

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РЕСПУБЛИКИ КАЗАХСТАН  
РГП на ПХВ «ЮЖНО-КАЗАХСТАНСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ ИМ.М.АУЕЗОВА» МОН РК



**AUEZOV**  
UNIVERSITY  
1943



## ОБРАЗОВАТЕЛЬНАЯ ПРОГРАММА

- 📍 160012, город Шымкент, проспект Тауке хана, 5
- ☎ (8-725-2) 21-01-41, факс: (8-725-2) 21-01-41
- ✉ canselyarya@mail.ru, info@ukgu.kz
- 📘 @official.ukgu.kz
- 📷 @auezov\_university

THE MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF  
KAZAKHSTAN  
M.Auezov SOUTH KAZAKHSTAN UNIVERSITY

« APPROVED »

Chairman of the Board - Rector \_\_\_\_\_

d.h.s., academician Kozhamzharova D.P.

« \_\_\_\_ » \_\_\_\_\_ 2021

**EDUCATIONAL PROGRAM**

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«6B05120 Biotechnology» \_\_\_\_\_

Registration number	
Code and classification of the field of education	6B05 – « Natural sciences, mathematics and statistics »
Code and classification of training areas	6B051 – « Biological and related sciences »
Group of educational programs	B050 – « Biological and related sciences »
Type of EP	innovative
ISCE level	6
NQF level	6
SOF of education level	6
Language of learning	Russian
Typical duration of study	4 years
Form of study	Full time, part-time, distance
Labor intensity of the EP, not less than	241 credits
Distinctive features of EP	-
University Partner ( JEP )	-
University Partner (TDEP)	-
Social Partner ( DE )	-

Developers:

Full Name	position	signature
Saparbekova A. A.	Candidate of Biological Sciences, Associate Professor, head of the department "Biotechnology"	
Ahanov Y.K.	Candidate of Agricultural Sciences, Associate Professor of the department "Biotechnology"	
Dauylbay A. K.	Candidate of Agricultural Sciences, Associate Professor, of the department "Biotechnology"	
Narymbayeva Z. K.	Candidate of Technical Sciences, Professor, of the department "Biotechnology"	
Kaltayev A.Zh.	Deputy Director of SKOF RSE RVL and N of the Ministry of Agriculture of the Republic of Kazakhstan	
Yermahanov M.N.	Head of the Department of South-West Research Institute of Plant and Animal Husbandry, LLP	
Sultan A.A.	Director LLP "Food-Master Shymkent Company"	
Repina O.	Leading specialist of the quality control and registration service of "Zerde-Fito" LLP	
Mahmudov Zh.U.	Director of Shymkent branch "Ana-zher" LLP	
Tleukeeva A.E.	PhD student of DHT-20-3R	
Saidazova L.A,	student of HT-18-5a	

EP was considered by the Academic Commission of "Engineering and Engineering activity" protocol No. from " \_\_\_\_\_ " 20 \_\_\_\_

Chairman of AC (Committee) \_\_\_\_\_

Considered and recommended for approval at the meeting of Educational and Methodical Council of M. Auezov SKU.

protocol No. from " \_\_\_\_\_ " 20 \_\_\_\_

Approved by the decision of the Academic Council of the University

protocol No. from " \_\_\_\_\_ " 20 \_\_\_\_

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## Introduction

### 1. Scope of application

It is intended for the implementation of bachelor's degree training in the educational program 6B05122 "Biotechnology in pharmaceutical production" in the NAO "M. Auezov South Kazakhstan University" of the Ministry of Education and Science of the Republic of Kazakhstan.

### 2. Regulatory documents

The Law of the Republic of Kazakhstan "On Education" (with amendments and additions as of 04.07.2018);

Model rules for the activities of educational organizations implementing educational programs of higher and (or) postgraduate education, approved by Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 30, 2018 No. 595 (registered with the Ministry of Justice of the Republic of Kazakhstan on October 31, 2018 No. 17657);

State mandatory standards of higher and Postgraduate education, approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018 No. 604;

Rules for the organization of the educational process on credit technology of training, approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152 with amendments and additions dated October 12, 2018 No. 563

#### *Biotechnology Standards*

This document was prepared by: Office of Career Readiness, Adult Learning & Education Options Nevada Department of Education 755 N. Roop Street, Suite 201 Carson City, NV 89701 [www.doe.nv.gov](http://www.doe.nv.gov) Draft for review by the Nevada State Board of Education on June 7, 2018

#### **Biotechnology Program Standard**

The approved program standard for Biotechnology program of instruction leading to an Ontario College Diploma delivered by Ontario Colleges of Applied Arts and Technology (MTCU funding code 51304) Ministry of Training, Colleges and Universities February 2012.

Production of dairy products. No. 4 of December 5, 2018. №339 от 11.12.2018. <http://atameken.kz/ru/services/16-professional-nye-standarty>

The Professional standard "On the protection, reproduction and use of the animal world" was approved by the Order of the Minister of Agriculture of the Republic of Kazakhstan No. 593-II dated 09.07.2004. (with changes and additions as of 15.06.2017).

Professional standard: "Feed production for farm animals" Approved by the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated 26.12.2019 No. 263

The professional standard "Food Production" was approved by the Order of the Minister of Agriculture of the Republic of Kazakhstan dated September 30, 2013 No. 20/460

Professional standard. Yeast production. Approved by the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated 26.12.2019, No. 263.

Professional standard. Production of dairy products Was approved by the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" No. 339 dated 11.12.2018-44 p.

Professional Standard Ecology and Environmental Protection Activities (by type)", Ministry of Environment and Water Resources of the Republic of Kazakhstan 11.12.2013 No. 09-02-41/25183

Environmental Code of the Republic of Kazakhstan (with amendments and additions as of 16.11.2015) Forest Code of the Republic of Kazakhstan. Code of the Republic of Kazakhstan dated 08.07.2003 No. 477 (as amended as of 15.06.2017).

