ALIKHAN BOKEIKHAN UNIVERSITY

MODULAR EDUCATIONAL PROGRAM
6B05121 "Biotechnology"

Semey, 2024

Developed by the Department of Applied Biology

Discussed and approved at the meeting of the Department of Applied Biology
(Protocol No. 6 of 03.02.2024)

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Reviewed and approved at the meeting of the Educational and Methodological Council of the University (Protocol No. 5 of May 28, 2024)

CONTENT

1. Explanatory note

The modular educational program (MEP) is compiled on the basis of the following documents:

- State standard of higher and postgraduate education, approved by the Order of the Minister of Science and Higher Education of the Republic of Kazakhstan No. 2 dated July 20, 2022;
- Rules for organizing the educational process on credit technology of education, approved by order of the Minister of Education and Science of the Republic of Kazakhstan No. 152 dated April 20,
- Typicalrules for the activities of educational organizations implementing educational programs of higher and (or) postgraduate education, approved by order of the Ministry of Education and Science of the Republic of Kazakhstan No. 595 dated 10/30/2018;
- Form 26 "Structure of the modular educational program"

The MEP is designed as a set of consecutive training modules for the entire period of study and is aimed at mastering the competencies necessary for the award**degrees**Bachelor of Science in the educational program 6B05121 "Biotechnology".

The modules of the block of general education disciplines (GED) include disciplines of the compulsory component (OK) - 51 credits and elective components (EC) - 5 credits, common to all educational programs.

The block of basic disciplines (DB) includes disciplines of the university component (OK) - 52 credits and elective components (EC) - 60 credits.

The block of major disciplines (PD) includes disciplines of the university component (OK) - 26 credits and elective components (EC) - 38 credits.

The final certification is 8 credits.

Practices are included in the blocks of university components of basic and major disciplines.

The criterion for the completion of the educational process is the development of 240 credits by the student.

The MOS consists of 14 modules.

Social partners:

1. Semey branch of LLP "KazNII processing and food industry";
2. KH "Kalikanuly";
3. Vostok-moloko LLP.
4. Non-profit joint-stock company "Shakarim University of Semey"

Purpose of the educational program. Training of highly qualified specialists in the field of biotechnology, with a high level of readiness for the implementation of basic professional functions and focused on the industrial and innovative development of the region.

Expected results of the modular educational program 6B05121 Biotechnology:

ON1: Practical application of skills in working with specialized laboratory equipment, devices, digital technologies, including artificial intelligence technology in the field of biotechnology to solve problems and research work

ON 2: Apply knowledge and understanding of basic concepts, methods of analysis, physical, chemical and mathematical laws to solve practical problems in the professional activity of a biotechnologist;

ON3: To apply in practice specialized knowledge of fundamental sections of microbiology and research skills to master the microbiological processes of various ecosystems. In particular, be able to conduct research on microbiological, physico-chemical processes occurring in the production of food

products, biologically active substances, secondary metabolites, and give a scientifically based assessment of the results obtained.
ON4: To analyze modern achievements in the field of biotechnology, radioecological research and new directions in the development of the biotechnology industry, as well as to put into practice new production technologies, digital technologies, including artificial intelligence technology, according to these achievements;
ON 5: Apply theoretical and practical knowledge to solve professional problems in the field of organization, planning and management of existing biotechnological processes and production;
ON 6: To use various types of information and communication technologies in professional activities;
ON 7: To carry out production activities at biotechnological enterprises;
ON 8: To use knowledge of the basics of genetic transformation of somatic and germ cells of animals and to use animal cell cultures for scientific and practical purposes;
ON 9: Apply knowledge and understanding of biotechnological processes at a professional level; formulate arguments and solve problems and problems related to biotechnology;
ON 10: Use the basics of knowledge and methodologies explaining the living world to identify problems and conclusions based on evidence, apply their knowledge to solve professional problems;
ON 11: To use methods for obtaining productive forms of microorganisms, farm animals, to conduct embryoengineering experiments;
ON12: Demonstrate knowledge of the concept of a modern rule of law state in order to instill skills in financial literacy, entrepreneurship, leadership, and receptivity to innovation based on scientific research while adhering to the principles of academic integrity and ensuring safety standards

In order to create special conditions for people with special educational needs to receive education, the graduate's competence model is complemented by professional competencies that ensure the adaptive nature of the main educational program. To this end, courses for the formation of the ability of people with special educational needs to successfully socialize in society and actively adapt to the labor market, taking into account the characteristics of the disease, are introduced into the catalog of courses of the additional educational program "Minor". The university also provides opportunities for people with disabilities to study using distance learning technologies.

II. COMPETENCE MODEL OF A GRADUATE

Learning outcomes are defined on the basis of the Dublin Descriptors of the first level (undergraduate) and are expressed through competencies.

Competence- this is the ability of a specialist in a particular field to apply knowledge, skills, skills: to successfully solve the problems of professional activity in accordance with specified standards; to create new objects and technologies in the field of science and technology.

Competence modelis a ranked set of competencies that describe the key qualities, behavior, knowledge, skills and other characteristics of a graduate necessary to achieve quality standards and work efficiency.

A graduate's competence model is a scientifically based, detailed image of a future specialist, which should be obtained as a result of mastering this educational program.

Competences are formed both at the level of the entire program, and at the level of a module and a separate discipline.

As a result of mastering the bachelor's program, the graduate should have formed general educational, basic and professional competencies.

1. Competence of general education

- aimed at forming the worldview, civil and moral positions of the future specialist, competitive on the basis of knowledge of information and communication technologies, building communication programs in Kazakh, Russian and foreign languages,focus on a healthy lifestyle, self-improvement and professional success;
- form a system of general competencies that ensure the socio-cultural development of the personality of a future specialist on the basis of the formation of his worldview, civic and moral positions;
- develop abilities for interpersonal social and professional communication in Kazakh, Russian and foreign languages;
- contribute to the development of information literacy through the mastery and use of modern information and communication technologies in all areas of their lives and activities;
- form the skills of self-development and education throughout life;
- form a personality capable of mobility in the modern world, critical thinking and physical self-improvement;
- evaluate the surrounding reality on the basis of worldview positions formed by knowledge of the foundations of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical knowledge, reveal the meaning of the content and specific features of the mythological-religious and scientific worldview;
- show a civil position based on a deep understanding and scientific analysis of the main stages, patterns, originality of the historical development of Kazakhstan, use methods, techniques of historical description to analyze the causes and consequences of events in the history of Kazakhstan;
- assess situations in various areas of interpersonal, social and professional communication, taking into account the basic knowledge of sociology, political science, cultural studies, psychology, arguing one's own assessment of everything that happens in the social and industrial spheres, as well as synthesize knowledge of these sciences as a modern product of integrative processes;
- use scientific methods, techniques for researching a particular science, as well as the entire socio-political cluster, select a methodology, analysis and generalize the results of the study;
- develop their own moral and civic position onbased on social, business, cultural, legal and ethical normsm of Kazakhstan society;
- apply in practice knowledge in the field of social sciences and humanities, which has worldwide recognition, synthesize new knowledge and present it in the form of humanitarian socially significant products;
- engage in oral and written communication in Kazakh, Russian and foreign languages, using language and speech means based on grammatical knowledge to solve problems of interpersonal, intercultural and industrial (professional) communication, as well as analyze information, actions and deeds of communication participants in accordance with the situation of communication;
- use various types of information and communication technologies in personal activities: Internet resources, cloud and mobile services for searching, storing, processing, protecting and disseminating information;
- build a personal educational trajectory throughout life for self-development and career growth, focus on a healthy lifestyle to ensure full-fledged social and professional activities through the methods and means of physical culture;
- know and understand the basic patterns of the history of Kazakhstan, the foundations of philosophical, socio-political, economic and legal knowledge, communication in oral and written forms in Kazakh, Russian and foreign languages;
- apply the acquired knowledge for effective socialization and adaptation in changing socio-cultural conditions, master the skills of quantitative and qualitative analysis of social phenomena, processes and problems.

