Kazakh Humanitarian Juridical Innovative University

Department of Information and Technology and Economics

Economy and Management Department

6V01509 - CHEMISTRY- BIOLOGY

THE CATALOGUE OF ELECTIVE SUBJECTS

Year of entrance - 2020

Semey, 2020 y.,

№	Name of discipline or module	Number of credits	Pre requi-sites	Post requi-sites	Short description of the content, the aims of education, expected results
GENERAL EDUCATIONAL DISCIPLINES					
Elective courses (EC)					
Module of economic and legal knowledge					
1	**Basics of a Market Economy and Entrepreneurship**	3	School course basics of entrepreneurship and business	-	The purpose of teaching this discipline is the formation of systemic economic thinking to understand the logic of the economic laws of society, processes and phenomena that occur at all levels, with the possibility of applying knowledge in practice in any situation and in any economic system. Mastering the skills of the scientific and practical foundations of the organization of entrepreneurial activity, the methods of its planning and implementation in modern market conditions. **Content:** consideration of the institution of entrepreneurship; mastering the economic skills of organizing entrepreneurial activities and evaluating its effectiveness; definition and use of state mechanisms of regulation and support of entrepreneurship. The study of processes, phenomena of the economic life of society; the development of methods, methods, principles, approaches for the study of economic processes; **Learning Outcome:** Know: the functions of money, the reasons for the differences in the level of remuneration; main types of taxes; organizational and legal forms of entrepreneurship; types of securities; economic growth factors; current state of the theory and practice of entrepreneurial activity; specifics of entrepreneurial activity; To be able to: give examples of factors of production and factor income, public goods, Kazakhstani enterprises of various organizational forms, global economic problems; describe the effect of the market mechanism, the main forms of wages and labor incentives, inflation, the main articles of the state budget of Kazakhstan, economic growth, use the basic terminology of modern entrepreneurship; use methods of entrepreneurial activity; Skills: obtaining and evaluating economic information; drawing up a family budget; assessment of their own economic activities as a consumer, family member and citizen.
	Fundamentais of law and anti-corruption	2	School course basics of law	-	**Aim.**Studying the course and introducing students to the system of knowledge on combating corruption and developing a civil position on this basis in relation to this phenomenon. **Content**. The main concepts and essence of legal relations, as well as legal mechanisms for regulating legal relations, the procedure for applying liability in legal relations. The essence of corruption and the reasons for its origin; measures of moral and legal responsibility for corruption offenses; current legislation in the field of anti-corruption. **The expected results of the study: to know:** basics and essence of corruption offences; the system and the legislative framework for combating corruption; the role of States and values and their legislative protection; development and peculiarities of branches of law in social relations; the question of responsibility and penalties for corruption; the application of the law and their application; General principles of the Constitution; the main provisions of current legislation of Kazakhstan; the system of state bodies and their powers; the mechanism between substantive and procedural law; be able to correctly assess the behavior of one's own or another person in a specific life situation, choose the right way to protect them in case of violation of their rights, and correctly analyze them when working with regulatory legal acts in the field of public administration. The student must have basic legal concepts and legal institutions, General theoretical knowledge; be able to: analyze events and actions from the point of view of the

					sphere of legal regulation and refer to the necessary regulations; apply the current legislation; enjoy the right to their own rights and interests. Skills: conducting discussions on legal issues, on the application of norms at the present stage, legal analysis of various documents. The student must be able to correctly analyze the acquired knowledge and normative legal acts, determine its main concepts; the student must be able to apply the acquired knowledge in practice and form experience in working with the main normative legal acts in this area, skills of respect, observance of rights and freedoms inherent in the legal culture.
Module of economic and natural knowledge					
2	**Basics of a Market Economy and Entrepreneurship**	3	School course basics of entrepreneurship and business	-	The purpose of teaching this discipline is the formation of systemic economic thinking to understand the logic of the economic laws of society, processes and phenomena that occur at all levels, with the possibility of applying knowledge in practice in any situation and in any economic system. Mastering the skills of the scientific and practical foundations of the organization of entrepreneurial activity, the methods of its planning and implementation in modern market conditions. **Content:** consideration of the institution of entrepreneurship; mastering the economic skills of organizing entrepreneurial activities and evaluating its effectiveness; definition and use of state mechanisms of regulation and support of entrepreneurship. The study of processes, phenomena of the economic life of society; the development of methods, methods, principles, approaches for the study of economic processes; **Learning Outcome:** Know: the functions of money, the reasons for the differences in the level of remuneration; main types of taxes; organizational and legal forms of entrepreneurship; types of securities; economic growth factors; current state of the theory and practice of entrepreneurial activity; specifics of entrepreneurial activity; To be able to: give examples of factors of production and factor income, public goods, Kazakhstani enterprises of various organizational forms, global economic problems; describe the effect of the market mechanism, the main forms of wages and labor incentives, inflation, the main articles of the state budget of Kazakhstan, economic growth, use the basic terminology of modern entrepren eurship; use methods of entrepreneurial activity; Skills: obtaining and evaluating economic information; drawing up a family budget; assessment of their own economic activities as a consumer, family member and citizen.
	Basics of life safely and ecology	2	School course of primary military and technological training	-	**Aim.** To form ideas about the safety of life in human life and the possibility of regulating the processes of mutual influence of the environment and man. **Content.** The study of the basic concepts of life safety, ecology, problems of modern civilization and the environmental consequences of economic and other human activities in the intensification of environmental management, emergencies, civil defense. Disclosure of principles and methods of protection of the population from various environmental factors, legislative and legal acts in the field of bzh. Preservation of the environment and biological resources **Expected results:** students must know: legislative framework of safety and environmental control, as well as methods for identification, eliminating the influence of harmful factors on human beings and the environment, and ensure comfortable conditions for life and human activities; to be able: to systematize safety standards for use in professional activity; to choose methods of protection against hazards in relation to their professional activities and select methods for providing comfortable living conditions; to own skills of life safety in production conditions and in emergency situations, skills of first aid.
Basic disciplines					
Elective courses (EC)-					
1	**Cytology and Histology**	3	The school course of biology	Anatomy and morphology of plants	**Aim.** To form students ' ideas about the methods of research of cells and tissues of plants and animals, cell organoids and their structure, classification, structure and function of tissues. **Content.** This discipline examines the basics of cytology and histology, cell research methods, chemical structure of cells, especially the structure of prokaryotic cells and eukaryotes: cytoplasm, plasma membrane, cytoplasmic organoids, the structure of the cell nucleus, as well as protein biosynthesis, epithelial and connective tissues, muscle tissue, nervous system tissue, histogenesis and methods of preparation of fixed preparations of cells and tissues. **Expected results:** the student should be able to: in practical classes with the help

					of microscopes to consider cytological and histological preparations, as well as students should independently work with microscopes, drawings depicting the morphology, physiology of cells and tissue systems; demonstrate knowledge and ability to compare the structure, structure, components, functions, development, properties, inheritance and change of signs and the use of various prokaryotic and eukaryotic cells, tissues and extracellular structures; to apply theoretical knowledge and skills in the use of laboratory equipment for solving practical problems and experimental studies; as a result of studying discipline the student should learn: the methodology for preparation of cytological, histological products; material on cell types and the basic types of tissue preparations on microscope and execution of drawings and diagrams in albums; apply theoretical knowledge; as a result of studying of the course the student should know the following types of laboratory tests: the basic principles of the theory of cells; methods of research of cells and tissues; structure and functions of cells and organoids of cells; differentiation and mechanisms of cellular distribution; methods of studying the structure, classification of tissues in the body.
1	**Cell and tissue biology**	3	The school course of biology	Botany	**Aim.** To equip the future specialist with modern ideas about the most promising areas of development of cell and tissue biology in the world, to show its relationship with the achievements in the field of cell and tissue biotechnology, molecular biology, cell and molecular Biophysics, biochemistry, molecular genetics, Microbiology, molecular immunology and bioinformatics. **Content.** This discipline examines the theoretical foundations and objects of cell and tissue biology, especially the structure of plant, animal, fungal and prokaryotic cells, plant culture, animal cells and their use, the biology of cultured cells, protoplast as an object of biological design, somatic hybridization, cell biology of microbiological systems., cellular, tissue and genetic engineering. **Expected results**: student must know: theoretical bases of cell and tissue biology, objects of cell and tissue biology, structure of plant, animal, fungal and prokaryotic cells, plant and animal cells, their cultures, using cultures of plant and animal cells, biology of cultured plant cells, cellular, tissue and genetic engineering; should be able to: critically analyze experiments, to conduct bibliographic search of the literature, issue literature data; demonstrate knowledge and ability to compare the structure, structure, constituent components, functions, development, properties, inheritance and change of signs and use of various prokaryotic and eukaryotic cells, tissues and extracellular structures; apply theoretical knowledge and skills in the use of measuring instruments, laboratory equipment, methods of studying various objects of the environment for practical purposes and in experimental studies; must possess: skills in the use of microscopes, preparation of cellular and histological preparations.
2	**General and Molecular Genetics**	4	The school course of biology	Cell Biotechnology	**Aim.** To give students an idea about genetics, its problems, the current state and the latest achievements, as well as to develop students ' genetic thinking. **Content.** During the course study, the following content of the discipline is revealed: the subject, tasks of general and molecular genetics, history of development; the material basis of heredity, variability; structure, nucleic acids; reproduction types of organisms; mono-, di- and polybreeding; patterns of inheritance of characters; basics of genetic analysis; chromosomal theory of heredity; species, causes of variability of organisms; gene structure; current state of the problems of genetics. **Expected results:** student must know: the subject and tasks of General and molecular genetics, the history of its development; material basis of heredity and variation, structure and types of nucleic acids, the realization of genetic information, types of reproduction of organisms, patterns of inheritance, the basis of genetic analysis, chromosome theory of heredity, the types and causes of variability of organisms, the fine structure of the gene, the main molecular-cellular mechanisms, modern problems of genetics, management features heredity and variability of organisms; be able to: conduct a bibliographic search for literary sources; solve genetic problems on mono -, di - and polyhybrid crossing; competently conduct experiments on the study of heredity and variability; be able to apply the knowledge of genetics in practice; learn to use the studied techniques and methods of genetics for the needs of bio-technology; demonstrate knowledge and ability to compare the structure, structure, components, functions, development, properties, inheritance and change of signs of various prokaryotic and eukaryotic cells, tissues and extracellular structures; have skills: construction of the second DNA chain in accordance with the nucleotide composition of the first