## **1. The concept of the educational program**

The purpose of the educational program is consistent with the mission of the university, aimed at generating new competencies, training a leader who translates research and entrepreneurial thinking and culture.

The educational program is harmonized with the 6th level of the National Qualifications Framework of the Republic of Kazakhstan, with the Dublin Descriptors, and with the 1st cycle of the Qualification Framework of the European Higher Education Area. (A Framework for Qualification of the European Higher Education Area), as well as the 6th level of the European Qualification Framework for Lifelong Learning.

The educational program is focused on the professional and social order through the formation of professional competencies related to the necessary types of research, practical and entrepreneurial activities, adjusted to meet the requirements of stakeholders.

**The uniqueness** of EP 6B05120 "Biotechnology" is that the educational program is aimed at achieving learning outcomes through the organization of the educational process using the principles of the Bologna Process, accessibility, inclusiveness. OP 6B05120 "Biotechnology" was accredited by Independent International Agencies ASIIN (Germany) in 2014.

The results of the training program are achieved through the following training activities:

- classroom activities: lectures, seminars, practical and laboratory activities-are conducted with the account of innovative technologies of training, the use of the latest achievements of science, technology and information systems;

- extracurricular activities: independent work of the student, including under the guidance of a teacher, individual consultations;

- conducting professional practices, completing term papers and theses (projects).

The University has taken measures to maintain academic integrity and academic freedom, to protect against any kind of intolerance and discrimination against students.

The quality of the EP is ensured by the involvement of stakeholders in its development and evaluation, systematic monitoring and review of its content.

### **4. Requirements for applicants**

Established in accordance with the Standard Rules for admission to training in educational organizations that implement educational programs of higher and postgraduate education Order of the Ministry of Education and Science of the Republic of Kazakhstan No. 600 of 31.10.2018

## **1. PASSPORT OF THE EDUCATIONAL PROGRAM**

### **1.1 The purpose and objectives of the educational program in the specialty**

The purpose of the EP is to provide comprehensive and high-quality training of qualified, competitive specialists in the field of biotechnology of pharmaceutical industries on the basis of broad fundamental training, including the development of students' personal qualities and the formation of general cultural universal and professional competencies.

EP objectives:

- formation of socially responsible behavior in society, understanding the importance of professional ethical standards and following these standards;
- providing basic bachelor's degree training that allows them to continue their lifelong learning, successfully adapt to changing conditions throughout their professional career;
- providing conditions for the acquisition of a high general intellectual level of development, mastering competent and developed speech, culture of thinking and skills of scientific organization of work in the field of pharmaceutical production technology and biotechnology;
- creating conditions for intellectual, physical, spiritual, and aesthetic development to ensure that they can be employed in the OP or continue their studies at subsequent levels of study.

### **1.2 List of qualifications and positions**

The graduate of this EP is awarded the degree " Bachelor of Engineering and Technology» Bachelors in EP 6B05120 "Biotechnology" can hold primary positions: a specialist in biotechnology and other employees, approved by the order of the Minister of Labor and Social Protection of the Population of the Republic of Kazakhstan dated May 21, 2012 No. 201-o-m.

- specialist (laboratory assistant) in research institutes and universities;
- technologist in production laboratories;
- specialist-technologist in biotechnological industries;
- specialist in biotechnology;
- biotechnologist-breeder;
- specialist in environmental services and organizations and others in accordance with the "Qualification Directory of positions of managers, specialists and other employees", approved by the order of the Ministry of Labor and Social Protection of the Population of the Republic of Kazakhstan dated 22.11.2002, No. 273-P;
- employee for research and design biotechnological organizations ;
- specialist of microbiological, pharmaceutical, and food industry enterprises;
- specialist of organizations that control and supervise the operation of biotechnological industries, the state of the environment and the quality of biological products.

### **1.3 Qualification characteristics of the graduate of the educational program**

#### **1.3.1 The field of professional activity**

The field of professional activity of bachelors of EP 6B05120 "Biotechnology" is the field of research institutes and universities of a biotechnological profile, the field of production and research of enzymes, viruses, microorganisms, cell cultures of animals and plants, products of their biosynthesis and biotransformation; technologies for obtaining products using microbiological synthesis, biocatalysis, genetic engineering and nanobiotechnologies, production enterprises, laboratories of the food and processing industries, laboratories for quality control and safety of biotechnological products, botanical gardens and plant protection stations, breeding stations, production cooperatives, joint stock companies, farmers, individual, collective farms, limited liability partnerships, scientific laboratories, state institutions of the Ministry of

Education and Science, Ministry of Agriculture, agricultural firms and other agricultural organizations.

### **1.3.2 Objects of professional activity**

The objects of professional activity of graduates of the bachelor's degree program EP 6B05120 "Biotechnology" are:

- microorganisms, cell cultures of animals and plants, viruses, enzymes, biologically active substances;
- devices and equipment for the study of the properties of used microorganisms, cell cultures obtained in laboratory and industrial conditions;
- installations and equipment for biotechnological processes;
- food biotechnologies;
- means of quality control of raw materials, semi-finished products and finished products;
- means of assessing the state of the environment and protecting it from the influence of industrial production.

### **1.3.3 Subjects of professional activity**

The subjects of professional activity of the bachelor in EP 6B05120 "Biotechnology" are: research institutes and universities of biotechnological, biological, ecological, pharmaceutical and agricultural profile; production enterprises and laboratories of the food and processing, microbiological, pharmaceutical industries; agricultural enterprises; botanical gardens and zoological parks; plant protection stations; breeding stations; environmental services and organizations; laboratories for quality and safety control of agricultural and food products.