2. Basic competencies (BC):

- Apply in practice the skills of working with specialized laboratory equipment and devices with various objects of biotechnology to solve practical problems and research activities in the field of biotechnology;
- Apply knowledge and understanding of basic concepts, methods of analysis, physical, chemical and mathematical laws to solve practical problems in the professional activity of a biotechnologist;
- Apply knowledge and understanding of biotechnological processes at a professional level; formulate arguments and solve problems, problems on biotechnology issues
- Know the methods of scientific research and academic writing and apply them in the field of study; organize research activities of students using the latest scientific data of domestic and foreign scientists.

3. Professional competencies (PC):

- Apply in practice the skills of working with specialized laboratory equipment and devices with various objects of biotechnology to solve practical problems and research activities in the field of biotechnology;
- Apply knowledge and understanding of basic concepts, methods of analysis, physical, chemical and mathematical laws to solve practical problems in the professional activity of a biotechnologist;
- Analyze modern achievements in the field of biotechnology and new directions in the development of the biotechnological industry, as well as put into practice new production technologies in accordance with these achievements;
- Apply theoretical and practical knowledge to solve professional problems in the field of organization, planning and management of existing biotechnological processes and production
- Carry out production activities at biotechnological enterprises
- Use knowledge of the basics of genetic transformation of somatic and germ cells of animals and use animal cell cultures for scientific and practical purposes
- Apply knowledge and understanding of biotechnological processes at a professional level; formulate arguments and solve problems, problems on biotechnology issues
- Use the foundations of knowledge and methodologies that explain the living world to identify problems and conclusions based on evidence, apply your knowledge to solve professional problems
- Use methods for obtaining productive forms of microorganisms, farm animals, conduct embryo engineering experiments
- Demonstrate knowledge of the historical and legal aspects of the idea of a modern rule of law state to instill entrepreneurial skills, leadership, receptivity to innovation in compliance with the principles of academic honesty, as well as ensuring safety standards.

4. Special competencies (SC)

- Apply in practice the skills of working with specialized laboratory equipment and devices with various objects of biotechnology to solve practical problems and research activities in the field of biotechnology;
- Apply knowledge and understanding of basic concepts, methods of analysis, physical, chemical and mathematical laws to solve practical problems in the professional activity of a biotechnologist;
- Apply in practice specialized knowledge of fundamental sections of microbiology and skills in performing research to master the microbiological processes occurring in the production of food products, biologically active substances and secondary metabolites, as well as evaluate the results obtained;

- Analyze modern achievements in the field of biotechnology and new directions in the development of the biotechnological industry, as well as put into practice new production technologies in accordance with these achievements;
- Use knowledge of the basics of genetic transformation of somatic and germ cells of animals and use animal cell cultures for scientific and practical purposes
- Apply knowledge and understanding of biotechnological processes at a professional level; formulate arguments and solve problems, problems on biotechnology issues
- Use the foundations of knowledge and methodologies that explain the living world to identify problems and conclusions based on evidence, apply your knowledge to solve professional problems

Table 1. The sequence of mastering disciplines in the process of forming special competencies

No.	Competencies	The list of compulsory, elective disciplines and the sequence of their study		
		list of disciplines	subsequencetheir study (sem.)	Expected results
1	Special	Phytoresources in biotechnology		Know: the species composition and ecological characteristics of plants of the Earth, the Republic of Kazakhstan, the Abay region and the city of Semey, used in biotechnology and the prospects for their use; **Be able to**: give a brief description of the flora objects used in the biotechnological process; **Own**put into practiceskills of working with specialized laboratory equipment and devices for solving practical problems.
		Animal resources in biotechnology	3	**Know:** organization, planning and direct implementation of a complex of works on artificial breeding, cultivation and acclimatization of economically valuable species of fish and invertebrates; **Be able to:** apply the acquired knowledge to solve specific scientific, practical, information retrieval, methodological and educational tasks; use modern methods of studying natural phenomena and processes; **Skills:** apply the methodology of field and laboratory ichthyological and hydrobiological studies; apply methods for assessing fish stocks, assessing water bodies; apply methods of fishery research, rules and conditions for their implementation;

		Cellular biotechnology	3	**Know:** about: the subject, tasks of the history of development, objects, methods of cell biotechnology, trends in the development of 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**: use knowledge and critically analyze scientific experiments;**Master the skills**work with specialized laboratory equipment and devices for solving practical problems.
		Cellular plant breeding		**Know:** The purpose of studying the discipline is to gain knowledge and skills for the development and application of cell breeding methods to improve and create new plant varieties with specified properties, as well as the purpose and objectives of cell plant breeding, the main directions, methods of cell breeding; variety and source material in plant breeding; obtaining mutant forms when using selection at the cellular level; intraspecific and remote hybridization; selection methods in plant breeding;; **Be able to**use theoretical and practical material in practice; master the skills of organizing and conducting experiments, using the knowledge, skills and abilities of working with various objects of biotechnology.
		Environmental protection and monitoring		**Know:** – theoretical foundations, purpose, tasks and functions of monitoring; – origin, types, sources of environmental pollution; – methods and tools for conducting observations and research in various monitoring systems and types; – features of the development of ecological systems; – principles of circularity and sustainable development. – conceptual framework for the classification of environmental monitoring; – features of the creation, development and organizational structure of the National Environmental Monitoring System of the Republic of Kazakhstan; – world and EU experience in the field of circular economy. – types of environmental monitoring of the Republic of Kazakhstan; – interaction of the National Environmental Monitoring System with the system of monitoring and forecasting of natural and man-made emergencies and the system of social and hygienic monitoring in the Republic of Kazakhstan; – a network of observation points, research facilities, controlled indicators for monitoring the quality of the environment in the territory of the Republic of Kazakhstan; – regulatory legal support for the activities of various environmental monitoring systems and types; **Be able to**use the foundations of knowledge and methodologies, conduct an environmental and economic analysis of environmental problems arising from different types and scales of the impact of natural and anthropogenic factors on the environment and the intensity of the use of natural resources; - to determine the regulations for observations, the composition of

		Rational use of natural resources	4	environmental information, the procedure for its receipt and provision to consumers of various levels; apply the acquired knowledge and skills to improve scientific and practical activities in order to ensure the development of an integrated approach to the analysis of environmental problems and solving issues of rational nature management; - use information and analytical materials and information technologies in the field of environmental monitoring to determine the strategy for rational use of natural resources; **Own**: understanding the mechanisms of operation of the National Environmental Monitoring System in the context of rational nature management and environmental protection; skills of practical work using information and analytical materials and information technologies in the field of environmental monitoring; skills in planning the main stages of environmental monitoring. **Know:**the basics of the economic system to learn the basic concepts and categories of environmental economics; approaches to the economic valuation of natural resources and the principles of fees for their use, a standard methodology for determining the economic efficiency of environmental protection measures and assessing the economic damage to the environment from pollution, the economic mechanism for influencing organizations in the implementation of environmental protection measures **Be able to**: apply their knowledge to solve professional problems and analyze the causes and mechanism of environmental quality, predict the impact on the natural environment and human society. To be able to find an integrated approach to the study of economic problems; find an integrated approach to the study of environmental problems; to distinguish between types of liability in case of violation of legislation on environmental protection, to carry out an economic assessment of natural resources, to use in practice the quality standards of the natural environment and industrial enterprises, to subdivide and determine the types of economic damage, to highlight the requirements for the formation and functioning of this mechanism, to select solutions for rational economic business behavior **Own**ability to work effectively in a team, to have the ability to work independently; to study legislative and regulatory documents, knowledge in the field of theoretical foundations for managing the "society-nature" system, protecting the health of citizens, methods of economic assessment of natural resources and reproduction of natural fertility, skills in generalizing the accumulated information about the characteristics of resources in Kazakhstan and other countries, about new types of energy, new materials, about the latest achievements in our country in the field of environmental economics

