

MODULAR EDUCATIONAL PROGRAM  
6B05121 "Biotechnology"

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## Content

1. Explanatory note
2. The graduate's competence model

## 1. EXPLANATORY NOTE

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

- The Law of the Republic of Kazakhstan "On Education" dated 27.07.2007 with additions and amendments dated 21.02.2019;
- The State mandatory standard of education at all levels of education, approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan No. 604 dated 31.10.2018.
  - \* Rules of the organization of the educational process on credit technology of training. which are approved by the order of the Minister of Education and Science of the Republic of Kazakhstan dated 12.10.2018 (No. 563).
  - \* Standard rules of activity of educational organizations implementing educational programs of higher and (or) postgraduate education, approved by the order of the Minister of Education and Science of the Republic of Kazakhstan dated 30.10.2018.
  - \* Form 26 "Structure of the modular educational program" No. 1 dated 17.01.2014
- Item 01.04/2012 of the Regulation on the formation of the trajectory of students' education No. 1 dated 25.10.2012;
- \* Regulations on the MOS

The MOS is designed as a set of sequential training modules for the entire period of study and is aimed at mastering the competencies necessary for awarding the Bachelor of Science degree in the educational program 6B05121 "Biotechnology".

The modules of the block of general education disciplines (OOD) include disciplines of the mandatory component: (OK) - 51 credits and optional components (KV) - 5 credits, common to all specialties of education.

The block of basic disciplines (DB) includes disciplines of the university component (OK) - 36 credits and elective components (KV) - 76 credits.

The block of profile disciplines (PD) includes disciplines of the university component (OK) - 22 credits and elective components (KV) - 38 credits.

Additional types of training (DVO) – 12 credits, which include the military department and the Final state certification.

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

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

The MOS consists of 20 modules.

When developing a modular educational program, the recommendations and wishes of external stakeholders - potential employers were taken into account (round table "Social Partnership: prospects and problems" dated 08.01.2020), who proposed to expand the material on the topic of biological processing and purification of industrial waste from various industries in the discipline "Fundamentals of eco-logical biotechnology" (educational program 6B05121 "Biotechnology").

Also, the social partners noted that the formulated learning outcomes of this educational program are relevant and achievable.

**The field (application of knowledge and skills) of the graduate's activity (where he can work):**

- manufacturing enterprises and laboratories of the food, processing, microbiological, medical, pharmaceutical industries;
- research institutes and universities, biotechnological, biological, medical, agricultural profile;
- breeding and variety testing stations, plant protection stations;
- environmental services and organizations;
- sanitary and epidemiological stations;
- laboratories for quality control and food safety;
- agricultural enterprises
- - fish-breeding and fur-breeding plants;
- standardization and certification centers, etc.

Graduates of the specialty 6B05121 "Biotechnology" can perform the following types of professional activities:

- production and technological;
- scientific research;
- project;
- selection;
- organizational and managerial.

**List of qualifications and positions.** Graduates of specialty 6B05121 "Biotechnology" can perform the following types of professional activities:

- biotechnologist;
- researcher at research laboratories;
- food production technologist;
- inspector of sanitary and epidemiological stations, environmental services;
- specialist in laboratories for quality control and safety of food products, agricultural enterprises, standardization and certification centers.

**The purpose of the educational program.** Training of highly qualified specialists in the field of biotechnology, able to navigate modern information flows and adapt to dynamically changing phenomena and processes in the world economy, with a high level of readiness to implement the main professional functions and focused on the industrial and innovative development of the region.

**Distinctive features of the educational program.** The educational program is aimed at the formation of professional competencies that provide employment opportunities for related professions in various organizations in the positions of: biotechnologist, researcher of research laboratories, food production technologist, inspector of sanitary and epidemiological stations and environmental services, specialist in laboratories for quality control and food safety, in standardization and certification centers.

A bachelor who has received training in this educational program will be competitive in the labor market.

## II. THE GRADUATE'S COMPETENCE MODEL

The learning outcomes are determined on the basis of the Dublin descriptors of the first level (Bachelor's degree) and expressed in terms of competencies.

Competence is the ability of a specialist in a particular field to apply knowledge, skills, and abilities: to successfully solve the tasks of professional activity according to specified standards; to create new objects and technologies in the field of science and technology.

The competence model is a ranked set of competencies describing the key qualities, behavior, knowledge, skills and other characteristics of the graduate necessary to achieve quality standards and efficiency of work activity.

The competence model of a graduate is a scientifically grounded, detailed image of a future specialist, which should be obtained as a result of mastering this educational program.

Competencies 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 degree program, the graduate should have general education, basic and professional competencies.

### 1. General education competencies (OC):

1) evaluate the surrounding reality on the basis of worldview positions formed by knowledge of the fundamentals of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical cognition;

2) to show a civic position based on a deep understanding and scientific analysis of the main stages, patterns and peculiarities of the historical development of Kazakhstan and to use methods and techniques of historical description to analyze the causes and consequences of events in the modern history of Kazakhstan;

3) to assess situations in various spheres of socio-political disciplines, applying in practice knowledge in the field of social sciences and humanities,

4) to engage in communication in oral and written forms in Kazakh, Russian and foreign languages to solve the problems of interpersonal, intercultural and industrial (professional) communication, using various types of information and communication technologies;

5) 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 methods and means of physical culture.

ON15: systematize, summarize legal and economic information for use in professional, including entrepreneurial activities. Analyze, summarize economic information and systematize safety standards for use in professional activities

## **2. Basic Competencies (BC):**

1) to use the skills of working with specialized laboratory equipment and devices to solve practical problems and research activities in the field of biotechnology; to organize and conduct experiments using the knowledge, skills and skills of working with various objects of biotechnology; (ON1)

2) is able to use the basic concepts and methods of analysis and apply physical, chemical and mathematical laws to solve practical problems in the professional activity of a biotechnologist; (ON2)

3) to apply in practice specialized knowledge of fundamental sections of microbiology and research skills to master microbiological processes occurring in the production of food, biologically active substances and secondary metabolites, as well as to evaluate the results obtained; (ON3)

4) possess the basics and methods of biotechnology, the principles of selection of biotechnological objects and requirements for them; (ON5)

5) manage the technological process of obtaining biotechnological products based on various raw materials and processes of separation and purification of finished products; (ON7)