### **1.3.4 Types of professional activity**

Bachelors in EP 6B05120 "Biotechnology" can perform the following types of professional activities:

- implementation of the production of biotechnological products, quality control of biotechnological products, creation of the necessary conditions for the cultivation and biological realization of biotechnological objects;
- organization of individual stages of biotechnological production in the field of agricultural biotechnology;
- production and technological activities: analysis of the main ingredients of food products; determination of the components of raw materials and finished products; development and implementation of new technological processes;
- selection: study of the source material for the selection of microorganisms, plants and animals; study of environmental factors on the genotype of microorganisms, plants and animals in order to achieve their maximum productivity; study of the features of the selection of microorganisms, plants, animals, domestication of species; study of the world gene pool of plants and animals for selection; intensification and improvement of the efficiency of the selection process through the introduction of biotechnological methods.
- experimental research: experimental study of the properties and life processes of biological objects; research of biotechnological processes; design of biotechnological devices and equipment; modification of genotypes of biological objects with economically valuable characteristics.

## **2. Results of training on the EP**

**LO1** Observe academic honesty, ethical principles and laws of the Republic of Kazakhstan, demonstrate communication skills in Kazakh, English and English, engage in self-development, plan work, analyze.

**LO2** Demonstrate natural science, mathematical, social, socio-economic knowledge in professional activities, methods of mathematical data processing, distance learning, theoretical and experimental research, regulatory documents and elements of economic analysis.

**LO3** Use network computer technologies, databases, software packages, carry out information processing using applied software for business activities, comply with the basic requirements of information security.

**LO4** Understand the general patterns and mechanisms of life of plants, human and animal organisms, specific features of various systems of the body and their individual structural elements, establishing the relationship of basic biological processes with each other.

**LO5** Discuss biological requirements, environmental protection issues, their legal basis, as well as issues of assessing the stimulating factors used in practical training, use methods to ensure the reliability of safety equipment and life activities of maintenance personnel during the operation of biotechnology equipment.

**LO6** Analyze modern methods of researching biological systems in order to solve the issues of production of biotechnological products for various purposes and the development of new biotechnological processes, to recommend effective procedures for monitoring, regulation and control of technological processes, to conduct a simple educational and research experiment based on the technique of work in the laboratory, to perform calculations, to draw up results, formulate conclusions.

**LO7** Compare biological processes in the cells of various groups of organisms in order to optimize and regulate the production technology of final products, work in laboratory conditions with cultures of microorganisms, independently develop a problem statement taking into account the needs of society and requirements for biotechnological products, as well as scientifically substantiate solutions to fundamental and applied tasks of agricultural biotechnology.

**LO8** To clarify the problems of biosafety of products of modern biotechnological production, organize and conduct a biological experiment with specific objects, independently analyze the results, acquire practical skills in conducting physicochemical methods for analyzing compounds produced by microorganisms, plants and animals, sanitary and hygienic control of food products, evaluate methods in biotechnology of animals, accelerated increase in productivity, reproduction of farm animals.

**LO9** Formulate biotechnological principles for the synthesis of products based on cells of microorganisms, plants and animals, investigate and establish links between the characteristics of products and biotechnological processes, use methods of using highly productive industrial breeds of animals, improve the quality of manufactured products, develop regulations for the production of agricultural products.

**LO10** To own the elements of spiritual, aesthetic and cultural culture, to form judgments, taking into account social and ethical problems. Possess the skill of conceptual, logical and analytical thinking, realize the potential in solving the assigned tasks and their correct documentation.

**LO11** Express their ideas and underlying professional knowledge and questions in writing or orally. Know the history of the Republic of Kazakhstan and the universal laws of the development of the world and society, as well as about moral categories and values based on the formation of a new political system. Be able to lead a healthy lifestyle. Know about the laws of human socialization and psychosomatics.

**LO12** Use research, entrepreneurial and uncertainty skills. Work effectively individually and as a team member, correctly defend your point of view, correct your actions and use various methods.

### **3 COMPETENCIES OF A GRADUATE OF THE EP**

**3.1** Successful completion of the EP training contributes to the formation of the following competencies in the graduate:

–key competencies (KC)

–professional competencies (PC)

Key competencies:

(KC1) *in the field of the native language*

- the ability to express and understand concepts, thoughts, feelings, facts and opinions in the field of music education in written and oral forms (listening, speaking, reading and writing), as well as to interact linguistically appropriately and creatively in a variety of social and cultural contexts: during school, at work, at home and at leisure;

(KC2) *computer*

- the ability to confidently and critically use modern information and digital technologies for work, leisure and communication, the ability to use, restore, evaluate, store, produce, present and exchange information through a computer, communicate and participate in collaborating networks using the Internet in the field of professional activity;

(KC 3) *economic, managerial and entrepreneurial*

- the ability to know and understand the goals and methods of state regulation of the economy, the role of the public sector in the economy; possess the basics of economic knowledge; possess the skills of critical thinking, interpretation, creative analysis, drawing conclusions, evaluation; manage projects to achieve professional goals, manage personnel, demonstrate entrepreneurial skills.

(KC 4) *additional competencies*

- the ability to possess the skills of critical thinking, interpretation, creativity of analysis, drawing conclusions, evaluation; to have creativity and an active life position; to make professional decisions in conditions of uncertainty and risk.

PC-1- The ability to carry out activities under the guidance of a certain degree of independence, to show individual responsibility for the performance of various tasks.

PC-2- The ability to define professional-level tasks and plan activities based on the set goal. The ability to independently solve standard and non-standard tasks, taking into account the choice of solutions based on knowledge and practical experience.

PC-3 - The ability to apply innovative technologies and new biological objects in biotechnology. The ability to independently develop and put forward various, including alternative versions of technologies using theoretical and practical knowledge.