		Ecology of microorganisms	4	Students acquire **knowledge** about the interactions of microorganisms with the environment, their role in ecosystems and processes of biogeochemical cycles. They **are able** to analyze the ecosystem functions of microorganisms, conduct research on their interactions with the environment and assess their impact on biogeochemical processes.; **acquire skills** in working with microbiological research methods, analyzing microbial communities and applying environmental principles to study the role of microorganisms in the environment.
		Microbiomes		Students should **know** and understand the basic principles of microbiology, including the structural and functional features of prokaryotes and eukaryotes. Knowledge of cell biology, metabolism and interactions between microorganisms. **Be able** to plan and conduct research related to the study of microbiomes, including the choice of methods and analysis of the data obtained. Possess **the skills** of microbiome research, data analysis, interpretation of results, interdisciplinary approach, effective communication of scientific findings and application of modern methods of molecular biology
		Plant biotechnology	5	**Know about: m**methods of cultivation of cells, tissues and organs of plants in vitro; processes of dedifferentiation leading to the formation of callus; pathways of in vitro morphogenesis and factors regulating plant regeneration; theoretical and methodological principles of using cultured cells to obtain important metabolites, for clonal micropropagation and plant health improvement, to overcome incompatibility during distant hybridization; **Be able to**: put into practice the skills of working with plant cultures; control plant growth; **Own**skills: work in sterile conditions with isolated cells, tissues, callus mass; isolating an explant from a plant object; calculation of concentrations of nutrient solutions; preparation of nutrient solutions; cultivation of plant tissue cultures; skills of working with specialized laboratory equipment and devices for solving practical problems.

		Biotechnology in plant protection		**Know**: research activities in the field of biotechnology; the basic laws of natural science disciplines in the field of professional activity, the current state of biotechnology in the field of plant protection, the technology for the production of biopreparations for plant protection and their application; **Be able to**: to substantiate the use of biotechnological preparations for plant protection, to use biotechnological methods in an integrated plant protection system; **Own**skills and experience in conducting microbiological studies of plant samples and biological preparations for plant protection; skills of working with specialized laboratory equipment and devices for solving practical problems.
		Biotechnology of products of plant and animal origin	6	**Know:**about new achievements and methods in the biotechnology of the food industry for the production of products of plant and animal origin; **Be able to**analyze modern achievements in the field of biotechnology and draw up schemes for the production of the desired product; **Own**the skills of managing the technological process of obtaining biotechnological products based on various raw materials and the processes of isolation and purification of finished products.
		Biopharmaceutical Technology		**Know:**algorithm for the manufacture of biological products based on modern technologies in accordance with the international system of requirements and standards; principles of creating modern biological products based on plant raw materials and microbiological material; on the main regulatory documents related to the manufacture, quality control, storage and use of biological products; **Be able to:**use the rules and norms of the sanitary and hygienic regime, the rules for ensuring aseptic conditions for the manufacture of biological products in accordance with the current scientific and technical documentation; manage the technological process of obtaining biotechnological products based on various raw materials and the processes of isolation and purification of finished products; **Own**knowledge skills: on the optimization of the technology of biological products based on the rational microbiological processing of plant materials; about trends in the development of microbiological technologies using new strains of microorganisms.
	Special	Engineering enzymology		Know the directions, achievements and prospects for the development of engineering enzymology; scientific foundations of biocatalysis for the synthesis and modification of organic compounds, the use of immobilized enzymes and proteins in medicine to create new drugs; **Be able to**apply and manage the technological process of obtaining biotechnological products based on various raw materials and processes for the isolation and purification of finished products;

			7	**Have the skills to develop technological methods for the use of enzyme preparations; on the implementation of the results of scientific research in production**
		Fundamentals of chemical technology		**Know:**principles and methods for assessing production efficiency; general patterns of chemical processes; **Be able to:**calculate the main characteristics of the chemical process; apply knowledge and manage the technological process of obtaining biotechnological products based on various raw materials and processes for isolating and purifying finished products; **Own**: skills to perform basic laboratory analyzes to determine the quality indicators of a technological product
		Fundamentals of Ecological Biotechnology	7	**Know:**basic characteristics of wastewater; the importance of microorganisms in maintaining natural balance, new technologies for biopurification based on the use of new generation biocatalysts - immobilized enzymes and whole microbial cells; – principles of circularity and sustainable development; – world and EU experience in the field of circular economy; **Be able to**use knowledge bases and apply the acquired knowledge to develop strategies to address specific environmental problems;argue the importance of living organisms in bioremediation, bioremediation technology and the use of bioreactors to clean the environment; **Own**skills of setting up experimental experiments in laboratory conditions.
		Biotechnology of soil and water treatment		**Know:**types of microorganisms capable of destroying substances - pollutants; biological methods of soil and water treatment; mechanism of accumulation of pollutants in biological objects; **Be able to:**be guided by regulatory requirements in achieving the specified results of soil and water biological treatment;to argue the importance of living organisms in bioremediation, bioremediation technology; **Own**: approaches to the choice of methods, biological objects and equipment for biological purification of soil and water bodies from pollutants; information on ways to intensify bioremediation processes; skills in drawing up a technological scheme for the processes of biological purification of soils and water bodies from pollutants based on the results of scientific developments.
				Know the theoretical foundations of food toxicology;methods of conducting a study of the properties of raw materials, semi-finished products and finished food products, allowing you to create information-measuring complexes for express control; systems of quality and safety of production products, assess risks in the field of ensuring the quality and safety of production products, supply, storage and movement of products. Ways of contamination of

		Toxicological analysis of food products	7	food raw materials and foodstuffs by xenobiotics of chemical and biological origin. Radioactive contamination, dioxin contamination. Control methods for the use of food additives used in industrial food production. Methods and methods of detoxification of contaminated food and food raw materials **Be able to** apply specialized knowledge in practice and determine the content of harmful substances in food products; monitor and evaluate compliance with environmental, chemical (toxicological analysis) safety of food raw materials, food ingredients and finished products; develop methods for conducting a study of the properties of raw materials, semi-finished products and finished food products, allowing you to create information-measuring complexes for express control; influence the development and implementation of a quality and safety system for production products, assess risks in the field of ensuring the quality and safety of production products, supply, storage and movement of products **Own**skills in determining toxic substances in food products;the ability to develop methods for conducting a study of the properties of raw materials, semi-finished products and finished food products, allowing you to create information-measuring complexes for express control; the ability as part of a team to set research objectives, choose methods of experimental work, interpret and present the results of scientific research
		Food Chemistry		Know: the chemical composition of raw materials, semi-finished products and finished food products; methods for assessing the nutritional value of food products; general patterns of chemical, biochemical and microbiological processes occurring during the storage of raw materials; transformation and interaction of the main chemical components of raw materials in the process of technological processing in the production of food products and the influence of its modes on the composition, properties of the main nutrients, nutritional and biological value of raw materials and finished products; Apply knowledge and be able to determine the chemical qualitative and quantitative composition of the object under study, reasonably choose a test method for specific tasks; **Own**: skills to conduct an experiment with appropriate calculations and formulation of conclusions; basic chemical and physico-chemical methods of analysis to determine the properties and technological indicators of the materials used and finished products.
		Biological food safety		**Know**general basic information on chemistry; **Be able to**: apply knowledge and analyze physico-chemical analysis data, organize and plan the quality of raw materials and finished products; **Own**: methods for determining organoleptic, chemical and physical indicators of the microbiological quality of raw materials and finished products