6) to use the basic laws of heredity and variability, features of genetic material, the basics of genetic analysis, chromosomal theory of heredity, types and causes of variability of organisms in solving practical problems in the field of genetic engineering, breeding, for biotechnological processes; (ON10)

7) to argue the importance of living organisms in bioremediation, bio-purification technology and the use of bioreactors for environmental purification; (ON13)

8) is able to use state and foreign languages in professional activities, scientific and practical work, in communication with foreign colleagues, for self-educational and other purposes; (ON14)

## **3. Professional Competencies (PC):**

1) to use the skills of working with specialized laboratory equipment and devices to solve practical problems and research activities in the field of biotechnology; to organize and conduct experiments using the knowledge, skills and skills of working with various objects of biotechnology; (ON1)

2) to apply in practice specialized knowledge of fundamental sections of microbiology and research skills to master microbiological processes occurring in the production of food, biologically active substances and secondary metabolites, as well as to evaluate the results obtained; (ON3)

3) analyze modern achievements in the field of biotechnology and new directions in the development of the biotechnological industry, as well as use some production technologies according to these achievements; (ON4)

4) demonstrate knowledge of the selection of raw materials, assortment and technology of food production, which are produced by the food industry; (ON6)

5) manage the technological process of obtaining biotechnological products based on various raw materials and processes of separation and purification of finished products; (ON7)

6) operate modern professional biotechnological equipment and scientific instruments, as well as organize, plan and manage existing biotechnological processes and production; (ON8)

7) know the principles of building technological schemes, technical and technological documentation; selection criteria and calculation of the areas of production workshops, laboratories and auxiliary premises; (ON9)

8) monitor and evaluate compliance with environmental, chemical (toxicological analysis) and biological safety of food raw materials, food ingredients and finished products at biotechnological production enterprises and in production and technological laboratories; (ON11)

9) demonstrate knowledge in the field of standardization and certification and the ability to work with regulatory and technical documentation; (ON12)

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

Course	Providing disciplines	Competencies	Expected result
1	The modern history of Kazakhstan	OC	<p>-Demonstrate knowledge of the main periods of the formation of the historical past of the independent Kazakh statehood; -correlate the phenomena and events of the historical past with the general paradigm of the world-historical development of human society through critical analysis; - master the techniques of historical description and analysis of the causes and consequences of events in the modern history of Kazakhstan; -to propose possible solutions to modern problems based on the analysis of the historical past and reasoned information; - to analyze the features and significance of the modern Kazakh model of development; - to determine the practical potential of international dialogue and respect for spiritual heritage; - to substantiate the fundamental role of historical knowledge in the formation of Kazakhstan's identity and patriotism; - to form their own civil position on the priorities of mutual understanding, tolerance and democratic values of modern society.</p>
1	Foreign language	OC	<p>The student has the following learning outcomes:            1) systematizes the conceptual foundations of understanding the communicative intentions of the partner, the authors of texts at this level; 2) compares and selects the forms and types of speech/communication corresponding to the communicative intention with a logical construction adequate to the type of speech; 3) adequately expresses his own communicative intentions with the correct selection and appropriate use of appropriate linguistic means, taking into account their compliance with the socio-cultural norms of the language being studied; 4) classifies the levels of use of real facts, references to authoritative opinion; speech behavior is communicatively and cognitively justified; 5) identifies patterns of development of a foreign language, paying attention to the study of stylistic originality; 6) knows the techniques of linguistic description and analysis of the causes and consequences of events in texts of a scientific and social nature; 7) expresses in a foreign language possible solutions to modern problems based on the use of reasoned information; 8) evidently uses language material with reasoned language means sufficient for this level, corrects mistakes in a timely manner and independently with 75% of error-free utterances; 9) knows the strategy and tactics of constructing a communicative act, correctly forms speech intonation, relying on lexical sufficiency within the framework of speech topics and grammatical correctness.</p>
1	Kazakh (Russian) language	OC	<p><u>Russian language</u>            The student has the following learning outcomes:            1) to make the right choice and use of language and speech means to solve certain communication and cognition tasks based on knowledge of a sufficient volume of vocabulary, grammatical knowledge system, pragmatic means</p>

of expressing intentions; 2) to convey the factual content of texts, formulate their conceptual information, describe the deductive knowledge (pragmatic focus) of both the entire text and its individual structural elements; 3) interpret the information of the text, explain the style and genre specifics of the texts of socio-cultural, socio-political, official business and professional spheres of communication in the scope of certification requirements; 4) request and report information in accordance with the communication situation, evaluate the actions and actions of participants, use information as a tool to influence the interlocutor in situations of cognition and communication in accordance with certification requirements; 5) build programs of speech behavior in situations of personal, social and professional communication in accordance with the norms of language, culture, specifics of the sphere of communication, certification requirements; 6) discuss ethical, cultural, socially significant problems in discussions, express your point of view, defend it in a reasoned manner, critically evaluate the opinion of interlocutors; 7) participate in communication in various situations of different spheres of communication in order to realize their own intentions and needs (domestic, educational, social, cultural), stating them ethically correctly, meaningfully fully, lexically-grammatically and pragmatically adequate to the situation; 8) compose everyday, socio-cultural, official business texts in accordance with generally accepted norms, functional orientation, using lexicogrammatical and pragmatic material of a certain certification level adequate to the goal.

#### Kazakh language

The student has the following learning outcomes:

students should know: the basic functions of the language, functional and semantic types of speech and their features, functional speech styles, communicative tasks of the text, techniques of text compression, techniques of annotating, taking notes and reviewing the text;

students should be able to: understand information on topics of personal, public, educational and professional spheres of life, note the highlighted provisions in argumentation in general, understand the implied and openly stated provisions in texts and direct messages; use language correctly and effectively in conversation on personal and professional topics, noting the connection of the theses expressed, clearly express their position through appropriate explanations; to argue, to evaluate the information received, to speak on professional topics, to solve typical and professional tasks in order to master professional and communicative skills, to formulate a topic, to determine the language features of the text;

the student must possess: the language system and the ways of its use in intercultural and communicative activities, possess the speech and communication system, the skills of using information from the media, official sources and fiction, possess the skills of creating texts of different functional types, have an idea of the peculiarities of the functioning of language in scientific discourse, possess the skills of description, generalization and analysis of information, compression of scientific text.