PC-4 – The ability to apply monitoring methods, analyze situations in the field of agricultural biotechnology, demonstrate creativity and initiative in management processes, including training others to improve teamwork, The ability to identify dangerous and harmful factors and ensure the safety of biotechnological production.

### 3.2 Matrix of correlation of the results of training in the EP as a whole with the formed competencies of the modules

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
KC1	+									+	+	
KC2		+	+							+	+	
KC3	+	+									+	+
KC4	+				+						+	+
PC1				+	+	+	+	+	+			+
PC2			+		+	+	+	+	+		+	
PC3		+	+		+	+	+	+	+			+
PC4					+		+	+				

**4. SUMMARY TABLE SHOWING THE AMOUNT OF LOANS DISBURSED IN THE CONTEXT OF THE MODULES OF THE EDUCATIONAL PROGRAM**

Course of study	Semester	Number of modules to be mastered	Number of subjects studied			Number of credits KZ					Total in hours	Total credits KZ	Quantity	
			OC	UC	EC	Theoretical training	Physical culture	Educational practice	Production practice	Final attestation			exams	def. credit
1	1	4	5	2	-	28	2	-	-			30	6	1
	2	4	3	2	2	26	2	2	-			30	5	2
2	3	6	3	3	2	28	2	-				30	6	2
	4	5	1	1	5	25	2	-	3			30	5	2
3	5	6	-	-	6	30	-	-	-			30	5	1
	6	4	-	2	2	22	-	-	8			30	2	2
4	7	3	-	-	4	20	-	-	-			20	4	-
	8	2	-	-	4	20	-	-	-			20	4	-
	9					20	-	-	-			20	-	1
<b>Total</b>		<b>34</b>	<b>12</b>	<b>10</b>	<b>25</b>	<b>219</b>	<b>8</b>	<b>2</b>	<b>11</b>			<b>240</b>	<b>37</b>	<b>11</b>

### 5. Information about the disciplines

Module name	Cycle	UC/ EC	Component name	Brief description of the discipline (30-50 words)	Credits amount s	Forming LO (codes)
Social Sciences Module	GED	OC	Modern history of Kazakhstan.	Formation of Kazakhstan state structure. Ethno-demographic processes and strengthening of interethnic harmony. The value of the program "People in the stream of history" to form new historical consciousness Mangilik El. After course, student demonstrates historical knowledge that meets the strategic objectives of strengthening the statehood of Kazakhstan and national security.	5	LO 10
	GED	OC	Philosophy	Philosophy and world philosophical understanding. Asia Philosophy. Philosophy of the Middle Ages and Renaissance. Philosophy of the New Age and the Enlightenment. Modern philosophy. The philosophy of natural sciences as the basis for biotechnology development After course, student uses philosophical knowledge basic to form worldview position in biotechnological processes.	5	LO2, LO 10
Socio-political knowledge module	GED	OC	Sociology and Political Science	Development and formation of political science. Power political theory and concept. The essence of political system and regime. State and features. Political institutions and parties. Politics relationship with public life other areas. Student learns sociological approach to society development and individual functioning about political systems and regimes, politics human dimension.	4	LO2, LO10, LO 11, LO12
	GED	OC	Sociology and Political Science	Sociology Fundamentals. Society social structure. Political Science Fundamentals. The political system of society. Basic social processes and political socialization in biotechnological industries. At the end of the course, the student learns about the sociological approach to the development and functioning of society and the individual; about political systems and regimes.	4	LO2 LO 10, LO 11, LO12
Socio – ethnic	GED	UC	Ecosystem and law	Ecosystem preservation as basis of law rule. Regulations and	5	LO1, LO2,

development module				regulatory documents of environmental protection. Citizens ' rights to clean air, water and soil. Biotechnological methods for determining maximum permissible concentrations of nature pollutants. Student has knows regulatory documents, citizens ' rights and methods for determining pollution level in urban areas.		LO5
	BD	EC	Abaytanu	Kazakh literature of the XIX century. Abay - founder of Kazakh classical literature. Abay's philosophy. At the end of the course, the student learns the main works of Kazakh writers of the 19th century, can use quotes from great writers in business correspondence and popularize Kazakh literature in the world.	3	LO2, LO10
	BD	EC	Current problems and modernization of public consciousness	This discipline examines the formation of a creative personality, instilling in young people the spiritual revival of the Independent Great Steppe, which is aimed at restoring our spirituality, which was in crisis during the Soviet era, and at being among the best thirty developed countries of the world.	8	LO1, LO2, LO5, LO12
	BD	EC	Mukhtar Studies	Kazakh literature of the XX century. M. Auezov - founder of - Kazakh classical literature. M. Auyezov's Philosophy in the world. Student learns he main works of Kazakh writers of the 20th century, can use quotes from great writers in business correspondence and popularize Kazakh literature in the world.		LO2, LO10
Communication and Physical Education module	GED	OC	Kazakh (Russian) language	Development communication and speech skills. Scientific speech and the language of my specialty. Use of business and scientific terminology. Biotechnological terms. Processing of scientific information in official languages. Student can process scientific information in Russian for further use in the educational and scientific processes in biotechnology.	10	LO1, LO11
	GED	OC	Foreign language	Foreign language and science. Basic rules and laws of the language. Use of business and scientific terminology. Biotechnological terms. Processing of scientific information in foreign languages. After course, the student can process scientific information in a foreign language for further use in	10	LO1, LO11