		Biological safety of biotechnological production	7	**Know**methods of quality control and safety of biotechnological products and apply knowledge in biotechnological processes; **Be able to:**prepare micropreparations of microbial cells; conduct microscopy of biological objects (cells, tissues and their parts); **Own:**skills in working with micropreparations; - methods for selecting optimal modes for growing microbial cultures; methods of safety analysis of biotechnological products.
2	Special	Radiobiology		They acquire **knowledge** about the mechanisms of ionizing radiation effects on biological systems, including molecular, cellular and tissue levels, as well as the principles of radiation protection. **They are able** to assess the radiation effects on biological objects, conduct experiments with ionizing radiation and develop radiation protection measures. **They acquire skills** in working with radiometric devices, analyzing radiation damage at the cellular level and developing scientifically based measures to protect against radiation.
		Radioecology	8	acquire **knowledge** about the effects of radiation on ecosystems, the mechanisms of its spread in the environment and methods of assessing and minimizing radiation risk to nature and humans.. **They are able** to assess radiation pollution in the environment, analyze its impact on ecosystems and develop measures to reduce radiation risk.; **acquire skills** in conducting radiation monitoring, analyzing data on radiation pollution and the development of environmentally friendly strategies to eliminate it;

Table 2. The sequence of mastering the disciplines of social and professional interaction

Well	Supporting disciplines	Competencies	Expected results
1	History Kazakhstan	Competencies general education	**Know:** - demonstrate knowledge and understanding of the main stages of development of the history of Kazakhstan; **Be able to:** - correlate the phenomena and events of the historical past with the general paradigm of the world-historical development of human society through critical analysis; - be able to objectively and comprehensively comprehend the immanent features of the modern Kazakh model of development; **Own:**

			- possess the skills of analytical and axiological analysis in the study of historical processes and phenomena of modern Kazakhstan; - systematize and give a critical assessment of historical phenomena and processes in the history of Kazakhstan
1	Foreign language	Competencies general education	**Know**: - lexical minimum and language material of topics and subtopics in a given discipline (social and social and cultural spheres of communication). **Be able to:** - understand by ear not only individual phrases and frequently used words, but also more voluminous statements on topics directly related to it, - understand the main content of short simple messages on the radio, at the airport, at the station. - understand when reading the content of short, simple texts, advertisements, brochures, menus, bus and train schedules, short simple personal letters, e-mails. - communicate in simple typical situations that require the exchange of information within the framework of familiar topics and activities, be able to talk about family, living conditions, training sessions. - write a simple letter of a personal nature, a note, an autobiography. **Own:** - understanding of foreign language dialogic and monologue speech within the framework of general cultural and professional topics; - a foreign language at a level that allows to carry out the main types of speech activity; - different ways of oral and written communication; - skills of adequate response in situations of everyday, academic and professional communication; - Skills of listening, reading, writing.
1	Kazakh language/ Russian language	Competencies general education	**Know:** -theoretical foundations of the course (language, its functions, forms of speech, text, its features, styles of speech, functional and semantic types of speech); -features of dialogic and monologue speech; -types of scientific information and the specifics of its implementation in a scientific text; - elements of structural-semantic analysis and semantic analysis of a scientific text, components of a speech situation, speaker's intentions. **Be able to:** - to carry out the correct choice and use of language and speech means for solving certain problems of communication and cognition based on knowledge of a sufficient amount of vocabulary, a system of grammatical knowledge, pragmatic means of expressing intentions; - compose everyday, socio-cultural, official and business texts in accordance with generally accepted norms, functional orientation, using lexico-grammatical and pragmatic material of a

			certain certification level that is adequate to the goal; - convey the factual content of texts, formulate their conceptual information, describe inferential knowledge (pragmatic focus) of both the entire text and its individual structural elements; - interpret the information of the text, explain in the scope of the certification requirements the style and genre specifics of the texts of the socio-cultural, socio-political, official business and professional spheres of communication; - participate in communication in various situations in different spheres of communication in order to realize their own intentions and needs (everyday, educational, social, cultural), declaring them ethically correct, meaningfully complete, lexico-grammatically and pragmatically adequate to the situation; - discuss ethical, cultural, socially significant issues in discussions, express their point of view, defend it with arguments, critically evaluate the opinion of interlocutors; - build speech behavior programs in situations of personal, social and professional communication in accordance with the norms of the language, culture, specifics of the sphere of communication, certification requirements; - request and communicate information in accordance with the situation of communication, evaluate the actions and deeds of participants, use information as a tool to influence the interlocutor in situations of knowledge and communication in accordance with certification requirements. **Own:** - the skills of producing oral and written speech in accordance with the communicative goal and the professional sphere of communication; - language skills in various situations of everyday, socio-cultural, professional communication; - skills of searching, processing information in Russian; - types of speech activity.
1	Information and Communication Technologies	Competencies general education	**Know:**- what economic and political factors contributed to the development of information and communication technologies; - features of various operating systems, architecture. **Be able to:**- determine the main trends in the field of information and communication technologies; - use information resources to search and store information; - work with spreadsheets, perform data consolidation, build graphs; - apply methods and means of information protection; design and build simple websites; - to process vector and raster images; create multimedia presentations; use different communication platforms; - calculate and evaluate performance indicators of supercomputers; - use various forms of e-learning to expand professional knowledge; - use various cloud services. **Own:**have the skills to: - develop the structure of the database; - designing and creating presentations; - receiving data from the server; - creating video files; - work with Smart-applications; - work with services on the e-government website.

2	Philosophy	Competencies general education	**Know:** - basic philosophical concepts and categories, patterns of development of nature, society and thinking; - the essence of philosophical categories, the terminology of philosophy and the structure of philosophical knowledge, the functions of philosophy, the methods of philosophical research; - the place and role of philosophy in public life; **Be able to:** - use the foundations of philosophical knowledge to form a worldview position; - analyze worldview, socially and personally significant philosophical problems; - navigate in the system of philosophical knowledge as a holistic view of the foundations of the universe and the prospects for the development of planetary society; - understand the characteristic features of the modern stage of development of philosophy **Own:** - skills of philosophical analysis of various types of worldview; - the skills of philosophical thinking to develop a systematic, holistic view of the problems of society; - skills in analyzing texts with philosophical content
1	Sociology	Competencies general education	**nat:** - patterns and stages of the historical process, basic historical facts, dates, events and names of world and domestic historical figures; - the main events and processes of national history in the context of world history **Be able to:** - critically perceive, analyze and evaluate historical information, factors and mechanisms of historical changes; - to analyze civil and ideological positions in society, to form and improve their views and beliefs, to transfer the philosophical worldview to the field of material and practical activity; - use various philosophical methods to analyze trends in the development of modern society, philosophical and legal analysis **Own:** - skills of a holistic approach to the analysis of society's problems; - methods of philosophical, historical and cultural studies, techniques and methods for analyzing the problems of society; - causal relationships in the development of Kazakhstani society; the place of man in the historical process and the political organization of society; skills of respectful and careful attitude to the historical heritage
	Political science		**Know:** - the main stages in the development of political knowledge in the history of civilization;