					DNA chain; construction of mRNA in accordance with the nucleotide composition of one of the DNA chains; determination of the amino acid composition of proteins in accordance with the nucleotide composition of DNA or mRNA; construction of the Pennet lattice for solving genetic problems of inheritance of signs; use of the hybridological method of studying the laws of inheritance of signs; assessment of the contribution of genetic and external factors to the development of pathology with hereditary predisposition; determining the frequency of pathological genes and genotypes in the human population; compiling pedigrees, presenting them in a graphical form and analyzing the type of inheritance of a pathological trait; forecasting the development of hereditary disease in a carrier of a pathological gene or predicting the birth of a child with hereditary pathology.
2	**Genetics with the basics of breeding**	4	The school course of biology	Introduction to biotechnology	**Aim.** To study the material basis of heredity, variability, patterns of inheritance of traits, the relationship of the influence of genotype and environmental factors on the development of the organism, the basis of modern methods of genetics, genetic engineering, selection. **Content.** During the course study, the following content of the discipline is revealed: cell cycle, mitosis, meiosis, patterns of inheritance of traits and principles of heredity, variability, the influence of physical environmental factors on the mutation process, the genetic basis of ontogenesis, genetics of plant development, genetics populations, non-chromosomal inheritance, mutational variability, the influence of physical factors and chemical agents of the environment on the mutation process. **Expected results:** student must know: the material basis of heredity, variability and mechanisms of their implementation; the patterns of inheritance of traits; effects of genotype and environmental factors on the developing organism; be able to: apply the basic laws of heredity and patterns of inheritance of traits to the analysis of inheritance of normal and pathological features; analyze material from different sources; to calculate the frequency of alleles in populations of different species of plants and animals; to demonstrate knowledge and ability to compare structures, structure, components, functions, development, properties, inheritance and change of signs of various prokaryotic and eukaryotic cells, tissues and extracellular structures; to possess: skills of work with literature, including periodic scientific literature; methods of genetic, cytogenetic and population analysis of the phenomena of heredity and variability; skills of description of karyotypes of plants and animals.
3	**Microbiology and Virology**	5	The school course of biology	Room and Garden Floriculture	**Aim.** To acquaint students with the features of the structure, properties, classification and nomenclature of prokaryotes and microscopic eukaryotes. To show the General biological significance of achievements in the field of Microbiology and Virology, to highlight the role of microorganisms in the development of biotechnology, food industry, agriculture, metallurgy and other industries. **Content.** During the course the following content of the discipline is revealed: morphology, structure, physiology, reproduction, differentiation, growth, cultivation, cultural properties, genetics, selection of microorganisms, microbiological laboratory, microscope device, immersion system, coloring solutions, preparation of bacterial preparations, methods of staining, metabolism, nutrient media, role of microorganisms, properties, structure, chemical composition, architecture, reproduction, cultivation of viruses, bacteriophages, practical use of microorganisms. **Expected results:** the student should know: the main properties of microorganisms; their classification, role in nature and human life; the Kingdom of viruses, their use in the production of antiviral vaccines; biological features of microorganisms that cause spoilage of food products; be able to: use the literature in the field of Microbiology and Virology; demonstrate knowledge and ability to compare the structure, structure, components, functions, development, properties, inheritance and change of signs and the use of various prokaryotic and eukaryotic cells; to apply theoretical knowledge and skills in the use of measuring instruments, laboratory equipment, cytochemical, and biochemical methods to study various objects in the environment to solve practical problems and experimental studies; to possess: methods to identify members of microorganisms; the isolation of pure cultures of microorganisms and study of their biochemical properties methods of microbiological tests used for assessing the environmental objects.
3	**Soil Microbiol**	5	The school course	Ornamental garden-	**Aim.** Formation of knowledge, skills and abilities in General, soil and agricultural Microbiology, understanding the role of soil microorganisms in agroecological processes.

	ogy		of biol-ogy	ing with the basics of land-land-scape design	**Content**. During the course the following content of the discipline is revealed: morphology, taxonomy, nutrition of microorganisms. the spread of microorganisms in different substrates, the transformation by microorganisms of the compounds C, S, P, Fe, etc., the participation of microorganisms in the nitrogen cycle in nature, agro-ecological role of soil microorganisms, soil microorganisms in the formation and destruction of humus in land reclamation, the concept of humification. **Expected results**: the student should know: morphology, systematics, physiology and ecology of microorganisms, the role of microorganisms in the transformations of various compounds and chemical elements in the soil; be able to: determine the biological activity of the soil and propose ways to regulate it, use bioindication, biotests; demonstrate knowledge and ability to compare the structure, structure, components, functions, development, properties, inheritance and change of signs and the use of various prokaryotic and eukaryotic cells; apply theoretical knowledge and skills of using measuring instruments, laboratory equipment, cytochemical, biochemical methods of studying various objects of the environment to solve practical problems and in experimental studies; possess a culture of thinking, capable of generalization, analysis, perception of information, setting goals and choosing ways to achieve it; ready to cooperate with colleagues, work in a team.
4	**General and Inorganic Chemistry**	5	School chemis-try course	Analyt-ical chemis-try	**Aim.** Formation of the basic chemical worldview based on the study of the theoretical foundations of General and inorganic chemistry and the acquisition of skills in the chemical laboratory, namely: the formation of ideas about the fundamental concepts, laws of General and inorganic chemistry; the formation of knowledge about the mechanisms and General laws of chemical processes; the formation of practical skills for the application of knowledge in professional activities. **Content**. During the course study, the following content of the discipline is revealed: atomic molecular doctrine; basic laws of chemistry; fundamentals of chemical thermodynamics, chemical kinetics; the doctrine of chemical equilibrium; solutions; elements of electrochemistry; redox reactions; basic classes of inorganic compounds; the structure of the atom; periodic law and the Mendeleev system; chemical bond; nomenclature of simple substances and inorganic compounds; complex compounds. **Expected results:** student must know: bases of chemical thermodynamics, the kinetic basis of the description of chemical reactions, methods and mechanisms of their acceleration, the doctrine of chemical equilibrium and methods of its displacement, fundamentals of the theory of solutions, elements of electrochemistry; theoretical basis of inorganic chemistry; the laws of change of properties of simple substances and compounds within the groups and rows of the periodic system; methods and ways of synthesis of inorganic substances; the essence of modern physical and physicochemical methods of investigation are used in inorganic chemistry; to be able to: use knowledge and skills in the theory and practice of General and inorganic chemistry for the development of theoretical foundations and methods of research in the field of inorganic materials, based on thermodynamic and kinetic concepts to predict the possibility of occurrence of chemical processes, to offer optimal conditions of carrying out reversible reactions; to predict the possibility of occurrence of exchange reactions in electrolyte solutions; justify the process in the electrolysis; compare thermodynamic, redox activity of the compounds; to carry out experiments on synthesis and research of inorganic compounds; to possess: basic chemical laws, theories, regularities and chemical transformations for explanation and use in real chemical processes occurring in the educational process; to use computational methods to solve various chemical tasks of educational and scientific-laboratory character; to possess methods of safe use of chemical materials taking into account their physical and chemical properties.
4	**Chemistry of the elements of the periodic system**	5	School chemis-try course	Physico - chemi-cal meth-ods of analy-sis	**Aim.** To give students an idea of the current state and ways of development and the current state of the periodic law and the periodic system of chemical elements, to consider the most interesting and important problems related to the law of periodicity and systematics of chemical elements, including controversial and not solved definitively to date. **Content.** During the course study, the following content of the discipline is revealed: the periodic law and the classical system of chemical elements; stages of development of the doctrine of periodicity; the shape of the periodic law; the