1	Information and communication technologies (in English language)		OC	<p><b>To know:</b> - what economic and political factors contributed to the development of information and communication technologies; - features of various operating systems, architecture;</p> <p><b>Be able to:</b> - identify 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 create simple websites; - process vector and raster images; create multimedia presentations; use various platforms for communication;- calculate and evaluate performance indicators of supercomputers; - use various forms of e-learning to expand professional knowledge; - use various cloud services.</p> <p><b>Possess skills:</b></p> <p>- development of the database structure; - designing and creating presentations; - receiving data from the server; - creating video files; - work with Smart applications; - work with services on the e-government website.</p>
2	Philosophy		OC	<p>The student has the following learning outcomes:</p> <p>1) describe the main content of ontology and metaphysics in the context of the historical development of philosophy; 2) explain the specifics of philosophical understanding of reality; 3) substantiate the worldview as a product of philosophical understanding and study of the natural and social world; 4) classify the methods of scientific and philosophical knowledge of the world; 5) interpret the content and specific features of the mythological, religious and scientific worldview; 6) substantiate the role and significance of key ideological concepts as values of social and personal existence of a person in the modern world; 7) analyze the philosophical aspect of media texts, socio-cultural and personal situations to justify and make ethical decisions; 8) formulate and competently argue their own moral position in relation to the current problems of modern global society; 9) conduct research relevant to identify the philosophical content of problems in the professional field and present the results for discussion.</p>
1	Social and political knowledge module	Sociology	OC	<p>Have an idea: about the subject and the basic laws of sociology, about the social structure of society and the ways of socialization of personality in society; about the sociological approach to personality, the basic laws and forms of regulation of its social behavior; about the mechanism of the emergence of social communities and social groups, the dynamics of social processes.</p> <p>To know: the main categories of sociology and their place in the analysis of social phenomena; typology, the main sources of the emergence and development of mass social movements, forms of social interactions, factors of social development of society; types and structures of social organizations; the main features of social institutions; the content of the theory of social management in organizations.</p> <p>Be able to: analyze the social structure of society, the nature of the changes taking place in it; apply the basic provisions of sociological science to analyze social phenomena and processes occurring in society and production collectives; conduct sociological research and have the skill of processing empirical social information; use the results of sociological research to solve practical problems of training and education of subordinates, increase the efficiency of economic work.</p>

		Political science	OC	<p>To know:- the main stages of the development of political knowledge in the history of civilization;- schools and directions of modern political science;- political life of society;- the political system and its institutions;- the essence of political processes in the country and the world.</p> <p>Master skills and abilities:- to use scientific methods of cognition, which contributes to the formation of a scientific worldview; - to show the place of political science in the system of social and humanitarian sciences; - to independently analyze, think critically and politically;- develop your intelligence and broaden your horizons;- develop your civic position and bear social responsibility to society.</p>
		Cultural studies	OC	<p>The student has the following learning outcomes:</p> <ul style="list-style-type: none"> <li>- must study and understand the essence and role of culture in the life of society, its structure and functions, its typologization, differentiation into branches, types and forms, the human purpose of culture;- be able to analyze theoretical systems, concepts and categories that make it possible to form a holistic picture of the formation and development of culture, and formulate rules of description that reflect the specifics of the deployment of socio-cultural processes;- must analyze and carry out an adequate assessment of the influence of the integral phenomenon of culture, its various types, branches, types and forms on the formation of social and spiritual qualities of personality, social community, society as a whole; - must be able to explain the features of cultural complexes, phenomena and events, mechanisms of functioning of cultural agents and institutions, their socializing impact on the formation of personality based on scientific understanding of the revealed facts, trends and patterns of development of socio-cultural processes</li> </ul>
		Psychology	OC	<p>To 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;- interrelation and mutual influence of the psyche and body;- techniques and techniques of effective communication.</p> <p>Be able to:- to study the psychological characteristics of students and classroom groups to solve professional problems; - to take into account the individual psychological characteristics of the individual when designing the educational process; - to identify patterns of behavior in a conflict situation and conduct self-diagnosis of the prevailing type of behavior in a conflict situation;- develop psychological recommendations for the development of tolerant behavior.</p> <p>Master:- personal self-regulation skills (stress management);- skills of prevention of emotional burnout in professional activity; - skills of recognition of psychological impact;- effective communication skills.</p>
1,2	Physical culture		OC	<p>To know: - the role of physical culture in the development and training of a specialist; - fundamentals 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.</p> <p>Be able to: - use practical skills and abilities in life that ensure the preservation and strengthening of health, development and improvement of psychophysical abilities and qualities; - use physical culture, sports and wellness activities to achieve</p>

			<p>life and professional goals; - apply the rules for the safe conduct of physical exercises and sports.</p> <p>Possess: - the skills of organizing mass sports competitions; - exercises for professional and pedagogical physical training, general physical training, special physical training, as well as apply special games in practice; - a system of practical skills that ensure the preservation and strengthening of health, development and improvement of psychomotor abilities and qualities.</p>
1	Module of economic and legal knowledge	OC – ON15	<p><b>Fundamentals of market economy and entrepreneurship</b></p> <p>Have an idea: about the theoretical and methodological foundations of entrepreneurship, about trends in the organization and evaluation of the effectiveness of entrepreneurial activity, about state mechanisms for supporting and regulating the development of entrepreneurship, about the mechanisms of functioning of enterprises and firms of various organizational and legal forms that are an integral part of professional education and allow making effective decisions in the implementation of practical activities.</p> <p>Be able to: use the acquired knowledge to develop an effective system for building a business and have the necessary competencies to solve problems in the field of research; demonstrate their knowledge in the field of entrepreneurship, including the organization, development and management of Kazakhstani enterprises, provide information to interested persons and specialists in the field of entrepreneurship about directions, ideas, problems and ways to solve them, summarize and interpret information about the theoretical foundations and experience of entrepreneurship to draw conclusions taking into account social, economic, scientific or ethical approaches.</p> <p>Have skills: independent continuation of education, organization of entrepreneurship.</p> <p><b>Fundamentals of law and anti-corruption culture</b></p> <p>The student should know: the basics and essence of corruption offenses; the system and legislative foundations of the fight against corruption; the importance of the state and values and their legislative protection; the development and features of branches of law in public relations; the issue of responsibility and penalties for corruption; the application of legislation and their application; the general foundations of the Constitution of the Republic of Kazakhstan; the main provisions of the current legislation of Kazakhstan; the system of state bodies and their powers; the mechanism between substantive and procedural law.</p> <p>The student must be able to correctly assess the behavior of his or another person in a specific life situation, choose the right way to protect them in case of violation of their rights, correctly analyze them when working with regulatory legal acts in the field of public administration.;</p> <p>The student must have basic legal concepts and legal institutions, general theoretical knowledge;</p> <p>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; use the right to their own rights and interests.</p> <p>Skills: conducting discussions on legal issues, on the application of norms at the present stage, legal analysis of various</p>