			- schools and directions of modern political science; - the political life of society; - the political system and its institutions; - the essence of political processes in the country and the world. **Be able to:** - analyze the features of political systems and the functioning of political institutions; - to critically evaluate the theoretical approaches of political science; - identify interrelations and patterns of the political process; - compare political systems, institutions and actors in an intercountry and subnational context, based on the knowledge gained and the methods mastered. **Own:** - Have the skills (gain experience) of working with primary sources on the topics of the course; analysis of normative legal acts and other documents; search, processing and analysis of information; solving problems related to the assessment of the political course; group work, project activities, business games; public speaking; academic writing. Possess the skills of expressing one's thoughts and opinions in interpersonal and business communication in a foreign language; the skills of extracting the necessary information from the original text in a foreign language.
	Culturology		**Know:** - basic theories of culture, basic concepts of cultural studies; the main directions of the methodology of modern cultural analysis; - the history of the formation of world culture and civilization, the theoretical features of basic cultural concepts, various interpretations of culture and civilization in world and domestic literature; - Actual problems of the development of modern culture; -the idea of culture as a socio-historical phenomenon; - patterns of development of world cultures, as well as the typology of the classification of cultures; -basic knowledge about the history of the most important cultures of mankind; - about the ways of acquiring, storing and transferring the basic values of culture - about the diversity and intrinsic value of different cultures, - forms and types of culture, the patterns of their functioning and development, the main cultural and historical regions - the history of Kazakh culture, its place in the system of world culture and civilization **Be able to:** - be able to highlight the features of a given culture, its dominant values; - explain the specifics of intercultural communication;

			- be able to conduct independent professional activities in a dynamically changing multicultural society; - be able to navigate in the cultural environment of modern society; - be able to explain the phenomenon of culture, its role in human life; - be able to navigate in cultural issues, independently understand the influence of cultural factors on the behavior of individuals; - **Own:** - practical skills to preserve and enhance the national and world cultural heritage; - practical skills in the practical use of knowledge and skills in matters of taking into account the specifics of the cultural behavior of various individuals and groups in the modern conditions of the formation of civil society in the Republic of Kazakhstan.
	Psychology		**Know:**the meaning and place of psychology in the system of sciences; the main directions of personality development in modern psychology; personal values and meanings in professional self-determination; the relationship and mutual influence of the psyche and body; techniques and methods of effective communication. **Be able to:**interpret basic psychological theories, concepts; use methods and mechanisms of regulation of emotions in everyday life; identify patterns of behavior in a conflict situation and conduct self-diagnosis. **Own:**definitions of individual psychological characteristics of a person, value-semantic representations in the professional self-determination of a person; recognition of psychological impact and effective communication.
1	Fundamentals of economic and legal knowledge	Competence of general education	To know: methods of scientific research in economics,various theories about entrepreneurship, financial literacy and market economy, types of entrepreneurial activity, spheres of entrepreneurship, to master various quantitative and qualitative methods for creating the future of your own business, entrepreneurial calculations, analytical calculations and forecasts, the main provisions of the Constitution and the current legislation of the Republic of Kazakhstan, the system of public administration bodies and their terms of reference, the mechanism of interaction of substantive and procedural law, the essence of corruption and the reasons for its origin, current legislation in the field of anti-corruption. Be able to: analyze and justify the reality of business plans, market segmentation, competently and professionally assess the market situation for the organization of their business, creatively approach the solution of various economic tasks, possess practical skills of independent economic work in the field of entrepreneurship, calculate your personal budget, have clear background information and fast and correct orientation to economic indicators, analyze events and actions from the point of view of the field of legal regulation and be able to refer to the necessary regulations, navigate the current legislation, using the law to protect their rights and interests, to use spiritual and moral mechanisms to prevent corruption.

			Skills: acquire practical skills in building graphs and diagrams illustrating various economic models, independent economic work in the field of entrepreneurship, quickly and correctly navigate the actual source information and estimated economic indicators, determine the levels of financial security, have the skills to identify problems of an economic nature in the analysis of specific situations and their solutions, taking into account the actions of economic patterns at the micro and macro levels, conducting discussions on legal issues, on the application of norms in the modern period, analysis of the situation of conflict of interests and moral choice.
1	Fundamentals of scientific and environmental knowledge	Competence of general education	To know: forms and methods of pre-scientific, scientific and extra-scientific cognition, modern approaches to socio-humanitarian knowledge and their commensurability; basic epistemological models, the nature of transformations of the concept of rationality; fundamentals of ecology and safe human activity in the habitat, environmental factors and their impact on living organisms, methods for identifying, eliminating the influence of harmful factors on humans and environment, and providing comfortable conditions for human life and activity. Be able to: formulate and solve problems that arise in the course of research and require in-depth professional knowledge; modify existing and develop new methods based on the tasks of a specific study; choose methods of protection from hazards in relation to the field of their professional activities and choose ways to ensure comfortable living conditions. Possess: the skills of conducting independent research and scientific and pedagogical activities that require extensive education in the appropriate direction; the ability to apply methodological and methodological knowledge in conducting scientific research; the skills to ensure the safety of life in professional activities, living conditions and in emergency situations.
1	Biotechnology objects	Basic competencies	**Know:**objects of biotechnology - representatives of groups of living organisms - microorganisms (bacteria, protists, yeasts, microalgae, cyanobacteria), viruses, plants, animals and components of cells and subcellular structures. **Be able to**: work with the main objects of biotechnology: microorganisms, plants and animals; cultivate cultures on nutrient media; work with a microscope and apply in practice. **Have an idea**about: - structural and functional features and classification of objects of biotechnology; - principles of selection of producers of biologically active compounds; - principles of cell and genetic engineering; - principles of implementation of industrial safety of industrial strains; - the main directions of the use of bioresources in industrial production.
1	academic writing	Basic competencies	**Know:**to build the structure of the main part of the study, reasonably expounds scientific judgments, competently introduces illustrative material into the work; **be able to**formulate the relevance, novelty, theoretical and practical significance of the study, as well as the hypothesis and expected results of the study; **own**skills that allow them to navigate research methods and select relevant tools for the implementation of their own scientific project and apply knowledge.