					periodic system of elements, in the light of ideas about the structure of atoms; periodic table and teaching about chemical bonds; problems of the doctrine of periodicity at the present stage. **Expected results:** student must know: theoretical bases of inorganic chemistry; to know the methods of getting and chemical properties of the basic simple substances and compounds of elements; to know the physical meaning of the periodic law and the periodic system of traditional and international; to be able to explain the modern theory of frequency; be able to creatively analyze the theoretical concepts and factual material of inorganic chemistry; characterized in the historical development of the wording of the periodic law and the form of the periodic system of chemical elements; to be able to use reference and scientific and technical literature; to possess the basic chemical laws, theories, laws and chemical transformations for explanation and use in real chemical processes occurring in the educational process; to use computational methods to solve various chemical tasks of educational and scientific-laboratory character; to possess methods of safe use of chemical materials taking into account their physical and chemical properties.
5	**Analytical chemistry**	5	General and Inorganic Chemistry	Organic Chemistry	**Aim.** Students receive basic education in all aspects of modern analytical chemistry, developing on the basis of the fundamental laws of physics and chemistry, fundamental methods and techniques for establishing the qualitative and quantitative composition of various objects and ensuring the control of technological processes. **Content.** During the course study, the following content of the discipline is revealed: assessment of the reliability of analytical data, the law of action of the masses, redox reactions, complex formation in analytics, qualitative analysis, cations, anions, salt analysis, quantitative analysis, gravimetric analysis, titrimetric analysis, analysis of organic compounds, physico-chemical and optical methods of quantitative analysis; photometric, chromatographic, refractometric, electrochemical, potentiometric methods of analysis. **Expected results** the student should be able to: describe the mechanism of chemical reactions of quantitative and qualitative analysis; justify the choice of methods of analysis, reagents and chemical equipment for a specific task; prepare solutions of a given concentration; conduct quantitative and qualitative analysis in compliance with safety regulations; analyze mixtures of cations and anions; monitor and evaluate the flow of chemical processes; carry out calculations of the analysis results and assess the reliability of the results; must know: the aggregate state of the substance; analytical classification of ions; equipment and technique of analysis; value of chemical analysis, methods of qualitative and quantitative analysis of chemical compounds; periodicity of properties of elements; methods of expression of concentration of substances; theoretical bases of methods of analysis; theoretical bases of chemical and physico-chemical processes; technique of analysis; types of errors in the analysis; the device of the main laboratory equipment and rules of its operation; possess basic chemical laws, theories, laws and chemical transformations to explain and use in real chemical processes occurring in the educational process; use computational methods to solve various chemical tasks of educational and scientific-laboratory nature; possess methods of safe use of chemical materials, taking into account their physical and chemical properties.
5	**Physico-chemical methods of analysis**	5	Chemistry of the elements of the periodic system	Chemistry of high-molecular compounds	**Aim.**. Students gain knowledge about the methods of chemical and physico-chemical analysis, their theoretical foundations, as well as the acquisition of skills and abilities to make theoretical conclusions based on the observed phenomena. **Content.** During the course study, the following content of the discipline is revealed: the laws of thermodynamics, Hess's law, methods of calculating the thermal effects of chemical reactions, heat capacity, dependence of heat capacity on temperature, Kirchhoff's law, the second law of thermodynamics, the law of the masses, equilibrium, solutions, electrochemistry, electrolytes, kinetics of simple reactions, electrolysis, chemical kinetics, catalysis, disperse systems, calloid systems, surface tension, adsorption theories. **Expected results:** students should know: mastering the theoretical foundations and skills of physico-chemical analyses of the studies; the nature of laws and chemical processes underlying the method of analysis, techniques, definitions; to be able: to understand the processes of physical-chemical analyses; to use the methods of physicochemical analysis for the analysis and examination of various

					objects; a complex application of physical and chemical methods for different types of analysis; to make the scheme of analysis; to use calculation methods to solve various chemical tasks of educational and scientific-laboratory nature; to possess methods of safe use of chemical materials taking into account their physical and chemical properties; to possess: basic methods of chemistry of definitions and analysis of objects; theoretical bases of physical-chemical chemistry; to have an idea of possibilities and limitations of use of this or; possess basic chemical laws, theories, patterns and chemical transformations to explain and use in real chemical processes encountered in the educational process.
6	**Cell Biotechnology**	5	General and Molecular Genetics	Applied biology	**Aim.** To equip the future biotechnologist with modern ideas about the most promising directions of development of cell biotechnology in the world, to show its relationship with achievements in the field of molecular biology, cell and molecular Biophysics, biochemistry, molecular genetics, Microbiology, molecular immunology and bioinformatics. **Content.** The course reveals the following content of the discipline: a brief history and stages of development of cell biotechnology; theoretical foundations of cell biotechnology; genomics, proteomics and bioinformatics; objects of cell biotechnology; cells and subcellular macromolecular structures and their use; somatic hybridization; cell biotechnology of microbiological systems; application of cell biotechnology in eukaryotic systems; cell biotechnology in medicine. **Expected results:** the student should know about: subject, tasks of the history of development, objects, methods of cell biotechnology, trends in cell biotechnology in the modern world and its most promising areas, cell biotechnology of microbiological systems, genetic engineering of plants and animals, achievements of cell biotechnology in medicine, environmental aspects of biotechnology; be able to: critically analyze scientific experiments; to demonstrate knowledge and ability to compare structures, structure, components, functions, development, properties, inheritance and change of signs and use of various prokaryotic and eukaryotic cells, tissues and extracellular structures; to apply theoretical knowledge and skills of use of measuring devices, laboratory equipment, cytochemical, biochemical methods of studying of various objects of environment for the solution of practical problems and in experimental researches; to possess skills of work with the specialized laboratory equipment and devices for the solution of practical problems.
6	**Introduction to biotechnology**	5	Genetics with the basics of breeding	Methods of organizing extracurricular work in chemistry and biology	**Aim.** To form a system of knowledge about the scientific and practical aspects of biotechnology, the main criteria for the selection of biological objects and modern methods of creating biological products. **Content.** During the course study, the following content of the discipline is revealed: biological objects and products of biotechnological processes; cultivation and growth of cells; cultivation of biological objects; cell and genetic engineering; the production of bioenergy, biotechnological processes of processing of mineral raw materials; biotechnology of microorganisms and plants; engineering Enzymology; agricultural biotechnology; biotechnology in animal husbandry and environmental protection; prospects of biotechnology development. **Expected results**: student must know about: scientific fundamentals of biotechnology; the main areas of production of nutrients; basics of engineering Enzymology; methods and possibilities of gene and cell engineering; technological fundamentals of bioenergy and biological processing of raw materials; use of biotechnology as an alternative in agriculture; fundamentals of environmental biotechnology; be able to: navigate in the modern directions and methods of biotechnology; to use the knowledge about biotechnology in the study of special disciplines; apply the knowledge gained in the rational use of natural resources and environmental protection; use the data obtained in writing abstracts; own applied aspects of biology.
7	**Anatomy and morphology of plants**	5	Cytology and Histology	Plant Physiology	**Aim.** Formation of students ' ideas about the structure of the plant body, its associated functions and their evolutionary changes. **Content.** During the course study, the following content of the discipline is revealed: similarities, differences between plants and their cells with other living organisms, the structure of plant cells, tissues, vegetative and generative organs of plants and their anatomy, morphological and functional features, types and types of plant reproduction, flower and its structure, formulas, flower diagrams, arrangement of flowers on the plant, seed, fruit. **Expected results**: the student should know the basic Botanical terms underlying

					the anatomy and morphology of plants; know the structure of cells, tissues and organs of plants; have an idea about the formation of the structure of plant organisms in ontology and phylogeny; be able to use a microscope, prepare preparations for microscopy, recognize the elements of the structure of plant organisms and correctly draw up the results of observations; to analyze the proposed plant objects, based on knowledge of the anatomical, morphological and physiological characteristics of the plant organism, the principles of their systematic classification, as well as the dependence of their structure and functions on the conditions of existence.
7	**Botany**	5	Cell and tissue biology	Phytochemistry	**Aim.** To form an integral system of knowledge about the structure, diversity, classification of higher plants, plant communities, taking into account modern scientific achievements. **Content.** During the course study, the following content of the discipline is revealed: plant morphology, especially the structure of cells of higher plants, the emergence of leaf-stem organization of higher plants, plant reproduction and life cycles, flower - reproductive organ of angiosperms, General issues of systematics, higher spore plants, seed plants, geobotany, the influence of important environmental factors on morphogenesis, the formation of phytocenoses. **Expected results**: the student should know: the basic concepts (terms), features of the structure of plant organisms at the macro-and microscopic levels; features of plant reproduction; features of plant development during ontogenesis and in the process of evolution; characteristic features, classification of various taxa of modern and fossil higher plants; be able to: navigate the diversity of the plant world, to diagnose different taxonomic groups of plants; to use knowledge and practical skills in pedagogical, scientific, industrial and environmental activities, in the study of other biological disciplines; to analyze the proposed plant objects, based on knowledge of the anatomical, morphological and physiological characteristics of the plant organism, the principles of their systematic classification, as well as the dependence of their structure and functions on the conditions of existence; possess: basic methods of anatomy, morphology, systematics, geobotany for the study of plants at the level of tissues, organs, organisms, plant communities; skills of identification of various taxonomic groups of higher plants; basic methods and techniques of describing plant communities.
8	**Zoology of invertebrates and vertebrates**	6	Cytology and Histology	Human Anatomy	**Aim.** Obtaining basic knowledge on anatomy, morphology, physiology, embryology, systematics and ecology of animals of world and regional fauna. **Content.** During the course the following content of the discipline is revealed: zoology as a science, the basic laws of animal evolution, podtsarstvo simplest types Sarcomastigophora, ciliates, kingdom of Prometazoa, types of flatworms, Nemertea, Cephalorhyncha, annelids, Arthropods, Molluscs, Echinoderms, Hemichordata; General characteristics of the type of Chordates, shells, characteristics of the subtype of vertebrates, classes of Cartilaginous and Bony fish, Amphibians, Reptiles, Birds, Mammals. **Expected results**: as a result of mastering the discipline, the student should know: the basics of systematics, morphology, physiology of invertebrates and vertebrates; know about the origin and evolution of the type, subtypes and classes of chordates; about the role of animals in ecosystems and the biosphere as a whole; know the structure and features of the local fauna and ecology of mass and rare species of animals; Latin names of animal taxa; to be able: to demonstrate basic ideas on the Zoology of invertebrates and vertebrates, to apply them in practice, to critically analyze the information obtained and present the results of research; to apply biological knowledge to explain the processes and phenomena of life of representatives of the animal Kingdom, indicating their taxonomic group, anatomical, morphological and environmental features in different periods of evolution; to possess: skills of research work, discussion; methods of laboratory Zoological research on morphology.
8	**Fauna of the world**	6	Cell and tissue biology	Morphology of human internal organs	**Aim.** To form a complex of knowledge about the composition, distribution and formation of fauna of the world, the Republic of Kazakhstan, as well as the East Kazakhstan region; about the distribution of animals in various ecological environments and geographical zones; about the role of animals in ecosystems and practical significance for humans. **Content.** During the course the following content of the discipline is revealed: the history of fauna, fauna of the world: different continents, oceans, seas, rivers, lakes; fauna of the Republic of Kazakhstan, East Kazakhstan region, the spread of animals in different environmental environments, geographical zones and