			<p>documents. The student should be able to correctly analyze the acquired knowledge and regulatory legal acts, determine its basic concepts;</p> <p>The student should be able to apply the acquired knowledge in practice and form experience working with the main regulatory legal acts in this area, skills of respect, observance of rights and freedoms inherent in legal culture.</p>
	Module of economic and natural knowledge		<p><b>Fundamentals of market economy and entrepreneurship</b></p> <p>Have an idea: about the theoretical and methodological foundations of entrepreneurship, about trends in the organization and evaluation of the effectiveness of entrepreneurial activity, about state mechanisms for supporting and regulating the development of entrepreneurship, about the mechanisms of functioning of enterprises and firms of various organizational and legal forms that are an integral part of professional education and allow making effective decisions in the implementation of practical activities.</p> <p>Be able to: use the acquired knowledge to develop an effective system for building a business and have the necessary competencies to solve problems in the field of research; demonstrate their knowledge in the field of entrepreneurship, including the organization, development and management of Kazakhstani enterprises, provide information to interested persons and specialists in the field of entrepreneurship about directions, ideas, problems and ways to solve them, summarize and interpret information about the theoretical foundations and experience of entrepreneurship to draw conclusions taking into account social, economic, scientific or ethical approaches.</p> <p>Have skills: independent continuation of education, organization of entrepreneurship.</p> <p><b>Fundamentals of life safety and ecology</b></p> <p>To know: the legislative framework for life safety and environmental control, as well as methods for identifying, eliminating the influence of harmful factors on humans and the environment, and ensuring comfortable conditions for human life and activity.</p> <p>Be able to: systematize safety standards for use in professional activities; choose methods of protection from hazards in relation to the field of their professional activities and choose ways to ensure comfortable living conditions.</p> <p>Possess the skills of ensuring the safety of life in industrial, domestic conditions and in emergency situations, the skills of first aid.</p>
1	Biotechnology objects	BC – ON1	<p>To know: objects of biotechnology - representatives of groups of living organisms - microorganisms (bacteria, protists, yeast, microalgae, cyanobacteria), viruses, plants, animals and components of cells and subcellular structures.</p> <p>Be able to:</p> <ul style="list-style-type: none"> <li>- work with the main objects of biotechnology: microorganisms, plants and animals;</li> <li>- cultivate crops on nutrient media;</li> <li>- work with a microscope.</li> </ul> <p>Have ideas about:</p>

			<ul style="list-style-type: none"> <li>- structural and functional features and classification of biotechnology objects;</li> <li>- principles of selection of producers of biologically active compounds;</li> <li>- principles of cellular and genetic engineering;</li> <li>- principles of implementation of industrial safety of production strains;</li> <li>- the main directions of the use of biological resources in industrial production.</li> </ul>
1	Physics	BC – ON2	<p><b>Know:</b> - basic laws and principles of physics; - methods of control of physical phenomena;</p> <p><b>Be able to:</b> - express physical theories, laws in mathematical form; - conduct experimental work;</p> <p><b>Skills:</b> - use the laws of physics in theoretical problems;- apply the acquired knowledge in practice.</p>
2	Inorganic and analytical chemistry	BC – ON2	<p><b>Знать:</b> все основные стехиометрические законы химии и уметь применять их при решении расчетных задач; электронное и пространственное строение, реакционную способность, электронные эффекты; закономерности протекания различных типов реакций, химические свойства соединений, их влияние на живой организм.</p> <p><b>Уметь:</b> на основании периодического закона и строения электронных оболочек атомов прогнозировать свойства и взаимодействие химических элементов и их соединений и решать соответствующий этим превращениям количественные задачи; рассчитывать равновесные концентрации веществ, по известным исходным концентрациям и константе равновесия; рассчитывать количества компонентов растворов заданной концентрации; готовить растворы определенной концентрации, переходить от одного вида концентрации к другому.</p> <p><b>Иметь навыки:</b> написания реакций получения и взаимодействия неорганических соединений; осуществления синтеза, выделения целевого вещества из реакционной среды; проведения простого учебно-исследовательского эксперимента на основе овладения основными приемами техники работ в лаборатории; выполнения расчетов, оформления результатов, формулирования выводов.</p>
2	Organic chemistry	BC – ON2	<p><b>Know:</b> all the basic 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.</p> <p><b>Be able to:</b> on the basis of the periodic law and the structure of the electronic shells of atoms, predict the properties and interaction of chemical elements and their compounds and solve quantitative problems corresponding to these transformations; calculate equilibrium concentrations of substances, according to known initial concentrations and the equilibrium constant; calculate the number of components of solutions of a given concentration; prepare solutions of a certain concentration, move from one type of concentration to another.</p> <p><b>Have the skills to:</b> write reactions for the production and interaction of inorganic compounds; carry out synthesis, isolation of the target substance from the reaction medium; conduct a simple educational and research experiment based on mastering the basic techniques of work in the laboratory; perform calculations, design results, formulate conclusions.</p>