			educational and scientific processes in biotechnology.		
GED	OC	Physical education	Physical education as basis improving the student health. Physical culture and mental activity. Physical exercises and a healthy lifestyle in the biotechnological production. At the end of the course, the student has knowledge of physical fitness and a healthy lifestyle to support life while working in educational and industrial processes.	8	LO10, LO12
BD	UC	Professional Kazakh (Russian) language/	Language and specialty. Basic terms of natural and related sciences. Terms and basic texts of biotechnology. An essay on a professional topic. According to the results of the course, the student is fluent in the professional state language for further research work in the field of biotechnology.	3	LO1, LO2
BD	UC	Professional-oriented foreign language	Foreign language and specialty. Basic terms of natural and related sciences. Terms and basic texts of biotechnology. Essay on a professional topic. According to the results of the course, the student is fluent in a professional foreign language for further research work in the field of biotechnology with foreign scientists.	3	LO1, LO2
GED	OC	Information and communication technologies	Introduction to computer systems. Types of software, goals, and characteristics. Information technologies - basis of - research. Methods of searching scientific information. Preparation of programs for biotechnological processes. Student uses information resources to e-learning. Search for scientific information, conduct statistical analysis of data, prepare basis of program for biotechnological processes.	5	LO3, LO6, LO10
BD	EC	Content and language integrated learning	The discipline studies the professional and personal qualities of a biotechnologist, covering the general patterns and mechanisms of life of plants and animals. It covers a sufficient level of study of the subject and the development of skills to express in writing and orally their ideas related to issues in the field of biotechnological products based on cells of microorganisms, plants and animals, issues of environmental protection through a foreign language.	5	LO4, LO5, LO11

	BD	EC	English in the professional sphere	English in the professional field forms and develops the communicative competence of a future specialist - a participant in professional communication in a foreign language in the field of science, technology, production and education. The acquisition of communicative competence lies in the ability to use English to meet professional needs, realize personal business contacts and further professional self-education and self-improvement.	4	LO1, LO3, LO11, LO12
General Mathematical and Natural Sciences	BD	UC	Higher Mathematics	Linear and vector algebra. Mathematical analysis. Indefinite and definite integrals. Functions of several variables. Ordinary differential equations. Numerical characteristics of systems of two random variables. Correlation coefficient. Student can make a mathematical analysis of the biotechnological process, calculate the probability theory of various circumstances in the production.	4	LO2, LO6, LO10
	BD	UC	Physics	Mechanics, Molecular physics. Thermodynamics. Electrostatics. Optics. Physical factors in biotechnological processes. At the end of the course, the student learns the basic laws of general physics and their applicability in biotechnological industries and the creation of biotechnological equipment.	4	LO2, LO6, LO8
	BD	UC	Chemistry	Chemical elements and reactions. Electrochemical processes. Analysis of substances chemical composition. Chemical kinetics. Catalysis. Solutions. Redox reactions. Complex connections. Qualitative chemical analysis. Student can conduct chemical analyses, determine the composition of substances and prepare the theoretical part of experiments in the preparation of scientific research in the field of biotechnology.	5	LO2, LO4, LO7, LO8, LO9
	BD	EC	Biochemistry	Introduction to Biochemistry. Metabolism basic provisions Energy of biochemical processes. Physical and chemical properties of natural compounds. Student learns the biochemistry of proteins, nucleic acids, carbohydrates, lipids,	5	LO2, LO4, LO6, LO8, LO9

				minerals and vitamins and hormones; the essence of chemical transformations occurring in organisms, the mechanisms of their regulation.		
	BD	EC	Inorganic chemistry	This discipline covers the basic concepts and laws of chemistry, the theoretical foundations of the structure of matter, the regularities of the course of chemical processes, familiarization with biogenic elements and their role in human life. The discipline informs about the practical application of chemical knowledge in the field of biotechnology, covers the regularities of the course of chemical processes, forms the ability to solve practical problems and conduct the simplest chemical experiments in this specialty.	5	LO7, LO9,
Biotechnology of the agro-industrial complex	BD	EC	Objects of biotechnology	Objects of biotechnology. Technological techniques and features of cultivation of microorganisms, cells and tissues of plants and animals. Subcellular structures. Immobilized biological objects. Student can analyze useful properties of biotechnology objects; use principles of improving the properties of biotechnology objects; cultivation methods and features of various organisms.	4	LO4, LO6, LO7, LO9, LO12
	BD	EC	General technology of the industry	Biotechnological processes in connection with mass transfer. Hardware design of the processes of isolation and purification of some products of microbial synthesis. The main areas of application of membrane technology: water treatment, medicine, bioenergetics. Student can work on basic biotechnological devices and perform basic analyses of biotechnological objects.	4	LO4, LO6, LO7, LO9, LO12
	BD	EC	Microbiology and virology	Microorganisms and classification. Morphology, composition and reproduction of microorganisms. Metabolism of microorganisms. Ecology of microorganisms. Genetics of microorganisms. The role of microorganisms in nature and possibility of using microbes in production. Student learns basic properties and classification of microorganisms and viruses, is able to isolate pure culture, work with microorganisms.	5	LO5, LO6, LO8, LO8, LO9

	BD	EC	Sanitation and hygiene of biotechnological industries	Fundamentals of microbiology, sanitation and hygiene in biotechnology. Modern methods of production sanitary control. Sanitary and hygienic indicators. Student learns modern methods of sanitation and hygiene in biotechnological production of products; methods of quality control of sanitation facilities, finished products; basic regulatory documents in the field of food production sanitation.	5	LO5, LO6, LO7, LO8, LO9
	BD	EC	Basics of biotechnology	Features of biotechnological processes, stages and principles of their implementation. Continuous, semi-continuous, and periodic cultivation processes. Basic methods for creating and maintaining aseptic cultivation conditions. Student learns methods and principles of biotechnology; the current state of biotechnology; modern requirements for biotechnological products; prospects for biotechnology development	5	LO4, LO5, LO6, LO7, LO8, LO9, LO12
	BD	EC	Theoretical basics of biotechnological production	Biological objects as specific component of biotechnological production, raw materials base of biotechnological production, technologies of laboratory, industrial, semi-industrial cultivation, periodic and continuous cultivation, production of biomass, waste products, primary and secondary metabolites, methods of isolation and purification of final products, production of concentrates, highly purified pharmaceuticals, finished products forms.	5	LO4, LO5, LO6, LO7, LO8, LO9, LO12
Methodological foundations of teaching	BD	EC	Methodology of teaching biology and biotechnology	Theoretical and methodological approaches to teaching biology and biotechnology. Regularities of the processes of knowledge transfer in biology and biotechnology to students. Quality control of training, its place in educational process. Student receives knowledge about the basic methodological principles, forms and techniques of effective teaching of biology and biotechnology.	4	LO1, LO2, LO10, LO11
	BD	EC	Criteria-based assessment technology	Criteria-based assessment is important factor in improving the productivity of information received and effectiveness of student work, the quality of products in all areas of mental activity. Using general theoretical applications in various branches of education that serve as the fundamental basis of	4	LO1, LO2, LO10, LO11