1	Cytology and histology	Basic competencies	**Know:**the main features of the structure, metabolism, patterns of reproduction, specialization of cells, the main features of the structure, development, functioning and evolution of animal and plant tissues, tissue types; general regularities in the structure of cells of various types, tissues and non-cellular structures; the role of cellular organelles in the processes of cell functioning; various theories of the origin of eukaryotic cells; basic methods of studying cytology and histology; **Be able to:**Apply in practice the skills of work, determine the cells of various tissues and their characteristic structures on micropreparations and electron micrographs, ensuring the performance of their inherent functions; determine the various components of cells when studying histological preparations and electron micrographs; use the knowledge gained in the study of various types of cells and tissues to prove the unity of living matter; explain the evolution of the cell from the standpoint of evolutionary theory; explain the properties of cells and tissues from the standpoint of a systematic approach to the study of biological objects; **Own**:the main methods of preparation of temporary preparations; the method of microscopic study of histological objects; skills of working with specialized laboratory equipment and devices for solving practical problems.
1,2,3,4	Physical Culture	Competences of general education	**Know**: - the role of physical culture in the development and training of a specialist; - the foundations of the state policy of the Republic of Kazakhstan in the field of physical culture and sports; - theoretical and methodological foundations of physical culture; - the main achievements of the Republic of Kazakhstan in the field of physical culture; - hygienic and organizational bases of physical culture and sports. **Be able to**: - use in life practical skills that ensure the preservation and strengthening of health, the development and improvement of psychophysical abilities and qualities; - use physical culture - sports and recreational activities to achieve life and professional goals; - apply the rules of safe conduct of physical exercises and sports. **Own:**- skills of organizing sports - mass competitions; - exercises on professional - pedagogical physical training of general physical training, special physical training, as well as to put into practice special games; - a system of practical skills that ensure the preservation and strengthening of health, the development and improvement of psychomotor abilities and qualities.
3	Professional Kazakh (Russian) language	Professional competencies	**Know:** - professional vocabulary and terminology; - the specifics of oral communication in the professional field; - linguistic features of oral and written communication; - features of business communication and business etiquette. **Be able to:** - use the Russian language in interpersonal communication and professional activities; - to carry out business communication and conduct business conversations on professional topics; - to make out and transfer the necessary information in writing; - explain your point of view and critically evaluate the provisions put forward; - create your own statements, essays, etc. - apply business etiquette in speech

			Own: - skills of expressing one's thoughts and opinions in interpersonal and business communication in Russian; - professional terms and concepts; - analysis of professional text; - information competence: the ability to work with a book, textbook, reference literature, dictionaries, find the necessary information.
3	Professionally oriented foreign language	Professional competencies	**Know:** - lexical material on the topics of this discipline; - regulatory requirements for registration (official letter, essay, etc.). mprove pronunciation skills; evelop productive and receptive lexical and grammatical skills; o improve the skills of dialogic speech of a general nature associated with situations of everyday d professional communication; - develop listening skills (with a full understanding of what they heard); - develop and improve writing skills; - improve the skills of introductory, studying, viewing and searching reading. **Be able to:** - automate the technical skills of reading to oneself; – develop the ability to transmit scientific information and literature of a socio-political nature; – develop the skills of monologue (prepared) speech - the deployment of the thesis; – to master reversed reading aloud of the prepared message; – teach referencing skills. **Own:** - complexity in solving practical, educational, educational and developmental goals (at the same time, practical goals act as leading ones); communicative orientation of the learning process.
2	General microbiology and biotechnology	Professional competencies	**Know:**principles of classification of microorganisms, structural features and vital activity; methods for isolating pure cultures of aerobic and anaerobic bacteria; fundamentals of genetics of microorganisms; composition of microflora and its significance; the basic regularities of the vital activity of microorganisms and their relationships with each other, morphology, principles of systematics and physiology of the main groups of microorganisms; **Be able to**: isolate physiological groups of microorganisms from natural substrates, make temporary preparations and microscope them at various magnifications, be able to work with the immersion microscope system and apply in practice; **Own**: determining the belonging of microorganisms to a certain morphological or ecological group, their physiological state; skills of working with microbiological material, specialized laboratory equipment and

			devices for solving practical problems.
2	General and molecular genetics	Professional competencies	**Know:**subject, tasks of general and molecular genetics, history of its development; material foundations of heredity and variability, structure and types of nucleic acids, realization of hereditary information (biosynthesis of proteins), patterns of inheritance of traits, basics of genetic analysis, chromosome theory of heredity, gene structure, basic molecular cellular mechanisms, current state of genetics problems; **Be able to:**Use knowledge, solve genetic problems for mono-, di- and polyhybrid crossing; competently conduct experiments to study heredity and variability; learn how to use the learned techniques and methods of genetics for the needs of biotechnology; to use the basic patterns of heredity and variability, the characteristics of genetic material, the basics of genetic analysis, the chromosome theory of heredity, the types and causes of variability in organisms when solving practical problems for biotechnological processes; **Own:**skillsbuilding a second DNA strand; building and RNA; determining the amino acid composition of proteins in accordance with the nucleotide composition of DNA or mRNA; using the hybridological method for studying the patterns of inheritance of traits; compiling pedigrees, presenting them in graphical form and analyzing the type of inheritance of a pathological trait; forecasting the development of a hereditary disease in a carrier of a pathological gene or predicting the birth of a child with a hereditary pathology.
2	Inorganic and Analytical Chemistry	Basic competencies	**Know:**all the main stoichiometric laws of chemistry and be able to apply them in solving computational problems; electronic and spatial structure, reactivity, electronic effects; patterns of various types of reactions, chemical properties of compounds, their effect on a living organism. **Be able to:**apply knowledge on the basis of the periodic law and the structure of the electron shells of atoms to predict the properties and interaction of chemical elements and their compounds and solve quantitative problems corresponding to these transformations; calculate the equilibrium concentrations of substances, according to the known initial concentrations and the equilibrium constant; calculate the amount of components of solutions of a given concentration; prepare solutions of a certain concentration, move from one type of concentration to another. **Have skills**: writing reactions for the preparation and interaction of inorganic compounds; implementation of the synthesis, isolation of the target substance from the reaction medium; conducting a simple educational and research experiment based on mastering the basic techniques of working in the laboratory; performing calculations, reporting results, formulating conclusions.
2	Organic chemistry	Basic competencies	**Know**: the subject of organic chemistry, the theory of the chemical structure of A.M. Butlerov, the characteristics of the covalent bond; isomerism; reactions of addition, elimination, substitution, rearrangement, homolytic and heterolytic reactions; homological series of methane, ethylene, acetylene, oxygen-containing compounds, nitrogen-containing compounds, their nomenclature, laboratory and industrial production methods, physical and chemical properties; **Be able to**: apply knowledge and depict structurally isomers of the main classes of organic compounds; give names according to different types of nomenclature and determine the structure of a substance by name; be able to describe the reaction taking into account the mechanism and determine the reaction products, analyzing the conditions for its implementation; **Own**basic chemical laws, theories, regularities and chemical transformations for explanation and use in

			real chemical processes encountered in the educational process; use calculation methods to solve various chemical tasks of an educational and scientific-laboratory nature; know the methods of safe use of chemical materials, taking into account their physical and chemical properties.
3	Biochemistry	Basic competencies	**Know:**– the basic principles of the formation of the most important biological macromolecules-proteins, nucleic acids, carbohydrates, lipids; - the functional role of proteins, nucleic acids, carbohydrates, lipids, hormones in life processes; - specific and kinetic nature of enzymes, as well as the role of enzymes for biotechnology; - properties of DNA and RNA and their role in the preservation and transmission of genetic data; - main metabolic pathways and regulatory mechanisms; - theoretical and practical significance of biochemistry, its connection with other natural sciences; - recent achievements in the field of biochemistry and prospects for their application in various fields of biotechnology, the national economy, medicine, and pharmacy; – relationship between biological functions and molecular structures of compounds; - connection of natural molecules with biotechnological productions. **Be able to:**apply the acquired knowledge in the discipline "Biochemistry" to study other disciplines, as well as to solve problems in the practice of biotechnology; - conduct a qualitative and quantitative analysis of biological materials; - work with biochemical equipment and apparatus; - apply theoretical knowledge in solving technological problems; **Master the skills**conducting practical research; study sources of data on biological chemistry; work on laboratory equipment, methods of observation and experiment.
2	Fundamentals of Biotechnology	Professional competencies	**Know:**new research methods, scientific and research and production aspects of their professional activities; Be able to: put into practice skills and abilities in organizing research and design work in team management, apply a variety of methodological approaches to modeling and designing varieties, plant protection systems, techniques and technologies for crop production; **Own**: the skills of drawing up practical recommendations on the use of research results and presenting the results in the form of reports, abstracts, publications and public discussions.
3	Industrial Biotechnology	Professional competencies	**Know:**specifics of industrial biotechnological processes; methods and methods of selection of highly productive strains; main elements of typical schemes of industrial biotechnology processes; modern hardware design of biotechnological productions; ways and methods of ensuring the safety of microbiological production. **Be able to:**develop a general scheme of the biotechnological process and individual stages of production; control the progress of the process and obtain the final product. **Own**work skills: in the field of laboratory, pilot and industrial production to create a biotechnological product; on modern laboratory equipment; isolation and purification of biologically active substances.
3	Modern methods in biotechnology	Professional competencies	**Know:**theoretical foundations for obtaining products of microbial synthesis; patterns of growth kinetics of microorganisms and formation of metabolic products; methods of cultivation of microorganisms; **Atmark:**analyze modern achievements in the field of biotechnology; work with pure cultures of microorganisms; to conduct the process of cultivation of microorganisms in flasks; apply in practice specialized knowledge of the fundamental sections of microbiology and the skills of performing research to master the microbiological processes occurring in the production of various products; evaluate the quantitative characteristics of the growth of microorganisms;