					features of their organization, the role of animals in ecosystems and practical value for humans; animals listed in the Red book. **Expected results:** student must know: the basics of animal systematics in the amount of classes and main groups; the diversity of invertebrate animals of the Republic of Kazakhstan and EKR (rare and endangered species); information on the role of animals in nature and human activities; to be able: to use methods of observation, description, identification and classification of biological objects; to apply modern methods of work with biological objects in field and laboratory conditions; to distinguish representatives of different classes and families; to characterize the structure and ecological features of the main groups of animals; to identify and recognize in nature the main groups and species of animals by traces of life, appearance, voices; to create educational collections; to design and store collectional material; to work with animals in nature and laboratories; to conduct excursions and speak publicly; apply biological knowledge to explain the processes and phenomena of life of representatives of the animal Kingdom, indicating their taxonomic group, anatomical, morphological and environmental features in different periods of evolution; possess: modern methods of processing, analysis and synthesis of field and laboratory biological information; skills of determining animals to family, genus and species; skills of independent work, self-organization and organization of tasks.
9	**Plant Physiology**	5	Anatomy and morphology of plants	Final State Attestation	**Aim.** Formation of knowledge about the General laws and specific mechanisms underlying the physiological processes occurring in plant organisms and substantiation of practical techniques aimed at improving plant productivity. **Content.** During the study of the course reveals the following content of the discipline: features of the structure of plant cells, its differences from animal cells; totipotency of plant cells, its use in plant biotechnology; carbon nutrition of plants: leaf pigments, energy, chemistry of photosynthesis, composition, function of photosystem I, II, water metabolism of plants; mineral nutrition; plant respiration; plant growth and development: phytohormones. **Expected results:** student must know: the subject and tasks of plant physiology, the history of its development; totipotency of plant cells; carbon nutrition of plants: pigments of the leaf, the energy and the chemistry of photosynthesis, structure, localization and function of photosystem I and II; water exchange of plants: basic mechanisms of entry of water into the cell and the movement of water in plants; evaporation of water plant, the basics of plant resistance to drought; mineral nutrition: receipt and movement of nutrients in the plant, the main macro-and microelements, physiological bases of application of fertilizers; breath of plants: its value in plant life, influence of various factors on intensity of breath; components of a respiratory chain; the mechanism of oxidative phosphorylation; growth and development of plants: phytohormones, principles of regulation of processes of growth and development; physiological bases of protection and stability of plants; to be able: to conduct bibliographic search of literary sources; accurately to carry out the plan of experiments with plant objects; to work with live plants, to compare and find differences between control and experimental plants; to carry out phenological observations; to make experiments on removal of physiological indicators of plants; to make out the received results by means of graphic images; to do the comparative analysis of the received results; to generalize and draw conclusions on the basis of the received results; to analyze the proposed plant objects, based on knowledge of the anatomical, morphological and physiological characteristics of the plant organism, the principles of their systematic classification, as well as the dependence of their structure and functions on the conditions of existence; to have the skills: conducting experiments to study the main physiological processes; determination of osmotic pressure, transpiration intensity, photosynthesis, respiration; chlorophyll isolation and determination of its quantity and physico-chemical properties; determination of the influence of various mineral elements on the growth and development of plants, individual indicators of growth, plant stability.
9	**Phytochemistry**	5	Botany	Final State Attestation	**Aim.** To form students ' knowledge, skills and practical skills on Phytochemistry, which are based on theoretical information on certain groups of biologically active substances, including their definition, classification, physical and chemical properties, methods of production, purification and separation, methods of identification, qualitative and quantitative determination, using rational and modern research methods. **Content.** During the course the following content of the discipline is revealed:

					General Phytochemistry; qualitative analysis, methods of quantitative determination of biologically active substances; special Phytochemistry; methods of quantitative and qualitative determination of biologically active substances in medicinal plant raw materials containing vitamins, polysaccharides, essential oils, fatty oils, alkaloids, cardiac glycosides, saponins, simple phenols, tannins, anthracene derivatives, flavonoids. **Expected results:** student must know: basic concepts of Phytochemistry, phytochemical methods of analysis; the basic directions of scientific researches in the field of Phytochemistry of medicinal plants; the main groups of biologically active substances of natural origin and their essential physical and chemical properties; pathways of biosynthesis of the major groups of biologically active substances; methods of isolation and purification of the main biologically active substances from medicinal vegetative raw material; basic methods of qualitative and quantitative determination of biologically active substances in medicinal plant raw materials; biological standardization of medicinal plant raw materials; raw material quality indicators and methods of their determination; safety rules when working with medicinal plants and medicinal raw materials; acquire such skills as: to isolate and purify active biologically active substances from medicinal plant raw materials; to carry out qualitative and microchemical reactions to biologically active substances to confirm their presence in medicinal plants and raw materials; to analyze the methods of quantitative determination, medicinal plant raw materials for the content of essential oils, cardiac glycosides, saponins, alkaloids, anthracene derivatives, tannins, flavonoids, coumarins, vitamins, etc. ; to determine the humidity, ash, extractives; to carry out statistical processing and registration of the results of pharmacognostic and phytochemical analyses; apply theoretical knowledge and skills of measuring instruments, laboratory equipment, cytochemical, biochemical methods of studying various objects of the environment to solve practical problems and in experimental studies.
10	**Human Anatomy**	4	Zoology of invertebrates and vertebrates	Human and animal physiology	**Aim.** The study of the whole organism, its individual parts, structure, age and sex differences, topographic relationships between organs, parts of the body. **Content.** This discipline considers the following content of the discipline: anatomy as a science, research methods in anatomy; anatomical structure of the skeleton; syndesmology; myology; anatomical structure of the digestive, respiratory, genitourinary system; morpho-functional characteristics of the cardiovascular system; nervous system; sensory system, analyzers; endocrine system; skin and its derivatives. **Expected results:** student must know: the place of anatomy in biology and medicine, basic stages of its development as a science; major trends in modern anatomy and the nature of the methods of anatomical research; General principles of structure of the human body and their manifestations in the organization of body systems; the structure of bodies of different types and their fundamental organ-specific features; the anatomy, topography and functions of organs, systems and apparatuses of the body taking into account the basic constitutional features of the; the most significant practical features of age anatomy; to be able: to identify visual signs of con-stitutionally type of person (meso-, the - or dolichomorphic); demonstrate and name the movements carried out in the major joints of the human body; apply biological knowledge to explain the processes and phenomena of life the body's own; to possess: skills in morphological assessment of human body in anthropological research.
10	**Morphology of human internal organs**	4	Fauna of the world	Physiology of higher nervous activity	**Aim.**To form ideas about morphology of internal organs of the person and their systems. **Content**. This course covers the following contents: the morphology of internal organs (splanchnology): respiratory, digestive, reproductive, urinary and genital systems, endocrine system, vascular system (angiology), the nervous system; their topography; the patterns of formation of internal organs and systems in the process of ontogenesis as reflection of phylogenetic development. **Expected results**: student must know: morphological features of the structure of internal organs, their topography; the patterns of formation of internal organs and systems in the process of ontogenesis as reflection of phylogenetic development; features of the morphological structure of a person; to be able: to establish the relationship of the anatomical structure, morphology and functions of the organs; to make judgments about the main directions of development of internal organs and systems of the human body; apply biological knowledge to explain the processes and phenomena of life of your own body; possess the skills of morpholog-

					ical assessment of the human body in anthropological studies.
11	**Organic Chemistry**	5	Analytical chemistry	Physical and Colloidal Chemistry	**Aim.** Formation of ideas about the basic laws of structure, properties and mutual transformations of different classes of organic compounds. **Content.** During the course the following content of the discipline is revealed: electronic theory of chemical bonds, the theory of directional valences, the theory of electronic displacements, classification of organic compounds, alkanes, alkenes, alkynes, alkenes, alkanes, alkanes, alcohols, esters, amines, aldehydes, ketones, carboxylic acids, amino acids, aromatic hydrocarbons, nitrogenous organic substances, heterocyclic compounds; structure, isomerism, nomenclature, physical, chemical properties of compounds. **Expected results**: student must know: the subject of organic chemistry the theory of chemical structure Butlerova A. M., characterization of the covalent bonds; isomers; addition reactions, cleavage, substitution, rearrangement, and heterolytic homolytic reactions; homologous series of methane, ethylene, acetylene, oxygen-containing compounds, nitrogen-containing soedinenii, their nomenclature, laboratory and industrial methods of preparation, physical and chemical properties; to be able to portray the structural isomers of the major classes of organic compounds; give names for different types of nomenclature and determine the structure of the substance by name; be able to paint the reaction taking into account the mechanism and determine the reaction products, analyzing the conditions of its conduct; possess the basic chemical laws, theories, laws and chemical transformations to explain and use in real chemical processes occurring in the educational process; use computational methods to solve various chemical tasks of educational and scientific laboratory nature; to know the methods of safe use of chemical materials, taking into account their physical and chemical properties.
11	**Chemistry of high-molecular compounds**	5	Physico-chemical methods of analysis	Polymer Chemistry	**Aim.** To form students ' competencies related to the ability to master the skills of chemical experiment, the main methods of obtaining and studying high-molecular compounds, their physical and chemical properties; skills of working on modern educational and scientific equipment during chemical experiments; methods of registration and processing of the results of chemical experiments; methods of selecting material for theoretical and laboratory work for subsequent application of the knowledge and skills to perform professional tasks. **Content.** During the course the following content of the discipline is revealed: classification of methods of synthesis of polymers, types of chemical reactions and their basic characteristics, chain polymerization, methods of polymerization reactions stepwise polymerization, the reactions of polycondensation, copolymerization and copolycondensation, basic methods of fabrication and investigation of high molecular compounds, their physico-chemical properties. **Expected results**: student must know: types of chemical reactions and their basic characteristics; recent developments and prospects in the field of chemistry, their interaction with other fields of knowledge; to be able: to perform calculations with chemical formulas and equations; to carry out a chemical experiment in accordance with the rules of safe handling of equipment and chemicals; to develop an individual path of self-education; to possess skills to operate laboratory equipment; skills identification of physical and chemical constants of the obtained compounds; methods of processing the obtained experimental results; rules and techniques of self-education; possess the basic chemical laws, theories, laws and chemical transformations to explain and use in real chemical processes occurring in the educational process; use computational methods to solve various chemical tasks of educational and scientific-laboratory character.
12	**Systematics of plants**	5	Room and Garden Floriculture	Final State Attestation	**Aim.** The formation of students ' theoretical and practical knowledge of modern plant taxonomy, instilling in students the skills of independent work with plant objects, the development of interest in research in the field of Floristics and taxonomy. **Content**. During the course study, the following content of the discipline is revealed: general characteristics of lower and higher plants, the division of blue-green algae, divisions of algae: green, charophytes, botanists, pyrophytic, yellow-green, diatoms, Fungi division, Lichens division, higher plants divisions: mossy plants, Rhyniophyta, Mosses, Khvoschova, Fern, Gymnosperm division, division angiosperms, classes: Dicotyledonous, Monocotyledonous., General characteristics, the most important directions of evolution. **Expected results**: the student should know: the diversity of the plant world and the basic laws of its formation, structure, spatial distribution, structure, evolution, systematic groups of plants; the ratio of concepts: systematics, evolution, phylog-