3	Biochemistry	BC – ON2	<p>To 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; - the specific and kinetic nature of enzymes, as well as the role of enzymes for biotechnology; - the properties of DNA and RNA and their role in the preservation and transmission of genetic data; - the main pathways of metabolism and mechanisms of regulation; - 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, national economy, medicine, pharmacy; - the relationship between biological functions and molecular structures of compounds; - the relationship of natural molecules with biotechnological industries.</p> <p>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; - carry out qualitative and quantitative analysis of biological materials; - work with biochemical equipment and apparatuses; - apply theoretical knowledge in solving technological problems; Possess practical research skills; study data sources on biological chemistry.</p> <p>Must master: - modern laboratory methods of biochemistry in the study of biological molecules to solve practical problems of biotechnology.</p>
3	Professional Kazakh (Russian) language	BC – ON14	<p>To know: professional terminology, subject area in the Kazakh (Russian) language, in the practice of communication and professional activity.</p> <p>Be able to: consistently and competently formulate and express their thoughts in their native language, possess oral and written language skills in Kazakh (Russian) to work with scientific texts and public speeches; possess a lexical and terminological minimum in the specialty; be able to use oral communication skills in general scientific and professional communication.</p> <p>Skills: have the skills to develop communication tools, skills to express their thoughts in Kazakh (Russian) using chemical, biological and biotechnological terms; possess the basic principles of translation.; has language skills to a degree sufficient for successful communication with educated native speakers, both in written and oral form, including on professional topics; skills in professional terminology on biotechnology; the use of the state language in professional activities, scientific and practical work, in communication with foreign colleagues, for self-educational and other purposes.</p>
4	Professionally- oriented foreign language	BC – ON14	<p>To know: features of oral and written professionally-oriented texts, including scientific and technical ones; general scientific terminology of the specialty in English; the main stylistic characteristics of the scientific presentation of the material in the studied foreign language.</p> <p>Be able to: read fluently, translate original literature on the chosen specialty; independently prepare and make oral reports on professional topics, including using multimedia tools; recognize and use the basic terminology of the specialty in oral and written statements.</p>

			Have the following skills: independent reading and translation of original literature in the specialty in order to extract the necessary information; writing articles, abstracts and reports related to the scientific interests of students; Is able to use a foreign language in professional activities, scientific and practical work, in communication with foreign colleagues, for self-educational and other purposes.
1	Cytology and Histology	BC – ON1	To know: the main features of the structure, metabolism, patterns of reproduction, specialization of cells, basic features of the structure, development, functioning and evolution of animal and plant tissues, tissue types; general patterns of the structure of cells of various types, tissues and non-cellular structures; the role of cellular organoids in the processes of cell functioning; various theories of the origin of eukaryotic cells; basic methods of studying cytology and histology; be able to: identify cells of various tissues on micro-preparations and electronic microphotographs and their characteristic structures that ensure the performance of their functions; identify various components of cells when studying histological preparations and electronic microphotographs; use the knowledge gained from studying various types of cells and tissues to prove the unity of living matter; explain the evolution of cells 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; possess: the conceptual apparatus of the discipline; the basic methods of preparation of temporary preparations; the technique of microscopic examination of histological objects; skills of working with specialized laboratory equipment and devices for solving practical problems.
	Cell and tissue biology	BC – ON1	Know: similarities and differences in the structure and functioning of bacterial, plant, fungal and animal cells; characteristic features of all tissues in comparison with each other; be able to: analyze the composition of cell populations of a multicellular organism; possess methods of cell biology, histology: ultrastructural microscopy, analytical cytology, cytogenetic methods, molecular biology; use skills with specialized laboratory equipment and devices to solve practical problems.
2	Phyto and zoological resources in biotechnology	BC – ON1	To know: the species composition and ecological characteristics of plants and animals of the Earth, the Republic of Kazakhstan, East Kazakhstan Region and the city of Semey used in biotechnology and the prospects for their use; to be able to: give a brief description of the objects of the animal and plant world used in the biotechnological process; to have the skills to work with specialized laboratory equipment and devices for solving practical problems.
	Biotechnology raw materials	BC – ON1	To know the theoretical and methodological foundations of the use of raw materials; to be able to apply the acquired knowledge to solve environmental problems; to have the skills to work with specialized laboratory equipment and devices for solving practical problems.
2	Microbiology and virology	BC – ON1	To know: basic properties, classification, role, possibilities of use in the production of microorganisms; biological features of microorganisms causing food spoilage; basic properties, structure and classification, the role of viruses, bacteriophages; to be able to: use literature in the field of microbiology and virology; to maintain production cultures of microorganisms; to possess: methods for determining the properties of microorganisms, isolation of pure cultures of microorgan-

			isms, methods of microbiological studies used to assess environmental objects; skills of working with specialized laboratory equipment and devices for solving practical problems.
	General Microbiology	BC – ON1	To know: principles of classification of microorganisms, features of structure and vital activity; methods of isolation of pure cultures of aerobic and anaerobic bacteria; fundamentals of the genetics of microorganisms; composition of microflora and its values; basic laws 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 microscopize them at different magnifications, be able to work with the immersion system of a microscope; possess: determination of 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	Cell biotechnology	BC – ON1	To know about: the subject, the tasks of the history of development, objects, methods of cellular biotechnology, trends in the development of cellular biotechnology in the modern world and its most promising areas, cellular biotechnology of microbiological systems, genetic engineering of plants and animals, achievements of cellular biotechnology in medicine, environmental aspects of biotechnology; to be able to: critically analyze scientific experiments; to have the skills to work with specialized laboratory equipment and devices for solving practical problems.
	Cell selection of plants	BC – ON1	To know the purpose and objectives of cellular plant breeding, the main directions, methods of cellular 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; possess the skills of organizing and conducting experiments using knowledge, skills and skills of working with various objects of biotechnology.
2	General and Molecular Genetics	BC – ON10	To know: the subject, the tasks of general and molecular genetics, the history of its development; the material foundations of heredity and variability, the structure and types of nucleic acids, the implementation of hereditary information (protein biosynthesis), the patterns of inheritance of traits, the basics of genetic analysis, chromosomal theory of heredity, gene structure, the main molecular cellular mechanisms, the current state of the problems of genetics; be able to: solve genetic problems for mono-, di- and polyhybrid crossing; competently conduct experiments to study heredity and variability; to learn how to use the studied techniques and methods of genetics for the needs of biotechnology; to use the basic laws of heredity and variability, features of genetic material, the basics of genetic analysis, chromosomal theory of heredity, types and causes of variability of organisms in solving practical problems for biotechnological processes; to have skills: building a second DNA chain; building mRNA; determining the amino acid composition of proteins in accordance with the nucleotide composition of DNA or mRNA; the use of a hybridological method for studying the patterns of inheritance of traits; drawing up pedigrees, presenting them graphically and analyzing the type of inheritance of a pathological trait; making a forecast of the development of a hereditary disease in a carrier of a pathological gene or a forecast of the birth