				the science of teacher education.		
	PD	UC	Teaching practice	The educational tasks of teaching biology and biotechnology in a modern school and the ways of their implementation are considered. It allows increasing effectiveness of teaching biology and biotechnology. The realization areas of creative potential of teacher-biologist are identified. The main paradigms of education in the domestic school are considered.	4	LO1, LO2, LO10, LO11
Fundamentals of the specialty	BD	EC	Introduction to specialty	Introduction to Biotechnology. The main directions of biotechnology. Achievements of biotechnology in molecular biology, medicine, veterinary medicine, food industry, energy industry, metallurgy, etc. Biotechnological monitoring of the environment. Student gets a general understanding of the discipline, the main objects and methods of research.	4	LO4, LO5, LO6, LO7, LO8, LO9
	BD	EC	Fundamentals of Academic Writing	Academic writing. Types of scientific activity. Business scientific correspondence. Structure of scientific texts. Analysis of theoretical and practical research results. Upon completion of the course, the student can prepare scientific texts on their discipline, conduct scientific correspondence with foreign scientists and scientific publications.	4	LO1, LO2, LO10, LO11, LO12
	BD	EC	Educational practice	The practice is to acquire practical skills in the conditions of existing production. During training practice, attention is paid to issues of life safety, labor protection and industrial sanitation. As a result, students will gain skills in development of new biological products, methods for obtaining them, and practical implementation options.	2	LO2, LO5, LO6, LO8
	BD	EC	Processes and apparatus of biotechnological production	This discipline examines the features of the course of mass transfer, thermal, hydrodynamic and mechanical processes in combination with the biological processes of growth, metabolism and the death of microorganisms. Regularities of such processes as defoaming, sterilization of liquid and air, grinding and packaging. The main features of the hardware design of microbiological industries.	4	LO4, LO6, LO7
	BD	EC	Equipment for biotechnological	This discipline examines the design and principles of operation of large-tonnage equipment for biotechnological	4	LO2, LO3, LO4, LO6,

			production	industries. A course containing technological operations used in biotechnological industries.		LO7, LO8, LO12
	PD	UC	Production practice I	Acquisition of practical knowledge and skills in production activities, experience in using the acquired knowledge and skills in solving specific technical problems. Students will learn the basics of planning and managing existing biotechnological processes; operate biotechnological equipment; and are able to work in a team.	3	LO2, LO6, LO7
Fundamentals of applied sciences	BD	EC	Medical and veterinary biotechnology	The main directions of medical and veterinary biotechnology. New pharmaceutical and veterinary drugs for the treatment of previously difficult-to-treat human and animal diseases. Student knows strategic medical-biological and veterinary-biological approaches to create diagnostic and medicinal products using medical, veterinary biotechnology; basics of industrial production of the main modern dosage forms.	5	LO4, LO5, LO6, LO8, LO9
	BD	EC	Pharmaceutical Biotechnology	Pharmaceutical biotechnology provides for the study of biotechnological processes when obtaining a number of medicinal and prophylactic drugs, methods of conducting experimental research, the study of standard and certification tests of raw materials, finished products and technological processes, introduces the methods of their application, the implementation of a quality management system for biotechnological products in accordance with the requirements of quality standards and GMP.	5	LO6, LO8, LO9
	BD	EC	General molecular Genetics	Molecular genetic methods of analysis and research studies the structural features and properties of macromolecules in a living cell, the structural and functional organization of the genetic apparatus of a cell, the implementation of genetic information, genetic methods for solving fundamental problems in the field of medical, food, agricultural, environmental biotechnology, analyzes the contribution of Kazakhstani scientists in the development of genetics, determines the importance of the impact of biotechnology on	6	LO6, LO7, LO9

				improving welfare in the country.		
BD	EC	Molecular Biology and Cytology	Cell molecular biology. Structural and functional organization of DNA, RNA, biological membranes. Transmitting an external signal to the cell. Intracellular mediators. Student learns modern theoretical knowledge and scientific achievements about structure, properties and functions of cells and their molecular structures, the basics of genetic information at the level of biomolecules.	6	LO6, LO7, LO8, LO9	
BD	EC	Animal Biotechnology	Development and current state, main objects and methods of animal biotechnology. Student should be able to give a description of cattle breeds and their competitiveness in the gene pool of the market; expand the global gene pool, and organize its involvement for the qualitative development of livestock production in Kazakhstan.	5	LO2, LO4, LO5, LO6, LO8, LO9	
BD	EC	Transgenic animals, plants and methods of their production	Principles of recombinant organisms design. Expression and isolation of target proteins. GMO in human economic activity. Transgenic plants and animals. Student learns basic principles of obtaining recombinant DNA, the stages of genetic engineering work; the scientific and legal bases for ensuring biosafety in the use of transgenic plants and animals.	5	LO2, LO4, LO5, LO6, LO8, LO9, LO12	
BD	EC	Environmental biotechnology	Microorganisms' role in circulation of substances. Domestic, industrial and agricultural wastewater, its structure and quality assessment criteria. The use of microorganisms in wastewater treatment plants, biosorption of metals. During the study, the student is able to carry out an environmental assessment of the state of air, water and land objects.	4	LO5, LO8, LO9	
BD	EC	Biodegradation and stability of polyutants, xenobiotics	Anthropogenic impact on environment. Self-healing of nature, accumulation and transformation of polyutants, xenobiotics. Use of plants, protozoa as accumulators of polyutants. Methods of wastewater treatmnt. Degradation and restoration of polluted land. Student can assess degree of environmental impact of pollutants, risks, disposal, prevention measures for occurrence of dangerous pollutants foci.	4	LO5, LO6, LO7, LO8, LO9	