					eny, systematics and Floristics; taxonomic categories used in modern systematics; lower and higher plants as the main educators of modern vegetation; the characteristics of specific plants in which are embodied features of the structure of the group as a Union of species and higher systematic categories; the amount of systematic groups geographical distribution of plants, the place and role of plants in ecological systems; the practical value of the properties plants from different groups; be able: to distribute the plants to groups, have a clear idea about the location of certain plants; to make practical use of important economic properties of various groups of plants; to analyze the proposed growing objects, based on knowledge of the anatomical, morphological and physiological characteristics of the plant organism, the principles of their systematic classification, as well as the dependence of their structure and functions on the conditions of existence; to be able to make dichotomous keys; to possess the skills: determination of plants belonging to complex groups in a systematic respect; microscopy, dissection, sketches, work with herbarium; distribution of plants into groups.
12	**Flora of the world**	5	Ornamental gardening with the basics of landland-scape design	Final State Attestation	**Aim.**. Formation of a complex of knowledge about features of flora of the world, the Republic of Kazakhstan and East Kazakhstan region, ways and regularities of their formation, systematic, ecological and structural diversity of plants, and also the characteristic of their role in biocenoses, economic value and protection. **Content**. During the course study, the following content of the discipline is revealed: the distribution of climate, soils, and flora of the world, the RK and EKR, introduction of tree and shrub flora, cultural plants and weeds, methods of floristic research, the systematic analysis of the flora of the world, the RK and EKR, biomorphic analysis of the flora,phytocenotic analysis of the flora, ecological groups of plants., analysis of endemism, relict. the red data book. **Expected results:** student must know the terminology of the discipline, especially the flora of the world, the kr and EKR, modern approaches to the analysis of the flora, the principles of geobotanical and floristic zoning, the major systematic and ecological groups of plants, especially the protection of flora in the world, Kazakhstan and the region in a nature reserve, national Park, nature reserves; to be able: to apply knowledge in floristic research, make notes of Flor and analysis, learn the rare and protected plant species of Kazakhstan, in the collections of the pictures, in nature; to analyze the proposed plant objects, based on knowledge of the anatomical, morphological and physiological characteristics of the plant organism, the principles of their systematic classification, as well as the dependence of their structure and functions on the conditions of existence; to possess: floristic research methods, methods of describing plant communities, methods of determining the range of species, knowledge and skills for professional treatment of Botanical objects.
13	**Human and animal physiology**	4	Human Anatomy	Evolutionary teaching	**Aim.** To equip the future specialist with knowledge about the laws of life processes occurring in human and animal organisms; to give students an idea about the processes of life of the animal organism and its constituent parts (cells and subcellular structures, tissues, organs, organ systems) in their unity and relationship with the environment. **Content.** During the course the following content of the discipline is revealed: research methods in physiology; General physiology; physiology of excitable tissues; muscle physiology; mechanisms of regulation of body functions; private physiology of the Central nervous system; structure, functions of the spinal cord; the brain; sensory systems; nervous regulation of vegetative functions; the internal environment of the body; internal organs; heat production, heat transfer; lactation. **Expected results:** student must know about: the subject and tasks of human and animal physiology, the history of its development; peculiarities of the structure of animal cell and its differences from plant cells; theoretical and methodological fundamentals of physiology; physiology of excitable tissues; physiology of human analyzers; the private CNS physiology; the mechanisms and patterns of activity of autonomic functions of the body; to be able: to conduct a bibliographic search of the literature; to somatometry (anthropometry); to determine the short-term verbal-logical memory; to determine the mental performance; to determine the basic physiometric indicators; to assess the physical development of man; to apply the theoretical knowledge and practical skills in practical and research activities; to apply biological knowledge to explain the processes and phenomena of life of their own organism and other representatives of the animal Kingdom, indicating their taxonomic group, anatomical, morphological and environmental

					features in different periods of evolution.
13	**Physiology of higher nervous activity**	4	Morphology of human internal organs	Anthropogenesis	**Aim.**. The study of the basic principles of higher nervous activity of animals and humans, physiological mechanisms of command, the structure of the behavioral act. **Content.** During the course the following content of the discipline is revealed: teaching the concept of HNA; the structure of the brain; reflexes; the types of braking of conditioned reflexes; learning; features of HNA in different animals; structure of behavioral act; narodnia motivation and emotion; neurophysiological mechanisms of memory; speech; thinking; mind, consciousness; sleep; typology of HNA; the research methods of the peculiarities of HNA in humans and animals. **Expected results**: the student must possess a sufficient Arsenal of the subject; know the mechanisms of the brain, the mechanisms of psychological processes; be able to apply biological knowledge to explain the processes and phenomena of life of his own body and other representatives of the animal Kingdom, indicating their taxonomic group, anatomical, morphological and environmental features.
14	**Physical and Colloidal Chemistry**	5	Organic Chemistry	Biochemistry	**Aim.** Acquisition of theoretical knowledge in physical and colloidal chemistry for further in-depth study of disciplines of the profiling cycle necessary for successful realization of professional activity of the bachelor. **Content.** During the course the following content of the discipline is revealed: the laws of thermodynamics; equilibrium; solutions; the law of mass action; electrochemistry; chemical kinetics and catalysis; disperse systems, thermodynamics of surface phenomena; adsorption theory; electrical properties of disperse systems, stability and coagulation; solutions of HMWC and their properties, gels and jellies; electrical properties of HMWC solutions; molecular kinetic properties of HMWC solutions. **Expected results**: the student should know: the basic laws of chemical processes and characteristics of the equilibrium state; the beginning of thermodynamics and the basic equations of chemical thermodynamics; methods of thermo-dynamic description of chemical and phase equilibria in multicomponent systems; thermodynamics of electrolyte solutions and electrochemical systems; equations of formal kinetics and kinetics of complex reactions; the fundamental concepts and laws of colloidal chemistry as a science of surface phenomena and disperse systems; basic concepts and relations of thermodynamics of surface phenomena, surface tension and surface energy, adsorption, adhesion, cohesion, wetting, spreading, capillary condensation; mechanisms of processes of formation of the surface layer; structural and mechanical properties and rheological methods of research of dispersed systems; features of optical properties of dispersed systems, scattering, absorption of light, coloring of sols; be able: to determine the thermodynamic characteristics of chemical reactions and equilibrium concentrations of substances; to determine the direction of the process in the given initial conditions; to establish the boundaries of the regions of phase stability in one-component and binary systems; to determine the compositions of coexisting phases in binary heterogeneous systems; to make kinetic equations in differential and integral form for simple reactions; to carry out calculations using the basic relations of thermodynamics of surface phenomena and calculations of the main characteristics of dispersed systems; to calculate the energy parameters of adsorption; to predict the influence of various factors on surface tension and surface energy; to obtain and purify colloidal solutions; to determine the charge sign of colloidal particles; to predict the effect of dispersion on reactivity, equilibrium constant and phase transition temperature; to generalize and process experimental information in the form of laboratory reports; to possess: skills of calculating the thermal effects of chemical reactions at a given temperature under conditions of constant pressure or volume; skills of calculating the equilibrium constants of chemical reactions at a given temperature; methods of calculation of chemical equilibrium; methods of measurement of surface tension, edge angle, adsorption and specific surface area, viscosity; possess the basic chemical laws, theories, laws and chemical transformations to explain and use in real chemical processes occurring in the educational process; use computational methods to solve various chemical tasks of educational and scientific-laboratory character; own methods of safe use of chemical materials, taking into account their physical and chemical properties.
14	**Polymer**	5	Chemistry of	Agrochemistry	**Aim.** The study of the basics of chemistry and physics of polymers and their role in human life.