			of a child with a hereditary pathology.
	Genetics with the basics of breeding	BC – ON10	To know: the material foundations of heredity, variability and mechanisms of their implementation; patterns of inheritance of traits; the influence of genotype and environmental factors on the development of the organism; to be able to: apply the basic laws of heredity and patterns of inheritance of traits to the analysis of inheritance of normal and pathological traits, as well as to conduct breeding work; to use the basic laws of heredity and variability, features of genetic material, fundamentals of genetic analysis, chromosomal theory of heredity, types and causes of variability of organisms in solving practical problems in the field of breeding; to possess: methods of genetic, cytogenetic and population analysis of the phenomena of heredity and variability; skills of describing karyotypes of plants and animals.
2	Plant physiology	BC – ON10	To know: about the subject and tasks of plant physiology; scientific and theoretical foundations of the study of life processes in plants; totipotency of plant cells and its use in biotechnology; plant water metabolism; photosynthesis process, leaf pigments, light and dark phase; mineral nutrition; plant respiration; plant growth and development; physiological foundations of protection and sustainable development; be able to: conduct experiments to remove physiological indicators of plants; compare and find differences between experimental and control plants; possess skills of working with a microscope, specialized laboratory equipment and preparation of micro-preparations; sketching objects from nature and under a microscope; observing processes in a plant cell.
	Anatomy and morphology of plants	BC – ON10	Master the basic botanical terms underlying the anatomy and morphology of plants; know the structure of cells, tissues and organs of plants; about the formation of the structure of plant organisms in ontogeny and phylogeny; be able to use equipment and devices to solve practical problems.
2	Human and animal physiology	BC – ON1	To know about the subject and tasks of human and animal physiology, the history of development, theoretical and methodological foundations of physiology; physiology of excitable tissues, analyzers, private 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 organism and the organism as a whole with the external environment; to be able to conduct anthropometric measurements; to determine the basic physiometric indicators; to use the skills of working with specialized laboratory equipment and devices to solve practical problems and research activities in the field of biotechnology; to organize and conduct experiments using the knowledge, skills and skills of working with animals and humans.
	General physiology	BC – ON1	To know: basic anatomical and physiological concepts and terms; morphofunctional organization of a person; the main mechanisms of regulation of the functions of biological systems of the body; the main mechanisms of adaptation and protection of a healthy organism under the influence of environmental factors; to be able to: the essence of specific reactions and their analytical effects; violations of the basic functional indicators of human activity; the most important indicators of human activity at rest and under load; possess: skills of working with specialized laboratory equipment and devices for solving practical problems, including the skills of measuring the main functional characteristics of human

			activity (pulse, blood pressure).
2	Fundamentals of Genetic Engineering	BC – ON10	Know the methods of gene isolation and genetic design, objects of genetic engineering in various industries: biotechnology, medicine, agriculture, etc.; be able to apply the knowledge gained to develop strategies for solving specific technological problems; use the basic laws of heredity and variability, features of genetic material, the basics of genetic analysis, chromosomal theory of heredity, types and causes of variability of organisms in solving practical problems in the field of genetic engineering, for biotechnological processes.
	Basics of Molecular Biotechnology	BC – ON10	To know the basic methodological principles and approaches of molecular biotechnology; to be able to: use the acquired knowledge to improve theoretical training, as well as learn how to apply them in practice; to use the basic laws of heredity and variability, features of genetic material, the basics of genetic analysis, when solving practical problems for biotechnological processes; be competent: - in the ability to professionally use the skills of conducting experimental research in standard and changing situations in future professional activities.
3	Biotechnology of microorganisms	BC – ON3	To know: the basics of growing microorganisms, products of microbiological synthesis and technology of biomass collection; requirements for final products and raw materials; to be able to determine the specific composition of microorganisms of the desired food industry object; to develop the composition of microorganisms and additives and its introduction into production; to possess the skills of applying in practice specialized knowledge of fundamental sections of microbiology and skills of performing research to master microbiological processes occurring in food production.
	Industrial Microbiology	BC – ON3	To know: the theoretical foundations of the production of microbial synthesis products; the laws of the kinetics of the growth of microorganisms and the formation of metabolic products; methods of cultivation of microorganisms; to be able to: work with pure cultures of microorganisms; to conduct the process of cultivation of microorganisms in flasks; to apply in practice specialized knowledge of fundamental sections of microbiology and research skills to master the microbiological processes occurring in the production of various products; to evaluate the quantitative characteristics of the growth of microorganisms; possess: techniques for working with microorganisms; rules for safe work in a microbiological laboratory.
3	Plant Biotechnology	BC – ON1	Know about: methods of cultivation of cells, tissues and organs of plants in vitro; processes of dedifferentiation leading to the formation of callus; ways of morphogenesis in vitro and factors regulating plant regeneration; theoretical and methodological principles of using cultured cells to obtain important metabolites, for clonal micro-reproduction and plant health improvement, to overcome incompatibility with distant hybridization; be able to: work with plant cultures; control plant growth; have skills: work in sterile conditions with isolated cells, tissues, callus mass; isolation of explant from a plant object; calculation of nutrient solution concentrations; preparation of nutrient solutions; cultivation of plant tissue cultures; skills in working with specialized laboratory equipment and devices for solving practical problems.
	Biotechnology in plant protection	BC –	Know: 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 of production of biological products for plant protection and their applica-