			Own:methods of working with microorganisms; rules for safe work in a microbiological laboratory.
3	Plant Physiology/ Physiology of man and animals	Basic competencies	**Know:**aboutthe subject and tasks of plant physiology; scientific and theoretical foundations for the study of life processes in plants; plant cell totipotency and its use in biotechnology; water exchange of plants; photosynthesis process, leaf pigments, light and dark phase; mineral nutrition; plant respiration; growth and development of plants; physiological basis of protection and sustainable development; **Be able to:**put into practice the skills of work and set up experiments on the removal of physiological indicators of plants; compare and find differences between experimental and control plants; **Own**skills in working with a microscope, specialized laboratory equipment and preparation of micropreparations; sketching objects from life and under a microscope; observation of processes in the plant cell. Know about the subject and tasks of human and animal physiology, the history of development, the theoretical and methodological foundations of physiology; physiology of excitable tissues, analyzers, particular physiology of the central nervous system, qualitative differences in physiological functions in animals at different levels of evolutionary development; mechanisms that ensure the interaction of individual parts of the body and the body as a whole with the external environment; **Be able to**carry out anthropometric measurements; determine the main physiometric indicators; **Own**skills of working with specialized laboratory equipment and devices for solving practical problems and research activities in the field of biotechnology; organize and conduct experiments using the knowledge, skills and abilities of working with animals and humans.
3	Fundamentals of physical and chemical analysis / Physical and colloidal chemistry	Basic competencies	**Know:**theoretical foundations of physico-chemical analysis; **Be able to**apply use the concepts and methods of physical and chemical analysis and apply physical, chemical and mathematical laws to solve practical problems, draw up analysis schemes, select a method to achieve a specific goal; **Own**: basic methods of chemistry definitions and analysis of objects; theoretical foundations of physical and chemical chemistry./ **Know:**the purpose and objectives of physical and colloidal chemistry, ways to solve them, the basic laws of physics and chemistry, physical and chemical phenomena and patterns used in physical and colloidal chemistry; safety rules for working in a chemical laboratory and with physical equipment; solutions and processes occurring in aqueous solutions; Be able to use the basic techniques and methods of physical and chemical measurements; work with the main types of instruments used in physical and colloidal chemistry; make calculations on the issues under study; carry out elementary statistical processing of experimental data in physical and chemical experiments; **Own:**methods of statistical processing of experimental results of physical and chemical studies; technique for conducting basic physico-chemical experiments.
2	Fundamentals of Python Programming/ Mathematical modeling in biology	Professional	**Know:**basic data collection and processing methods in Python; **Be able to:**apply knowledge and find the data necessary for working in a programming language; **Own:**programming skills in Python; Ability to work with different data file formats **Know:**basic research methods; **Be able to:**identify and systematize the main ideas in scientific texts; critically evaluate any incoming information, regardless of the source; avoid automatic application of standard formulas and techniques

			when solving problems; possess the skills of collecting, processing, analyzing and systematizing information on the research topic; skills in choosing methods and means for solving research problems
3	Fundamentals of food biotechnology/ Isolation and purification of biotechnology products	Professional	**Know:**the latest achievements in the field of biotechnology in the food industry; traditional biotechnological processes used in the food industry; microbiological processes in food production; the influence of enzymes, food additives, biologically active substances on the quality and properties of biological raw materials and food products based on it; general food production technology; methods for studying food quality indicators; **Be able to**: apply theoretical and practical knowledge and use the knowledge gained to analyze experimental data regarding the selection, characterization and improvement of biotechnology objects, as well as their use in various technological processes of food production; use knowledge of technologies and factors affecting the rate of biochemical processes in food production; **Own:**technique for determining the quality indicators of bacterial, yeast and enzyme preparations, food additives, biologically active substances, finished food products; technique for selecting raw materials, assortment and technology for the production of food products that are produced by the food industry./ **Know**main groups of biotechnology products and their most important characteristics, basic concepts and principles of isolation methods, purification of biotechnology products, methods of chemical, biochemical identification and determination of biotechnology products; **Be able to:**solve professional problems and use the basic laws of biochemistry, molecular biology in the development of technologies for the isolation and purification of biologically active substances; use quantitative and qualitative methods for the analysis of biotechnology products; **Own**skills of managing the technological process of isolation and purification of finished products.
3	Animal Biotechnology/ Biotechnology in Animal Welfare	Professional	**Know**Keywords: general biological foundations of animal biotechnology, experimental approaches to cellular and embryological engineering, principles of cloning of genetic transformation of somatic and germ cells of animals; on the application of biotechnological methods in the science and practice of animal husbandry and medicine; Be able to: apply theoretical knowledge for implementation in science and practice; **Own**skills: handling microscopic equipment and specialized laboratory equipment and instruments for solving practical problems./ **Know**: information about the organization of work to protect animals at an agricultural enterprise; the possibility of using biological objects for the protection of animals, methods of biotechnology in the protection of animals; **Be able to**use biological objects to protect animals; **Own**the skills of organizing and conducting experiments, using the knowledge, skills and abilities of working with various objects of biotechnology.
3	Technological equipment of the food industry /	Professional	Know the basic laws of the course; understand the essence of the main methods used in the operation of biotechnological machines; have an idea about modern problems of operation of biotechnological machines; Know how to apply andoperate modern professional biotechnological equipment and devices; **Own**skills of the ability to organize, plan and manage existing biotechnological processes and production./ Know the basic concepts, stages of biotechnological processes, the main methods of chemical