	Chemistry		high-molecular compounds	with the basics of soil science	**Content.** During the course the following content of the discipline is revealed: chemistry of polymers; fundamentals of polymer synthesis and their derivatives; reactions of polymers and their derivatives; polymer physics; the main provisions of the physics of polymers; properties of polymers; separation and determination of polymers; the role of polymers in human life; manufacture of polymers. **Expected results**: the student should know: modern ideas about the structure and properties of high-molecular compounds used in the production of gunpowder, solid rocket fuel and polymer composite materials; theoretical foundations of the synthesis of polymers and their chemical transformations; basic physical and chemical processes occurring in the manufacture of polymer composite materials; standard methods for determining the properties of; to be able to: conduct studies of properties of polymeric materials, propellants, solid rocket fuels according to standard procedures; to possess experience of a choice of methods of carrying out complex testing of polymers, polymer composites and products on their basis; be familiar with the basic chemical laws, theories, patterns, and chemical transformations to explain and use in real chemical processes that occur in the educational process; the use of computational methods for the solution of various chemical job training and laboratory nature; to know the methods of safe use of chemical materials, taking into account their physical and chemical properties.
15	**Biochemistry**	5	Physical and Colloidal Chemistry	Ecological and green chemistry	**Aim.** Formation of students ' complete system of knowledge about the chemical composition of living organisms, physico-chemical and biological properties of natural compounds, the main ways of metabolism, mechanisms of regulation and interrelation of metabolic processes. **Content.** During the course the following content of the discipline is revealed: proteins, amino acids, enzymes, lipids, carbohydrates, nucleic acids, vitamins, hormones, classification, nomenclature, structure, properties, structure, functional value and biological role in the cell; nucleosides, nucleotides, their structure, properties; DNA, RNA, properties, specificity of nucleic acids; the value of vitamins for the body; metabolism of proteins and amino acids, carbohydrates, lipids. **Expected results:** student must know: basic principles of structural organization of important biological macromolecules – proteins, nucleic acids, carbohydrates, lipids; functional role of proteins, nucleic acids, carbohydrates, lipids, of hormones in the processes of life; specific properties and kinetic characteristics of the enzymes and role of enzymes for biotechnology; properties and the role of DNA and RNA in reproduction and transmission of genetic information; the main ways and mechanisms of regulation of metabolism; theoretical and practical importance of biochemistry, the latest achievements in the field of biochemistry and prospects for their use in various fields of biotechnology, national economy, medicine, pharmacy; on the relationship of biological function and molecular structure of compounds; be able to: use the knowledge gained for the development of other biological disciplines, as well as to solve practical issues of biotechnology; conduct qualitative and quantitative analysis of biological material; work with biochemical equipment equipment; apply theoretical knowledge in solving technological problems; to own: modern methods of laboratory biochemical studies of biological molecules to solve practical issues of biotechnology; be familiar with the basic chemical laws, theories, patterns, and chemical transformations to explain and use in real chemical processes that occur in the educational process; the use of computational methods for the solution of various chemical job training and the laboratory of nature; to know the methods of safe use of chemical materials, taking into account their physical and chemical properties.
15	**Agrochemistry with the basics of soil science**	5	Polymer Chemistry	Coordination chemistry	**Aim.** Formation of representations, theoretical knowledge and practical skills on scientific bases and methods of agronomic chemistry. **Content**. During the study of the course reveals the following content of the discipline: plant nutrition, ways of its regulation; soil composition; agrochemical properties of the soil; chemical soil reclamation; classification of fertilizers and methods of their application; nitrogen, phosphorus, potassium, micro-fertilizers; the role, content and availability of phosphorus, potassium, nitrogen in plant life; complex fertilizers; the value of trace elements for plants; organic fertilizers. **Expected results**: the student should know: the chemical composition of plants and features of their nutrition; agrochemical properties of different types of soils; chemical composition and properties of fertilizers; conditions for the effective use of fertilizers to obtain the planned yields of agricultural crops; modern methods of determining the needs of crops in fertilizers; methods of chemical analysis

					of soils and plants; methods of mathematical and static processing of experimental data; be able to: select soil and plant samples for analysis; to carry out chemical analysis of soils, plants and fertilizers; to determine the need for fertilizers, the most effective terms and methods, technology of application and incorporation of fertilizers; to carry out soil and plant diagnostics; to possess the basic chemical laws, theories, laws and chemical transformations for explanation and use in real chemical processes occurring in the educational process; to use computational methods to solve various chemical tasks of educational and scientific laboratory nature.
16	**Evolutionary teaching**	5	Human and animal physiology	Final State Attestation	**Aim.** To form ideas about the General laws and driving forces of the evolutionary process. **Content.** During the course the following content of the discipline is revealed: the emergence and development of evolutionary theory; scientific and socio-historical background of the evolutionary doctrine; evolutionary doctrine of Ch.Darwin; evidence of the evolution of natural species; the main stages of chemical and biological evolution; driving forces of evolution; microevolution; view, speciation; macroevolution; direction of the evolutionary process; methods of phylogenetic transformations of organs; general laws of macroevolution. **Expected results**: the student should know: the subject, goals and objectives of the course; the emergence, development and current problems of evolutionary theory; evolutionary concepts of J. B. Lamarck, C. Darwin; speciation processes; ways of macroevolution (divergence, convergence, parallelism); methods of phylogenetic transformation of organs; be able to: determine the qualitative functional changes of organs; determine the quantitative functional changes of organs; determine and describe the issues of human origin; determine the driving forces of anthropogenesis; apply biological knowledge to explain the processes and phenomena of life of their own organism and other representatives of the animal Kingdom, indicating their taxonomic group, anatomical, morphological and environmental characteristics in different periods of evolution; possess skills: application of knowledge in theoretical and practical activities.
16	**Anthropogenesis**	5	Physiology of higher nervous activity	Final State Attestation	**Aim.** On the basis of modern ideas about the evolution of the organic world to form a holistic vision of the world and the place of mankind in it, taking into account the unique combination of biological and social components of human nature. **Content.** During the course the following content of the discipline is revealed: a brief historical overview of the process of formation of modern structures of knowledge about the historical course of anthropogenesis; the spectrum of current concepts of anthropogenesis, the analysis of their arguments; the options of consistent synthesis; analysis of paleo-ecological environment surrounding the anthropogenesis; probable human ancestors, and system of relationship within the primates; analysis of the current situation of the development of mankind. **Expected results**: the student should know: theoretical and methodological principles of the modern stage of development of the complex of biological Sciences about man in their inseparable unity by social Sciences; be able to: apply the knowledge gained in the field of scientific research and professional activity; apply biological knowledge to explain the processes and phenomena of life of; methods of collection and analysis of ethnological materials.
MAIN DISCIPLINES					
Elective courses (EC)					
1	**Room and Garden Floriculture**	5	Microbiology and Virology	Systematics of plants	**Purpose.** To form ideas about indoor and garden plants, their classification, biology and care. **Content.** During the course the following content of the discipline is revealed: the biological basis of floriculture; classification, origin of flower plants;room floriculture; variety of indoor plants, certification; placement of flowers in the premises; agricultural cultivation of flower plants open, closed ground; design of green spaces; floristry, design; flower beds in the design of the site; arrangement of flower beds and rocky areas; educational and experimental site, organization, structure. **Expected results**: students should know: the main groups of indoor and garden plants, features of their organization, diversity, ecological, aesthetic and practical role; principles of plant placement; rules of care for plants; the main diseases of indoor plants; be able to: make a passport of plants, design projects of beds and beds, flower beds; prepare soil mixtures; transplant and transfer plants; make

					fertilizers and feed plants; propagate plants with seeds and vegetatively; describe own observations or experiments, to distinguish them goal setting and the results obtained; to own skills of preparation of Pro-Stasi recommendations for maintenance and care of room and other cultural plants; reproduction of plants; certification of indoor and garden plants, as well as the organization of educational-experienced area; thus, to possess applied aspects of biology.
1	**Ornamental gardening with the basics of landscape design**	5	Soil Microbiology	Flora of the world	**Aim.** Formation of complex of knowledge about organizational, scientific and methodical bases of modern decorative gardening and the used technologies, readiness to the creative approach at the decision of practical tasks on greening of inhabited territories and economic objects. **Content.** During the course the following content of the discipline is revealed: General issues of decorative gardening; ornamental plants of open ground in landscape design; landscape as an object of landscape art; landscape composition; classification of green spaces; decorative herbaceous plants in the system of urban and rural landscapes; principles of gardening settlements; modern garden design; current trends in modern landscape design. **Expected results**: the student should know: zoned assortment of decorative woody plants for landscaping areas of various functional purposes and interiors; agrotechnical techniques used at different stages of green construction; be able to: - recognize the main types of woody, shrub, flower and herbaceous crops used in decorative gardening on the morphological characteristics of plants, fruits, seeds; - use drawing and artistic tools and materials; - to create a landscape project, to develop design and estimate documentation, to select plants for landscaping objects; to possess: - methods of production of planting material and care of decorative plantings; ability to build, design and read drawings, to constructive drawing of natural forms and landscape elements, to make landscape compositions; to possess applied aspects of biology.
2	**Modern methods of teaching biology**	5	Methodology of teaching biology	Final State Attestation	**Aim.** Introduction to the theoretical and methodological aspects of the technological approach in education; teaching methods of modeling the educational process of biology through the use of modern teaching technologies; formation of motivational orientation of students to innovative activities in the organization of the educational process in biology. **Content.** During the course the following content of the discipline is revealed: the concept of learning technology; diversity and possible classifications of learning technologies; meaning-search activity of a specialist in the design of learning technology; modern training; technology problem, modular, project, case study, interactive, information and communication training in biology lessons; technology of critical thinking in biology lessons; test technology in biology lessons. **Expected results**: the student should know: modern methods and technologies of multicultural, differentiated and developmental education in the course of biology; be able to: use a variety of forms, techniques, methods and means of teaching biology within the updated education system of basic General education and secondary General education; use standard, applied, modern pedagogical methods and technologies in accordance with the goals and objectives in planning and conducting classes in high school and College; possess: forms and methods of teaching biology, including beyond the scope of training sessions: project activities, laboratory experiments, field practice, Desk processing, etc.; possess knowledge of regulatory and legal documents in the field of education, educational and instructional documentation, skills to develop current educational and organizational documentation for the implementation of educational concepts of educational programs.
2	**Theory and technology of teaching biology**	5	Methodology of teaching biology	Final State Attestation	**Aim.** To form ideas about the theory and technologies of teaching biology. **Content.** During the course the following content of the discipline is revealed : technology and theory of education; technology of teaching biology as a pedagogical science; methodological basis of technology of teaching biological disciplines; connection of theory and technology of teaching biological disciplines with other sciences; technology of formation of natural science concepts. **Expected results**: the student should know: the content of the SES of General secondary education, school programs in biology, taking into account the update, the content of textbooks on biology; to be able: to use standard, applied, modern pedagogical methods and technologies in accordance with the goals and objectives in planning and conducting clas-