		ON1	tion; be able to: justify the use of biotechnological preparations for plant protection, use biotechnological techniques in an integrated plant protection system; have the skills and / or experience to conduct microbiological studies of plant samples and biological products for plant protection; skills of working with specialized laboratory equipment and devices for solving practical problems.
3	Basics of food biotechnology	BC – ON6	To know: the latest achievements in the field of biotechnology in the food industry; traditional biotechnological processes used in the food industry; microbiological processes in the production of food; the effect of enzymes, food additives, biologically active substances on the quality and properties of biological raw materials and food based on it; general technology of food production; methods of research of food quality indicators; be able to: use the acquired knowledge to analyze experimental data concerning 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 speed of biochemical processes in food production; possess: techniques for determining the quality indicators of bacterial, yeast and enzyme preparations, food additives, biologically active substances, finished foods; the technique of selection of raw materials, assortment and technology of food production, which are produced by the food industry.
	Isolation and purification of biotechnology products	BC – ON7	To know the main groups of biotechnological products and their most important characteristics, the basic concepts and principles of methods of isolation purification of biotechnological products, methods of chemical, biochemical identification and determination of biotechnological products; to be able to: use the basic laws of biochemistry, molecular biology in the development of technologies for isolation and purification of biologically active substances; to use quantitative and qualitative methods for the analysis of biotechnological products; to manage the technological process of isolation and purification of finished products.
3	Animal Biotechnology	BC – ON1	To know: general biological fundamentals of animal biotechnology, experimental approaches to cellular and embryological engineering, principles of cloning of genetic transformation of somatic and germ cells of animals; about the application of biotechnological methods in the science and practice of animal husbandry and medicine; to be able to: use theoretical knowledge for implementation in science and practice; to acquire: practical skills in handling microscopic equipment and specialized laboratory equipment and devices for solving practical problems.
	Biotechnology in animal protection	BC – ON1	To know: information about the organization of animal protection works at an agricultural enterprise; the possibility of using biological objects for animal protection, methods of biotechnology in animal protection; be able to use biological objects for animal protection; have the skills to organize and conduct experiments using knowledge, skills and skills of working with various objects of biotechnology.
3	Basics of physical and chemical analysis	BC – ON2	To know: the theoretical foundations of physico-chemical analysis; to be able to: use the concepts and methods of physico-chemical analysis and apply physical, chemical and mathematical laws to solve practical problems, to draw up analysis schemes, to select a method to achieve a specific goal; to possess: basic techniques of chemistry definitions and analysis of objects; theoretical foundations of physico-chemical chemistry.

	Physical and Colloid Chemistry	BC – ON2	To know: the purpose and objectives of physical and colloidal chemistry, ways to solve them, the basic laws of physics and chemistry, physico-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 basic techniques and methods of physico-chemical measurements; work with the main types of devices used in physical and colloidal chemistry; make calculations on the issues under study; to carry out elementary statistical processing of experimental data in physico-chemical experiments; to possess: methods of statistical processing of experimental results of physico-chemical studies; techniques for conducting basic physico-chemical experiments.
3	Fermentation biotechnology	BC – ON3	To know: the basics of biotechnology and the technique and technology of fermentation production, technical requirements for raw materials, materials and finished products; to possess: the skills of using research methods and devices for conducting research, as well as laboratory research skills; to be able to: apply in practice specialized knowledge of fundamental sections of microbiology and research skills to master microbiological processes of fermentation production.
	Technical Microbiology	BC – ON3	To know: the basic laws of the vital activity of microorganisms; the role of individual groups of microorganisms in the processes occurring in the biosphere and the possibility of their use in practice; to be able to: apply in practice specialized knowledge of fundamental sections of microbiology and research skills to master microbiological processes occurring in the production of food, biologically active substances and secondary metabolites, as well as to evaluate the results obtained; to master the skills of: determining the belonging of microorganisms to a certain morphological or ecological group, their physiological state.
4	Engineering Enzymology	BC – ON7	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 medicines; be able to manage the technological process of obtaining biotechnological products based on various raw materials and processes of isolation and purification of finished products.
	Chemical Technology Basics	BC – ON2	To know: principles and methods of production efficiency evaluation; general laws of chemical processes; to be able to: calculate the main characteristics of the chemical process; to manage the technological process of obtaining biotechnological products based on various raw materials and processes of isolation and purification of finished products; to possess: skills of performing basic laboratory analyses to determine the quality indicators of a technological product.
4	Fundamentals of environmental biotechnology	BC – ON13	To know: the main characteristics of wastewater; the importance of microorganisms in preserving the natural balance, new technologies of bio-purification based on the use of biocatalysts of a new generation-immobilized enzymes and whole microbial cells; to be able to: apply the knowledge gained to develop strategies for solving specific environmental problems; to argue the importance of living organisms in bioremediation, bio-purification technology and the use of bioreactors for environmental purification; to possess the skills of setting experimental experiments in laboratory conditions.
	Biotechnology for	BC –	To know: types of microorganisms capable of destroying pollutants; biological methods of cleaning soils and reservoirs;

	cleaning soils and ponds	ON13	the mechanism of accumulation of pollutants in biological objects; to be able to: be guided by regulatory requirements when achieving the specified results of bioremediation of soils and reservoirs; to argue the importance of living organisms in bioremediation, bioremediation technology; to possess: approaches to the selection of methods, biological objects and equipment for bioremediation of soil and reservoirs from pollutants; information on ways to intensify bioremediation processes; skills of drawing up a technological scheme of processes of bio-purification of soils and reservoirs from pollutants based on the results of scientific developments.
2	Fundamentals of Biotechnology	PC – ON5	Have an idea of the main objects, methods and principles used in biotechnology; about the current state of various branches of biotechnology; about the requirements for biotechnological industries and biotechnological products. To know: modern requirements for biotechnological products; fundamentals of solving theoretical and applied problems of biotechnology; prospects for the development of biotechnology. Have the skills to: use biotechnological equipment.
3	Industrial Biotechnology	PC – ON8	To know: the specifics of industrial biotechnological processes; methods and methods of breeding highly productive strains; the main elements of standard schemes of industrial biotechnology processes; modern hardware design of biotechnological productions; methods and methods of ensuring the safety of microbiological productions. Be able to: develop a general scheme of the biotechnological process and individual stages of production; monitor the progress of the process and obtain the final product. Possess the skills of work: 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	PC – ON4	Be able to apply the acquired knowledge to further improve the level of practical and theoretical training. To do this, it is necessary to understand the essence of methods in biotechnology to study the main processes and their regulation. Have the skills of appropriate selection of methods and analysis of experimental results; Possess the skills of planning and conducting experiments in various branches of biotechnology.
3	Biotechnology of plant and animal products	PC – ON7	To know: about new achievements and methods in the biotechnology of the food industry for the production of products of plant and animal origin; to be able to draw up schemes for the production of the desired product; to manage the technological process of obtaining biotechnological products based on various raw materials and processes of isolation and purification of finished products.
	Biopreparations technology	PC – ON7	To know: the algorithm for the manufacture of biological products based on modern technologies in accordance with the international system of requirements and standards; the principles of creating modern biological products based on plant raw materials and microbiological material; about the main regulatory documents related to the manufacture, quality control, storage and use of biological products; to be able to: use the rules and norms of sanitary and hygienic regime, rules for ensuring aseptic conditions for the manufacture of biological products in accordance with the current NTDs; to manage the technological process of obtaining biotechnological products based on various raw materials and the