	Processes and devices in biotechnology		identification of substances; **Be able to**choose equipment, type of producers and conditions for conducting a specific biotechnological process;operate modern professional biotechnological equipment and devices, as well as organize, plan and manage existing biotechnological processes and production; **Own** skills in the use of biotechnological equipment.
4	Agricultural biotechnology/ Medical and Veterinary Biotechnology	Professional	**Know:**about the conditions and factors for the development and creation of finished biotechnological products, the main patterns and methodological approaches used in the creation of new bioproducts needed in various branches of agriculture; **Be able to**use methods and make a creative approach to the production technologies of modern bioproducts for agriculture in the study of biotechnological processes and industries; **Own:**skills in drawing up a technological scheme of processesproduction of modern bio-products for agriculture./ **Know:**main and priority directions of development of medical and veterinary biotechnology. the main sources of medicinal, diagnostic, prophylactic agents and related products; innovative biotechnological methods and techniques for improving drug producers and biotechnological processes; **Be able to:**apply in practice the acquired theoretical knowledge about the basic biotechnological methods used in the field of medical and veterinary biotechnology; **Own:**knowledge of the functioning of the general scheme of biotechnological production, obtaining highly effective producers by methods of genomics, proteomics and bioinformation methods of writing abstracts and articles on the topic being developed, a system of techniques that allow obtaining the necessary information from Internet resources
4	Fundamentals of designing biotechnological production / industrial ecology	Professional	**Know**: basic principles of designing food enterprises; norms of technological design of food industry enterprises; basic principles of organization of biotechnological production, methods for assessing the effectiveness of production; a schematic diagram of biotechnological production; selection criteria and equipment for the stages of cultivation, isolation and purification of biosynthesis products; the most important structural elements of machines and devices; methods and equipment for transportation of solid, liquid and gaseous media; instrumentation and automatic control systems for biotechnological processes; norms of safety and labor protection; **Be able to:**draw up a scheme of biotechnological production; formulate arguments and solve problems, problems on biotechnology issues **Own**knowledge of the most important structural elements of machines and apparatuses and the norms of technological design of food industry enterprises./ Know: the specifics and mechanism of the toxic effects of harmful substances, energy effects and the combined action of factors; legal, regulatory, technical and organizational foundations of environmental safety; means and methods for improving the safety and environmental friendliness of technical means and technological processes; **Be able to**: identify the main hazards of the human environment, technological processes and equipment, evaluate the effectiveness of various methods and devices for protecting the environment from pollutants and develop recommendations for reducing environmental pollution; use basic means of environmental quality control; operate modern professional biotechnological equipment;

			Ownskills in applying methods of instrumental control of parameters and levels of negative impacts of environmental pollution on personnel, population and the natural environment.
4	Standardization and certification of biotechnological products/ Environmental management	Professional	**Know:**basic concepts and definitions of standardization and certification; the main provisions of systems (complexes) of general technical and organizational and methodological standards; technical regulations; product quality; scope of certification; rules and procedures for certification; **Be able to:**apply theoretical and practical knowledge to the requirements of regulatory documents for the main types of products and processes; apply quality system documentation; use measuring instruments; **Own**knowledge in the field of standardization and certification and the ability to work with regulatory and technical documentation; / **Know**: the laws of development of nature and society in the light of the emergence and development of environmental management; methodology for planning and implementing an environmental management system in an organization; To be able to: use professionally conduct managerial, marketing, commercial, advertising work related to the environmental activities of the organization; develop;apply in practice the norms of environmental law in the system of eco-management; create an eco-management system at different levels of economic activity, aimed at achieving the goals of clean, low-waste and non-waste production; **Own**:methods for assessing the ecological state of an enterprise: to master modern technologies of eco-management, eco-audit

3.List of modules included in the educational program

Module number	Name of the module	The list of disciplines included in the module	Block	Term	Volume of loans	Form of control	Total credits by module
M1	Instrumental and communication module	Information and Communication Technologies	MC GED	1	5	Ex.	29
		Foreign language	MC GED	1.2	10	Ex.	
		Kazakh (Russian) language	MC GED	1.2	10	Ex.	
		Academic writing	UK BD	2	4	Ex.	
M2	Module of historical and philosophical knowledge	History of Kazakhstan	MC GED	2	5	GE	10
		Philosophy	MC GED	4	5	Ex.	
M3	Socio-political knowledge module	Sociology	MC GED	2	2	Ex.	8
		Political science	MC GED	2	2	Ex.	
		Culturology	MC GED	1	2	Ex.	
		Psychology	MC GED	1	2	Ex.	
M 4	Module of economic, legal, scientific and environmental knowledge	Fundamentals of economic and legal knowledge	MC GED	2	3	Ex.	5
		Fundamentals of scientific and environmental knowledge	MC GED		2	Ex.	

M5	Health Promotion Module	Physical Culture	MC GED	1-4	8	Dif. offset	8
M2	Professional languages	Professional Kazakh (Russian) language	UC BD	6	3	Ex.	6
		Professionally oriented foreign language	UC BD	6	3	Ex.	
M 6	Biotechnology facilities	Biotechnology objects	UC BD	1	5	Ex.	29
		Cytology and histology	UC BD	1	3	Ex.	
		Educational practice (objects of biotechnology)	UC BD	2	1	Dif. offset	
		General microbiology and biotechnology	UC BD	3	6	Ex.	
		General and molecular genetics	UC BD	3	5	Ex.	
		Cellular Biotechnology / Cellular Plant Breeding	UC BD	3	5	Ex.	
		Plant Physiology / Human and Animal Physiology	UC BD	5	4	Ex.	
M 7	Fundamentals of chemical technology	Inorganic and Analytical Chemistry	UC BD	3	6	Ex.	19
		Organic chemistry	UC PD	4	5	Ex.	
		Biochemistry	UC PD	5	5	Ex.	
		Engineering enzymology / Fundamentals of chemical technology	UC PD	7	3	Ex.	
M 8	Biotechnology and biosafety	Fundamentals of physico-chemical analysis of food products / Physical and colloidal chemistry	UC BD	6	4	Ex.	21
		Biological food safety / Biotechnological safety of biotechnological production	UC PD	7	5	Ex.	
		Toxicological analysis of food products / Food chemistry	UC PD	7	6	Ex.	
		Standardization and certification of biotechnological products / Environmental management	UC PD	8	6	Ex.	
M9	Methodology of scientific research	Field trip I	UC BD	4	2	Divide standings	12
		Fundamentals of Biotechnology	UC PD	4	5	Ex.	
		Modern methods in biotechnology	UC PD	6	5	Ex.	
M10	Microorganisms in the biotechnological process	Field trip II	UC BD	6	4	Divide standings	19
		Ecology of microorganisms/ Microbiomes	КВ БД	4	5	Ex.	
		Industrial Biotechnology	UC PD	5	5	Ex.	
		Radiobiology/ Radioecology	КВ ПД	8	5	Ex.	
M11	Biotechnological processes and programming	Fundamentals of Python Programming / Mathematical Modeling in Biology	UC BD	4	3	Ex.	16
		Technological equipment of the food industry / Processes and apparatuses in biotechnology	CC PD	6	5	Ex.	
		Fundamentals of designing biotechnological production /	CK PD	7	5	Ex.	

		Industrial ecology					
		Undergraduate practice	UK PD	8	3	Divide standings	
M12	Fundamentals of biotechnology	Phyto resources in biotechnology / Animal resources in biotechnology	CC BD	3	6	Ex.	30
		Fundamentals of food biotechnology / Isolation and purification of biotechnology products	CC BD	5	5	Ex.	
		Agricultural biotechnology / Medical and veterinary biotechnology	CC BD	7	5	Ex.	
		Field trip III	UC PD	8	8	Divide standings	
		Biotechnology of products of plant and animal origin / Technology of biological products	UC PD	6	6	Ex.	
M13	Environmental management	Environmental protection and monitoring / Rational use of natural resources	CC BD	4	4	Ex.	20
		Plant biotechnology / Biotechnology in plant protection	CC BD	5	5	Ex.	
		Animal Biotechnology / Biotechnology in Animal Welfare	CC BD	5	5	Ex.	
		Fundamentals of Ecological Biotechnology / Biotechnology of soil and water treatment	CC BD	7	6	Ex.	
M.14	Final certification	Final certification	FA	8	8	FC	8
Total					**240**		**240**