					ses in high school and College; to produce didactic material for biology lessons; to work independently with a book (textbook, determinant); to schematically depict the studied object and provide it with appropriate signatures; to conduct phenological observations in nature; to own the technology of teaching; in practice to apply their knowledge; skills of laboratory experiment, methods of practical work in nature, etc.; possess knowledge of regulatory and legal documents in the field of education, training and instructional documentation, skills to develop current educational and organizational documentation for the implementation of educational concepts of educational programs.
3	**Modern methods of teaching chemistry**	5	Methods of teaching chemistry	Final State Attestation	**Aim.** To acquaint with theoretical and methodological aspects of technological approach in education; to teach methods of modeling of educational process of chemistry through application of modern technologies of training; to form motivational orientation of students to innovative activity at the organization of educational process in chemistry. **Content.** During the course the following content of the discipline is revealed: the concept of learning technology; diversity and possible classifications of learning technologies; meaning-search activity of a specialist in the design of learning technology; modern training; technology problem, modular, project, case study, interactive, information and communication training in chemistry lessons; technology of critical thinking in chemistry lessons; test technology in chemistry lessons. **Expected results**: the student should know: methods and technologies of multicultural, differentiated and developmental education in the course of chemistry; be able to: use a variety of forms, techniques, methods and means of teaching chemistry within the framework of the system of basic General education and secondary General education; use standard, applied, modern pedagogical methods and technologies in accordance with the goals and objectives when planning and conducting classes in high school and College; possess: forms and methods of teaching chemistry, including beyond the scope of training sessions: project activities, laboratory experiments, industrial chemical research, etc.; possess knowledge of regulatory and legal documents in the field of education, educational and instructional documentation, skills and abilities to develop current educational and organizational documentation for the implementation of educational concepts of educational programs.
3	**Theory and technology of teaching chemistry**	5	Methods of teaching chemistry	Final State Attestation	**Aim.** On the basis of modern achievements of psychological and pedagogical science and practice, a specific branch of knowledge (chemistry), as well as effective technologies and practices of school education in the subject area of chemistry to form professional competencies necessary for the successful implementation of training, development and educational tasks included in the professional duties of a school teacher. **Content.** During the course the following content of the discipline is revealed: theory and technology of teaching chemistry; the content of the course of chemistry; the concept of "standard training"; technology of teaching chemistry; technology of control of learning outcomes and diagnosis of knowledge and skills; extracurricular learning technology; technology of teaching the initial chemical concepts, concepts, chemical terminology; technology of organization and conduct of chemical experiment. **Expected results**: student must know: the requirements of the state standard of General education subject area chemistry for all levels of education in the school; aims, objectives and content in chemistry education; content, structure and methodological features of curricula and school textbooks in chemistry; methods and techniques of teaching chemistry; the basic organizational forms of study in chemistry; to be able: to plan teaching activities; to analyze the theoretical positions methods of teaching chemistry school curricula and chemistry textbooks, other learning tools; optimally choose the method of teaching chemistry; prepare a lesson plan, organize and conduct various forms of teaching chemistry; conduct a demonstration experiment; use standard, applied, modern pedagogical methods and technologies in accordance with the goals and objectives in planning and conducting classes in high school and College; possess knowledge of normative and legal documents in the field of education, educational and instructional documentation, skills and abilities to develop current educational and organizational documentation for the implementation of educational concepts of educational programs.

4	**Methods of solving problems in chemistry**	5	Methods of teaching chemistry	Final State Attestation	**Aim.** To develop the creative abilities of students and teach them to use the basic laws and concepts of inorganic chemistry in solving experimental, computational and other problems of increased complexity, to teach students to solve problems in several alternative ways, the choice of the most elegant solutions. Formation of students ' knowledge and skills to teach students to solve chemical problems. **Content.** During the course the following content of the discipline is revealed: the importance of the ability to solve problems; classification, methods of solving chemical problems; methods of solving problems in chemical formulas, equations, mixtures of substances, solutions, solubility, equilibrium in solutions of electrolytes, thermochemistry, chemical thermodynamics, oxidation-reduction reactions, electrochemistry, experimental tasks to determine the composition of substances, mixtures. **Expected results:** student must possess the following knowledge, skills and abilities: possess methodical methods of the solution of tasks of varying complexity on the basic sections of chemistry; own methodical techniques of solving of Olympiad tasks; be able to solve complex creative problems of theoretical and applied research; to be able to solve problems using mainframe and personal computer; proficient in computer programs to solve problems; know the methods of use of multimedia for training students in the solution of chemical problems; to be able to write and draw solutions to problems and exercises of increased complexity; the use of standard, applied modern pedagogical methods and technologies in accordance with set goals and objectives when planning and conducting lessons in high school and College; to possess knowledge of regulatory and legal instruments in the field of education, training and guidance documentation, and skills to develop the current training and organizational documentation for the implementation of educational concepts training programs.
4	**Methods of conducting a school chemical experiment**	5	Methods of teaching chemistry	Final State Attestation	**Aim.** To form a holistic view of the preparatory stages and methodology of the school chemical experiment. **Content.** During the course the following content of the discipline is revealed: the study of chemistry and its equipment; chemical experiment in the system of organizational forms of teaching; methods of chemical experiment; technique and methods of chemical experiment for the study of basic topics of chemistry; the basic methodology of demonstration experiments and laboratory works for the study of basic topics of chemistry. **Expected results**: the student should know: the scheme of construction and methodology of the chemical experiment in school; the technique and methodology of the chemical experiment in the study of the main sections of chemistry; be able to: organize and conduct basic demonstration experiments and laboratory work; use standard, applied, modern pedagogical methods and technologies in accordance with the goals and objectives when planning and conducting classes in high school and College; own: methodological techniques of the school chemical experiment; to possess knowledge of normative and legal documents in the field of education, educational and instructional documentation, skills and abilities to develop current educational and organizational documentation for the implementation of educational concepts of training programs for chemical experiments.
5	**Applied Chemistry**	5	Organic Chemistry	Chemical Technology	**Aim.** To form the basic concepts of chemical production, familiarity with the theoretical foundations of chemical technology, the main components of chemical processes, as well as consideration on this basis of some technologies for the production of some of the most important chemical products (acids, ammonia, urea, ethylene, polymer materials. **Content.** During the course the following content of the discipline is revealed: modern requirements for chemical production; chemistry and energy; raw materials; water in the chemical industry; thermal processing of solid fuels; processing of natural combustible gases, aromatic hydrocarbons, oil; petroleum products; production of hydrogen, nitrogen and oxygen, acids; General information about metallurgy; technology of basic organic synthesis; high-molecular compounds. **Expected results**: the student should know: the main technological processes of production of the most important chemical products in industrial and laboratory conditions, the main devices and devices of chemical technology, safety requirements, industrial sanitation and environmental standards of production of chemical products; be able: to solve typical problems in applied chemistry, to determine technologically and economically optimal conditions for technological

					processes; to make structural formulas of polymers; to design the main ways of synthesis of polymers; demonstrate knowledge about the laws of chemical transformations in industrial production, as well as about the structure, organization and technological design of the main chemical industries; possess: skills of synthesis, isolation and purification of chemicals in the laboratory, working with modern equipment for modeling technological processes, the main methods of obtaining polymers, the skills of determining the physical and mechanical properties and identification of polymers and composite materials; possess knowledge of applied chemistry.
5	**Introduction to chemical technology**	5	Chemistry of high-molecular compounds	Nanotechnology in Chemistry	**Aim.** To form ideas about the General laws of chemical-technological processes in relation to the main types of reactors and chemical-technological systems, laws of homogeneous and heterogeneous, catalytic and non-catalytic processes. **Content.** During the course the following content of the discipline is revealed: technology, classification, priority areas of modern chemical technology; theoretical foundations of chemical technology; chemical production, chemical-technological process; General laws of chemical processes; the main types of chemical processes; chemical reactors and their classification; chemical-technological systems (CTS); raw materials subsystem CTS; energy subsystem CTS; the most important industrial chemical production. **Expected results:** student must know: prospects of technical development; technical requirements for raw materials, materials, finished products; the main technical and design features of chemical plants; the ways of rational use of raw materials, energy and other resources; ways of intensification of chemical-technological terminology; be able to assess the composition and properties of intermediate products in order to allow the development of new technological processes, providing the most complete use of them; to analyze and justify the optimal parameters of technological processes; to demonstrate knowledge about the laws of chemical transformations in industrial production, as well as about the structure, organization and technological design of the main chemical industries; to possess: the skills of drawing up thermal and material balances of chemical devices and installations; methods of kinetic analysis and modeling of chemical reactors.
6	**Applied biology**	5	Cell Biotech technology	Final State Attestation	**Aim.** To form ideas about the main theoretical and practical achievements in different branches of production on the basis of the achievements of modern biological science. **Content.** During the course the following content of the discipline is revealed: the essence of applied biology; applied aspects of biology in medicine, agriculture, electricity, biotechnology, metallurgy; soil science, agriculture, agrochemistry; field husbandry, vegetable growing; cereals, legumes; biological bases of animal husbandry and horticulture; agrotechnology of the main fruit and berry crops; applied molecular biology; applied value of genetic research and genetic engineering for biotechnology. **Expected results**: the student should know: about the essence of applied biology; about the relationship of biological knowledge and biological objects with the practical activities of man; biological features of crops and domestic animals, agricultural technology of cultivation of crops and promising varieties of cultivated plants, the importance of seed Bank, breeding, feeding, growing farm animals, the role of the latest biological research in modern scientific knowledge of nature; about the use of biological objects in the technology of food production; to be able to: work with biological objects in laboratory and natural conditions; to organize the process of using biological objects in the production of food; to possess: the basic methods of biological Sciences (including field research); to possess applied aspects of biology.
6	**Methods of organizing extracurricular work in chemistry and biology**	5	Introduction to biotechnology	Final State Attestation	**Aim.** Formation of ideas about the theoretical foundations of extracurricular work in chemistry and biology and the use of knowledge and skills to solve professional problems. **Content.** This discipline considers the questions about the content and organization of extracurricular work in chemistry and biology; the forms and types of extracurricular activities; the ways, the means of increasing the effectiveness of extracurricular activities; after school, extra curricular activities; research work in chemistry and biology; about the methods of the organization of the groups, open classrooms, elective courses; the methods of the organization, various forms and types of extracurricular activities. **Expected results**: the student should know: ways of designing educational