			processes of isolation and purification of finished products; to have an idea: about the optimization of the technology of biological products based on rational microbiological processing of plant raw materials; about the trends in the development of microbiological technologies using new strains of microorganisms.
3	Food Processing Equipment Technology	PC – ON8	To know the basic laws of the course; to understand the essence of the main methods used in the operation of biotechnological machines; to have an idea of the modern problems of the operation of biotechnological machines; to be able to operate modern professional biotechnological equipment and devices, as well as to organize, plan and manage existing biotechnological processes and production.
	Processes and devices in biotechnology	PC – ON8	Know the basic concepts, stages of biotechnological processes, basic methods of chemical identification of substances; be able to choose equipment, type of producers and conditions for a specific biotechnological process; operate modern professional biotechnological equipment and devices, as well as organize, plan and manage existing biotechnological processes and production; have skills in using biotechnological equipment.
4	Food microbiology and sanitary hygiene	PC – ON11	Know the basic concepts and terms of food microbiology, the main types of microorganisms dangerous to humans, possible sources of microbiological contamination in food production, conditions of their development, sanitary and technological requirements for premises, equipment, inventory, clothing; be able to carry out microbiological control of food products, identify the main groups of microorganisms; possess skills of working with basic laboratory equipment.
	Biotechnological safety of raw materials and biotechnological production	PC – ON11	Know state laws, regulatory documents ensuring the biological safety of raw materials and biotechnology of production; modern methods of research of biological safety of raw materials and biotechnology of production; research methodology; be able to: monitor and evaluate compliance with environmental, chemical (toxicological analysis) and biological safety of food raw materials, food ingredients and finished products in laboratories; possess the skills of: food quality management; determination of the main types of contamination of food raw materials and biotechnological production of products; control of biological safety of raw materials and biotechnological production of products.
4	Toxicological analysis of food products	PC – ON11	To know the theoretical foundations of food toxicology; to be able to determine the content of harmful substances in food products; to monitor and evaluate compliance with environmental, chemical (toxicological analysis) safety of food raw materials, food ingredients and finished products; to have the skills to determine toxic substances in food products.
	Food chemistry	PC – ON2	To know: - chemical composition of raw materials, intermediates and finished food products; methods of assessing the nutritional value of food; general patterns of chemical, biochemical and microbiological processes occurring during storage of raw materials; transformations and interaction of the main chemical components of raw materials during processing in food production and the influence of its modes on the composition, properties of the main nutrients, nutritional and biological value of raw materials and finished products; be able to: - determine the chemical qualitative and quantitative composition of the object under study, reasonably choose a test method for specific tasks; possess: the skills of conducting an experiment with appropriate calculations and conclusions; basic chemical and physico-chemical methods of analysis to determine the properties and technological indicators of the materials used and finished products.

4	Basics of biotechnology production design	PC – ON9	To know: basic principles of designing food enterprises; norms of technological design of food industry enterprises; basic principles of organization of biotechnological production, methods of evaluating production efficiency; schematic diagram of biotechnological production; selection criteria and equipment for stages of cultivation, isolation and purification of biosynthesis products; the most important structural elements of machines and apparatus; methods and equipment for transporting solid, liquid and gaseous media; control and measuring equipment and automatic control systems of biotechnological processes; safety and labor protection standards; be able to: draw up a scheme of biotechnological production, having knowledge of the most important structural elements of machines and apparatuses and the norms of technological design of food industry enterprises.
	Industrial ecology	PC – ON8	To know: the specifics and mechanism of toxic effects of harmful substances, energy effects and combined effects of factors; legal, regulatory, technical and organizational bases of environmental safety; means and methods of improving the safety and environmental friendliness of technical means and technological processes; be able to: identify the main hazards of the human habitat, technological processes and equipment, evaluate the effectiveness of various methods and devices for protecting the environment from pollutants and develop recommendations for reducing pollution of the habitat; use basic means of quality control of the habitat; operate modern professional biotechnological equipment; possess the skills of applying methods of instrumental control of parameters and levels of negative impacts of environmental pollution on personnel, population and the natural environment.
4	Biotechnology of biological active substances	PC – ON3	To know: the basic laws of BAS biotechnology; to be able to: use theoretical knowledge in the field of BAS biotechnology, as well as the main sections of microbiology to master the microbiological processes occurring in the production of biologically active substances and secondary metabolites; to possess: the theoretical foundations of biotechnology of biologically active substances.
	Basics of isolation and purification of bioproducts	PC – ON7	To know: the main groups of biotechnological products and their most important characteristics; basic concepts and principles of methods of isolation purification of biotechnological products; methods of chemical, biochemical identification and determination of biotechnological products; to be able to: use the basic laws of biochemistry, molecular biology in the development of technologies for isolation and purification of biological products; to use quantitative and qualitative methods for the analysis of biotechnological products; have the skills to manage the technological process of obtaining biotechnological products based on various raw materials and processes of isolation and purification of finished products.
4	Standardization and certification of biotechnology products	PC – ON12	Be able to: apply the requirements of regulatory documents to the main types of products and processes; apply the documentation of quality systems; use measuring instruments; demonstrate knowledge in the field of standardization and certification and the ability to work with regulatory and technical documentation; know: the 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

			procedure for certification.
	Quality management in the organization of biotechnological production	PC – ON12	Know: the requirements of the standards of the quality management system of biotechnological production; methodological documents on product quality management; requirements for the organization of work with personnel; be able to: use control and measuring devices in the production of biotechnological products; use the basic principles of the organization of metrological support of production; production; demonstrate knowledge in the field of standardization and certification and the ability to work with regulatory and technical documentation; possess: methods in the field of quality management system of biotechnological production; operational control skills at all stages of the production process for compliance with quality standards and specifications.