and ways of integrating digital technologies into the educational process.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • use various forms of interactive electronic educational content; • use IT technologies in the organization of project activities; • structure, integrate and present information in teaching activities, considering life and educational context of students; • plan effective teaching using IT technologies; • develop digital educational resources on biology.

Course title	Design of STEM education
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Research in Biology 20 academic credits
Academic credits	5
Prerequisites	Assessment and development
Post-requisites	Ecology of plants, animals and humans
Course Description/ competencies	<p>The purpose of this course is to improve the following areas of pedagogical and subject competence:</p> <ul style="list-style-type: none"> • Competence area in Pedagogy and Didactics (2) • Competence area for professional development (8,9) • Competences in conducting scientific research (7) • Competences in the science application (8,10, 12) <p>Pre-service teachers analyze the design features of STEM learning based on the applied nature of the real world challenges, learning through problem solving and critical thinking, and the integration of different content into the educational process. The course builds pre-service teachers' abilities to use new technological opportunities in biology, as well as to design and adapt STEM education considering the diversity of students.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • link science and STEM subjects with real life challenges or situations; • identify practice-oriented problem situations; • build project/phenomena-based learning processes in which students make observations, identify problems and find solutions independently and with their peers; • conduct experimental research with mathematical and IT modeling; design STEM lessons for students' academic and extracurricular activities in an inclusive environment.
Course title	Modern approaches to the organization of a biological experiment
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Research in Biology 20 academic credits
Academic credits	5
Prerequisites	Structure and functions of plant organisms
Post-requisites	Ecology of plants, animals and humans
Course Description/ competencies	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competences in conducting scientific research (4,6) • Competences in the science application (10, 12)

	<p>Pre-service teachers analyze modern approaches to the organization of experiments in the field of biological sciences, the stages of conducting and the aspects of organizing and planning of experiments, the methods of data processing, and the ways of presenting the results. Special emphasis is placed on molecular genetic approaches to the organization of experiments. The course is aimed at developing pre-service teachers' skills in conducting biological experiments by using modern approaches and experiments in their professional and research activities.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • apply modern approaches to the organization of biological experiments and apply them in their professional and research activities; • work with scientific and laboratory equipment, use them during biological experiments; • determine and formulate a research hypothesis, draw up an experiment plan, select methods, and on the basis of this conduct theoretical and applied research in the field of biology; <p>organize and conduct experimental work with biological objects, processing and presenting the results of this work.</p>
Course title	Methodology of biological research
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Research in Biology 20 academic credits
Academic credits	5
Prerequisites	Structure and functions of plant organisms
Post-requisites	Ecology of plants, animals and humans
Course Description/ competencies	<p>The purpose of this course is to improve the following areas of pedagogical and subject competence:</p> <ul style="list-style-type: none"> • Competence area in Pedagogy and Didactics (2) • Competences in conducting scientific research (4,5,7) • Competences in the science application (8,11, 12) <p>Pre-service teachers analyze the methodology of organizing scientific research in the field of biology, the stages of research, the variety of research methods in biology, the methods of processing data, and the ways of presenting the results. The course is aimed at developing pre-service teachers' skills in working with scientific equipment and conducting theoretical and applied research.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • use methods of conducting biological research in their professional and research activities; • work with scientific and laboratory equipment, use them during research; • determine and formulate a research hypothesis, draw up an experiment plan, select methods, and on the basis of this conduct theoretical and applied research in the field of biology; • organize and conduct experimental work with biological objects, processing and presenting the results of this work;

	teach research methods in various types of learning environments.
Course title	Research and project activities in biological education
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Research in Biology 20 academic credits
Academic credits	5
Prerequisites	Structure and functions of plant organisms
Post-requisites	Ecology of plants, animals and humans
Course Description/competencies	<p>The purpose of this course is to improve the following areas of pedagogical and subject competence:</p> <ul style="list-style-type: none"> • Competence area in Pedagogy and Didactics (2) • Competence area for interaction (3,4) • Competence area for professional development (8,9) • Competences in conducting scientific research (4,7) • Competences in the science application (8,11, 12) <p>Pre-service teachers analyze the methodology of project activity in education, the method of projects in a modern school, the practice of educational design, the organization and stages of project activity of students, as well as the collaboration between a teacher and students. The discipline is aimed at developing pre-service teachers' skills within the framework of research and project activities.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • set goals and define tasks in the organization of scientific and project research; • carry out information-analytical and information-bibliographic work with the involvement of modern information technologies; • creatively find solutions for new problems and situations; • mentor students during research project; competently
Course title	Academic letter
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Research in Biology 20 academic credits
Academic credits	5
Prerequisites	Modern approaches to the organization of a biological experiment
Post-requisites	Ecology of plants, animals and humans

Course Description/competencies	<p>The purpose of this course is to improve the following areas of pedagogical and subject competence:</p> <ul style="list-style-type: none"> • Competence area for interaction (3,4) • Competences in conducting scientific research (4,7) <p>Pre-service teachers analyze the features of academic writing, and the ways of correct writing and execution of written types of work in accordance with the principles of academic integrity. The discipline is aimed at the formation of pre-service teachers' writing skills, as well as skills in designing all types of written works in accordance with existing requirements.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • use the knowledge gained within the discipline for writing, registration of all types of written works, in accordance with the requirements; • work with databases of scientific publications, bibliographic sources, and make references to the sources; • use citations correctly in compliance with the referencing system at use; present information to the audience, interact with the audience, and competently build communication based on the goals and situation of communication.
Course title	Content-language integrated learning in biology
Component	Subject component, Optional component
Cycle	Major disciplines
Module	Research in Biology 20 academic credits
Academic credits	5
Prerequisites	Modern approaches to the organization of a biological experiment
Post-requisites	Ecology of plants, animals and humans
Course Description/competencies	<p>The purpose of this course is to improve the following areas of pedagogical and subject competence:</p> <ul style="list-style-type: none"> • Competence area in Pedagogy and Didactics (1) • Competence area for interaction (5) • Competence area for professional development (8,9) • Conceptual-theoretical knowledge competencies (2). • Competences in conducting scientific research (7) • Competences in the science application (8,12, 13) <p>Pre-service teachers explore the basic approaches, techniques and forms used in content-language integrated learning (CLIL) in biology. During the course, pre-service teachers acquire knowledge of biology, while improving their foreign language knowledge and skills.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • identify language problems of students; • use communicative and interactive tasks that contribute to a better understanding of biology studied in a foreign language; • apply error correction strategies that encourage the correct use of a spoken foreign language; • use activities in the classroom that contribute to both studying biology and developing foreign language skills;

	<ul style="list-style-type: none">• use authentic educational material.
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