	PD	UC	Production practice II	The practice is conducted to gain professional skills and experience in professional activities. Based on the results of the practice, students will learn the basics of planning and managing existing biotechnological processes; operate biotechnological equipment; and are able to work in a team.	4	LO2, LO6, LO7
Fundamentals of scientific research	BD	EC	Planning and setting up of scientific research works	Classification of scientific research. Research objectives and state of the problem. Definition of research objects and methods. Setting research goals and objectives. Processing of research results. Student can formulate the goals and objectives of research, make plans and process experimental biotechnological research.	5	LO2, LO6, LO7, LO9
	BD	EC	Fundamentals of scientific research and patenting	Methodology of scientific research and design of scientific results, preparatory stage of research work, the methodology of experimental research, design of research results in form of scientific papers, basics of patent science and theory of solving inventive problems, basics of scientific ethics, research institutions, preparation of students' research work.	5	LO2, LO6, LO7, LO9
	PD	EC	Modeling and scaling in biotechnology	Modeling and scaling of biotechnology processes and schemes. Physical and mathematical modeling of biotechnology processes. Hydro-mechanical and thermal processes. Mass transfer processes. Hardware design of biochemical processes. Student learns basic scheme of biotechnological production, basics of modeling and methods of engineering calculation of main processes and devices of biotechnological production.	5	LO2, LO3, LO6, LO7, LO12
	PD	EC	Bioinformatics	Introduction to Bioinformatics. Structural and comparative genomics. Proteomics. Computer simulation of biological molecules interaction Methods for comparing spatial structures of biological macromolecules, modeling interactions between macromolecular complexes. Molecular graphics. Student can use main technical means of searching for scientific and biological information, work with biological information in global computer networks.		LO2, LO3, LO6, LO7, LO12
General physiology	PD	EC	Plant physiology	Plant cell physiology. Water regime of plants. Mechanisms of	4	LO4,

				absorption and transport of mineral elements. Specifics of respiration in plants. Main ways of carbohydrate dissimilation. Student learns principles of functional organization of plant objects and physiological and biochemical foundations of molecular mechanisms of plant life, basic concepts of plant physiology.		LO6,LO8, LO9, LO12
	PD	EC	Basics of microclonal plant reproduction	Callus formation. Preparation and cultivation of plant cells and tissues. The advantage of plants. microclonal reproduction Prospects for application of microclonal plant reproduction in agricultural biotechnology. Student learns the theoretical and practical basics of microclonal reproduction of plants for use in further scientific research.	4	LO4, LO8, LO9
	PD	EC	Human and animal physiology	Physiology of human and animal body. Physiology of central nervous system. Physiology of blood system. Physiology of respiratory system. Physiology of digestive system, excretory system. Reproductive function. Comparative animal and human physiology. Student learns morphofunctional organization of animals and humans, main mechanisms of regulating functions of body biological systems.	5	LO4, LO8, LO9
	PD	EC	Modeling of physiological processes	Modeling of natural processes, population dynamics. Description of interaction of two species models. Study of the stability of stationary states. Modeling of physiological processes. Upon completion of the course, students have the skills to apply mathematical modeling methods to analyze specific natural processes for further application in biotechnological research.	5	LO4, LO8, LO9
Biotechnology objects and products	PD	EC	Molecular genetic methods of analysis and research	Organization, information molecules of the genome. Methods of genome research. Enzymes used in molecular genetic research. Modern methods of molecular genetic research. When studying the course, the student can use the services of searching for scientific information in the field of molecular biology, modern methods of molecular genetic research.	5	LO3, LO4, LO8, LO9
	PD	EC	Plant and animal	Cytological bases, molecular foundations of heredity.	5	LO4, LO7,

		genetics	Variability of genetic material. Fundamentals of population genetics. Problems of classical and modern genetics and prospects for its development. Student learns the main characteristics of a living organism, the most important biological processes occurring at all levels of the organization of living matter.		LO9
BD	EC	Industrial biotechnology	Modern methods, main directions and prospects of biotechnology development. Biotechnology and agriculture. Features and processes based on use of live or inactivated biomass of microorganisms and products from synthesis. Students should know the specifics of industrial biotechnological processes, the scientific principles of their implementation; modern hardware design of biotechnological production.	5	LO5, LO6, LO7, LO8, LO9, LO12
BD	EC	Biological processing of industrial and agricultural waste	Biotechnological processing of industrial waste. Efficient resource-saving technologies. Problems of biological processing of wastewater from chemical enterprises. Assessment of impact of industrial and economic activities on environment state. Student learns basic processes and equipment in field of waste processing and disposal; able to prepare production reports in waste management.	5	LO5, LO6, LO7, LO8, LO9, LO12
BD	EC	Agricultural biotechnology	Food security, high-quality, environmentally friendly food, products for veterinary medicine, crop production. Modern postgenomic and biotechnological methods. Biotechnology of drugs for agriculture. Student uses methods of developing and implementing biotechnological approaches to solving problem of increasing fertility of agricultural soils, applying theoretical knowledge gained in practice of the agro-industrial complex.	5	LO7, LO8, LO9, LO12
BD	EC	Assessment of the quality and safety of agricultural products	Sanitary and hygienic assessment of agricultural crops quality. Assessment of products quality, animal feed. Student should know: the method of sampling and the specifics of sample preparation for various types of raw materials and finished products; the main criteria for assessing food safety.	5	LO7, LO8, LO9, LO12