					routes; forms, methods and means of self-education-the main directions of innovative educational policy; be able: to design educational routes in the organization of extracurricular activities in chemistry and biology; to select the components of the educational environment for the implementation of innovative educational tasks through the implementation of extracurricular activities in chemistry and biology; to use standard, applied, modern pedagogical methods and technologies in accordance with the goals and objectives when planning and conducting classes in high school and College; to classify methods, forms and principles of training and education of modern educational process; to possess: skills of application of forms, methods of organization of extracurricular work as an integral component of professional improvement of the teacher; skills of application of innovative forms, methods of organization of extracurricular work in chemistry and biology; possess knowledge of normative and legal documents in the field of education, educational and instructional documentation, skills and abilities to develop current educational and organizational documentation for the implementation of educational concepts of educational programs.
7	**Ecological and green chemistry**	6	Biochemistry	Final State Attestation	**Aim.** To form an idea of the qualitative and quantitative composition of anthropogenic pollution of the biosphere as a result of human industrial and agricultural activities and mechanisms of chemical transformations of substances in the environment, as well as the possibilities, role and place of "green chemistry" in modern natural science. **Content**. During the course the following content of the discipline is revealed: environmental pollution; global cycles of elements; changes in the chemical composition of the atmosphere; principles of assessment of the toxicity of substances; anthropogenic impact on nature; the emergence of a new scientific field of "green" chemistry; renewable chemicals; new chemical technologies, energy sources; new technology of processing of plastic; the latest development of "green" chemistry. **Expected results:** student must know: modern state and development trends of environmental chemistry; laws of interaction of living organisms and their aggregates with the environment and the factors affecting these processes; ecological significance of the chemical properties of the soil; the impact on living organisms pen location and chemical composition of air masses; types of plant bioindicators used in environmental diagnostics; principles of "green chemistry" and the last of its development; be able to: conduct a screening analysis of the quality of the environment; to reasonably choose the method and methodology of analysis of environmental objects and biological objects in accordance with the objectives of the study; to carry out a screening bioindication survey of the ecological state of biogeocenoses; to process the results of analytical measurements; to apply the principles of environmental and "green chemistry" when performing chemical experiments; to possess: the laws of the action of environmental factors to predict the optimal ecological niches of plants; methods of sampling and conservation of biological material and environmental objects to determine the quality of the habitat; methods of registration of analytical parameters during bioindication and chemical studies.
7	**Coordination chemistry**	6	Agrochemistry with the basics of soil science	Final State Attestation	**Aim.** In-depth study of the chemistry of coordination compounds; study of the structure and properties of coordination compounds. **Content.** During the course the following content of the discipline is revealed: the foundations of coordination theory; chemical bonding in complexes; the centers of coordination; ligands; isomerism of coordination compounds; formation of complexes: thermodynamic aspect; research methods in coordination chemistry; the basics of synthesis of coordination compounds; reactivity of coordination compounds; applied aspects of coordination chemistry. **Expected results**: the student should know: General ideas about coordination chemistry, including coordination chemistry of rare earth elements and actinides, as well as General irregularities in the change of chemical properties of the corresponding CS; be able to: isolate the main thing; give suggestions for the formulation or rationalization of the relevant experiment; use computational methods to solve various chemical tasks of educational and scientific-laboratory nature; possess: terminology and technique of the simplest estimates and calculations, for example, using circular thermochemical cycles or ligand field theory; possess basic chemical laws, theories, patterns and chemical transformations for explanation and use in real chemical processes occurring in the educational process; possess methods of safe use of chemical materials, taking into account their physical

					and chemical properties.
8	**Chemical Technology**	5	Applied Chemistry	Final State Attestation	**Aim.** To give an idea of the basic provisions and theory of chemical production technology and their practical application to industrial facilities. **Content.** During the course the following content of the discipline is revealed: directions in the development of chemical technology; basic products of the chemical industry, dynamics; physical and chemical laws of technological processes; chemical and technological systems; raw materials in the chemical industry; prospects for General chemical technology; current trends in the development of theory and practice of chemical technology; promising sources of raw materials and energy for the chemical industry. **Expected results**: the student should know: the basic principles of the organization of chemical production, its hierarchical structure; methods of assessing the effectiveness of the chemical process and the production as a whole; General laws of chemical transformations in industrial production; structure, organization and technological design of the main chemical production of modern enterprises of chemical profile of East Kazakhstan; be able to: demonstrate knowledge about the patterns of chemical transformations in terms of industrial production, but also about the structure, organization and process design the basic chemical production; to calculate the basic characteristics of a chemical process to choose a rational scheme of production of a given product; to assess the technological efficiency of production; compile and process experimental information; to own: methods of analysis of efficiency of chemical production; skills of calculation and determination of technological parameters of the process.
8	**Nanotechnology in Chemistry**	5	Methods of organizing extracurricular work in chemistry and biology	Final State Attestation	**Aim.** To form a system of knowledge about the basics of nanochemistry, synthesis and analysis of nanomaterials, application of nanotechnology in organic chemistry, biology, medicine and other fields. **Content.** During the course the following content of the discipline is revealed: basic concepts of nanotechnology; nanochemistry and the objects of its study; the main types of nano-objects and nano-systems based on them; methods for preparation and stabilization of nanoparticles, methods of research of sizes and shapes of nanoparticles; synthesis methods of nanostructured materials; place of nanomaterials in science and technology; problems of safety. **Expected results**: the student should know: the definition and classification of nanoparticles, the concept of nanomaterials, their special physical and chemical properties; the main methods of synthesis and analysis of nanomaterials; existing and promising applications of nanotechnology and nanomaterials; harmful effects of nanomaterials on the environment, human health and safety, as well as ways to prevent them; be able: to analyze and evaluate various methods of synthesis of certain nanomaterials; to propose methods of analysis of nanomaterials depending on their nature; to offer possible applications of various nanomaterials; to demonstrate knowledge about the laws of chemical transformations in industrial production, as well as about the structure, organization and technological design of the main chemical industries; to possess: the skills of finding sources of information about new achievements of nanochemistry and nanotechnology.

LIST
of components for your choice for the educational program
6B01509 "Chemistry-Biology"
Duration of studies: 4 years. Form of study: full - time

Name of disci-pline or module	Code of discipline	Credits	Seme ster
1. General educational disciplines			
Component of choice 1			
Module of economic and legal knowledge		5	
Basics of a Market Economy and Entrepreneurship	*BMEE1111*	3	2
Fundamentais of law and anti-corruption	*FLAC1112*	2	
Module of economic and natural knowledge		5	
Basics of a Market Economy and Entrepreneurship	*BMEE1111*	3	2
Basics of life safely and ecology	*FLAC1112*	2	
2. Basic disciplines			
Component of choice 1			3
Cytology and Histology	CH2216	3	
Cell and tissue biology	CTB2216	3	
Component of choice 2			3
General and Molecular Genetics	GMG2217	4	
Genetics with the basics of breeding	GWBB2217	4	
Component of choice 3			3
Microbiology and Virology	MV2218	5	
Soil Microbiology	SM2218	5	
Component of choice 4			3
General and Inorganic Chemistry	GIC2219	5	
Chemistry of the elements of the periodic system	CEPS2219	5	
Component of choice 5			4
Analytical chemistry	AC2220	5	
Physico-chemical methods of analysis	PCMA2220	5	
Component of choice 6			4
Cell Biotechnology	CB2221	5	
Introduction to biotechnology	IB2221	5	
Component of choice 7			4
Anatomy and morphology of plants	AMP2222	5	
Botany	Bot2222	5	
Component of choice 8			4
Zoology of invertebrates and vertebrates	ZIV2223	6	
Fauna of the world	FW2223	6	
Component of choice 9			5
Plant Physiology	PP3224	5	
Phytochemistry	Phy3224	5	
Component of choice 10			5
Human Anatomy	HA3225	4	
Morphology of human internal organs	MHIO3225	4	
Component of choice 11			5
Organic Chemistry	OC3226	5	
Chemistry of high-molecular compounds	CHMC3226	5	
Component of choice 12			6
Systematics of plants	SP3227	5	
Flora of the world	FW3227	5	
Component of choice 13			6
Human and animal physiology	HAP3228	4	
Physiology of higher nervous activity	PHNA3228	4	
Component of choice 14			6

Physical and Colloidal Chemistry	PCC3229	5	
Polymer Chemistry	PC3229	5	
Component of choice 15			
Biochemistry	Bio4230	5	7
Agrochemistry with the basics of soil science	AWBSS4230	5	
Component of choice 16			
Evolutionary teaching	ET4231	5	7
Anthropogenesis	Ant4231	5	
3. Profiling disciplines			
Component of choice 1			
Room and Garden Floriculture	RGF3305	5	5
Ornamental gardening with the basics of landscape design	OGWBLD3305	5	
Component of choice 2			
Modern methods of teaching biology	MMTB3306	5	6
Theory and technology of teaching biology	TTTB3306	5	
Component of choice 3			
Modern methods of teaching chemistry	MMTC4307	5	7
Theory and technology of teaching chemistry	TTTC4307	5	
Component of choice 4			
Methods of solving problems in chemistry	MSPC4308	5	7
Methods of conducting a school chemical experiment	MCSCE4308	5	
Component of choice 5			
Applied Chemistry	AC4309	5	7
Introduction to chemical technology	ICT4309	5	
Component of choice 6			
Applied biology	AB4310	5	7
Methods of organizing extracurricular work in chemistry and biology	MOEWCB4310	5	
Component of choice 7			
Ecological and green chemistry	EGC4311	6	8
Coordination chemistry	CC4311	6	
Component of choice 8			
Chemical Technology	CT4312	5	8
Nanotechnology in Chemistry	NC4312	5	