Bio Sciences Integration Module	PD	EC	Food biotechnology	Technological processes for food production using microorganisms, development and introduction of new modern technologies, BAS, vitamins, amino acid enzymes and protein products. Microbiological control of products. Student should know the general laws of circulation, which are accompanied by the action of various microorganisms in the process of their vital activity.	5	LO5, LO6, LO7, LO8, LO9, LO12
	PD	EC	Biological and food safety	Food security: Classification of potentially hazardous food substances and main ways of its contamination. Fundamentals of radiation safety of food raw materials and food products. Student learns the main indicators of the safety of finished food products; the parameters of implementation of technological control of the safety of finished products.	5	LO5, LO6, LO7
	PD	EC	Plant biotechnology	Prospects of plant biotechnology and biosafety issues. In vitro cultivation methods. Callus and cell cultures. Biotechnologies for accelerating the selection process. Student receives knowledge about the physiology of cultured cells, plant tissues in vitro; the principles of using cultured cells to obtain important metabolites, development of methods of clonal micropropagation.	6	LO4, LO8, LO9
	PD	EC	Bioprotectors and stimulators of plants	Mechanisms of regulation of physiological processes of plants. Hormonal regulation. Regulation of plant growth and development. The process of photosynthesis and adaptation. Plant protection products. At the end of the course, the student has knowledge of plant bioprotectors, the composition and functions of plant stimulants.	6	LO4, LO8, LO9
	PD	EC	Biotechnology of microorganisms	Microbiological processes used in biotechnology; requirements for raw materials and producing microorganisms, methods of microorganisms' cultivation, isolation and purification of target products, specific industrial productions. Industrial production of antibiotics, enzymes, amino acids, polysaccharides, organic acids and neutral products, bacterial plant protection products and fertilizers, protein of single-celled organisms.	6	LO5, LO6, LO7, LO8, LO9, LO12

	PD	EC	Industrial microorganisms	Industrial biotechnology. Stages of industrial cultivation. Preparation of seed material. Obtaining pure crops. Genetically modified microorganisms. Metabolites of microorganisms. Upon completion of the course, the student has theoretical and practical skills in the isolation and cultivation of industrial microorganisms for use in biotechnology.	6	LO5, LO6, LO7, LO8, LO9, LO12
	BD	EC	Cellular biotechnology	Cellular biotechnology studies the foundations of methods for the cultivation and vital activity of cells of animal and plant organisms in vitro. Methods for constructing cells of a new type based on their hybridization, reconstruction and cultivation, the possibility of cloning tissues or whole organisms from individual cells. Forms biotechnological principles for the synthesis of products based on cells of microorganisms, plants and animals.	5	LO4, LO6, LO7, LO9
	BD	EC	Cultivation technology of plant cell and tissue culture	Technique of growing culture of plant objects in vitro. Callus cultures. Dedifferentiation and callus formation. Suspension culture of plant cells. Methods of isolation and cultivation of protoplasts. Fusion of protoplasts. Hybridization of somatic cells. Students should know in vitro cultivation of plant cells and tissues for use in biotechnological processes.	5	LO2, LO4, LO5, LO6, LO7, LO8
	PD	EC	Biophysics	Laws of biophysics and biophysical properties of biomolecule systems. Biophysics of membranes, proteins, and complex molecular systems. Student has an understanding of the basic phenomena, concepts, laws and methods of biophysics, the skills of the simplest practical calculations, as well as experimental work in the laboratory.	5	LO2, LO4, LO8, LO12
	PD	EC	Bionanotechnology	Bionanotechnology is a field of science at the intersection of biology and nanotechnology, which covers a wide range of technological approaches, including: the use of nanotechnological devices and nanomaterials in biotechnology; the use of biological molecules for nanotechnological purposes; nanobiophysics of biomolecules; folding proteins; creation of biotechnological products, the	5	LO4, LO6, LO12

				properties of which are determined by dimensional characteristics; the use of biotechnological approaches based on the principle of controlled self-organization of nanostructures.		
Module of acquired new professional competencies	BD	EC	Subjects in the additional educational program	Studying additional educational program - Minor (Minor). A set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies that allow graduates to be more in demand on the labor market of the region and the country as a whole.	12	LO4, LO6
Final certification module	PD	UC	Pre-graduate or industrial practice/	Pre-graduate practice and subsequent diploma design or research work is intended for independent professional activity. The purpose of pre-graduate practice is to acquire the student's production skills for independent work, to collect data for the completion of the final qualification work or source data for research work.	8	LO2, LO4, LO6, LO7, LO8, LO9, LO12
			Writing and defending a thesis, a graduate work of preparing and passing a comprehensive exam	It provides implementation of analytical review, setting goals, study objectives, experimental part, results analysis Level of learning outcomes formation of EP is determined: possession of basic knowledge in field of natural science disciplines, skills in handling modern technology, ability to use information technologies in professional activity; critical thinking, solving tasks.	12	LO1, LO2, LO3, LO10, LO11

## APPROVAL SHEET

according to the Educational program 6B05120 «Biotechnology»

Director DAA \_\_\_\_\_ Naukenova A. S.  
signature

Director DAS \_\_\_\_\_ Nazarbek U.B.  
signature

Director DE and C \_\_\_\_\_ Bazhirov T. S.  
signature