Geology and Oil-gas Business Institute named after K. Turyssov

Department of Chemical and Biochemical Engineering

EDUCATIONAL PROGRAM
8D05105 – Biotechnology

Code and classification of the field of education: **8D05** Natural Sciences, Mathematics and Statistics

Code and classification of training areas: **8D051** Biological and related sciences

Group of educational programs: **D082** Biotechnology

Level according to the NQF: 8

Level according to the IQF: 8

Duration of study: 3 years

Volume of loans: 180

Almaty 2025

The educational program 8D05105 «Biotechnology» was approved at the meeting of the Scientific Council of KazNTU named after K.I.Satpayev

Protocol №10 from «06» 03 2025y

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of K.I.Satpayev KazNTU

Protocol №3 from «20» 12 2024y

The educational program 8D05105 «Biotechnology» was developed by the academic committee in the direction: 8D051 «Biological and related Sciences»

Name	Academic degree/ academic	Post	Place of work	Signature
Chairman of the Academic Committee:				
Belkozhaev Ayaz Maratovich	Doctor PhD	Associate Professor	Kazakh National Research Technical University named after K.I.Satpayev	
Teaching staff:				
Narmuratova Zhanar Bakhytovna	Doctor PhD	Associate Professor	Kazakh National Research Technical University named after K.I.Satpayev	
Mangazbaeva Rauash Amantaevna	Candidate of Chemical Sciences, Associate Professor	Associate Professor	Kazakh National Research Technical University named after K.I.Satpayev	
Sandybayeva Sandugash Kalzhankyzy	-	Lecturer	Kazakh National Research Technical University named after K.I.Satpayev	
Employers				
Jamalova Gulya Abaevna	Candidate of Agricultural Sciences	Associate Professor	General Director of Scientific Diagnostic Center "Animal expert group" LLP	
Students:				
Amantai Indira	-	Student	Kazakh National Research Technical University named after K.I.Satpayev	

Content

List of abbreviations and designations

EP – Educational program

CC – Communicative competence

LO – Learning Outcomes

NJSC - Non-profit joint stock company

1. Description of the educational program

The educational program (hereinafter EP) is a set of documents developed by the Kazakh National Research Technical University named after K.I. Satpaev and approved by the Ministry of Science and Higher Education of the Republic of Kazakhstan. The EP takes into account the needs of the regional labor market, the requirements of government agencies and relevant industry requirements.

The EP includes both theoretical knowledge and practical application from fundamental science through experimental design to production, product analysis and life cycle analysis of the manufactured object. The curriculum provides a cross-platform approach allowing students to have a unique and personalized experience that will appeal to a wide range of employers. Students practice problem solving, project management, and professional communication skills.

The EP is based on the state educational standard for higher professional education in the relevant field.

The EP defines the program educational goals, the learning outcomes of undergraduates, the necessary conditions, content and technologies for the implementation of the educational process, the assessment and analysis of the quality of students during training and after graduation.

The EP includes the curriculum, the content of disciplines, learning outcomes and other materials to ensure quality education for undergraduates.

2. The purpose and objectives of the educational program

The purpose of the educational program "Biotechnology" is to train qualified, competitive specialists capable of applying modern experimental methods of working with biological objects and modern equipment in the conditions of modernization of biotechnological production.

The main professional educational program is focused on the implementation of the following principles: within the framework of the program, different directions are offered: The direction is intended to provide specialization in a specific field of industrial biotechnology. Students have the opportunity to adapt their education by choosing one direction and supplementing it with courses in other areas or other courses in biotechnology. You can also choose courses from any field to create your unique professional profile.

Areas of professional activity:

- scientific and experimental research in industrial areas of biotechnology, breeding and breeding of new breeds of animals, plant varieties and strains of microorganisms;

- production of biotechnological products for various purposes and development of new biotechnological processes.

3. Requirements for the evaluation of learning outcomes of the educational program

Formed learning outcomes:

RO1. Systematically understand the basic concepts, scientific theories and concepts, critically assess their scientific significance, analyze concepts in the fields of biotechnology and adjacent Sciences.

RO2. Put forward hypotheses, develop methodically based scientific projects, and determine the problem of research in the field of Biotechnology.

RO3. Solving biotechnological problems using molecular, genetic, biochemical and bioinformatic methods.

RO4. Analyze the obtained data, create scientific publications in accordance with international standards, present them in the scientific community and interpret the results of scientific research.

RO5. To propose ways to apply scientific results in industrial, medical, agricultural and environmental systems and put them into practice, taking into account the possibilities of technology transfer.

RO6. Introduce digital technologies and information resources into scientific and pedagogical processes, improve the efficiency of professional activities and use them

RO7. Interact constructively in a professional environment, support the culture of the ethical scientific community, and comply with the norms of scientific ethics and the principles of academic integrity.

RO8. Conduct an expert analysis and evaluate biotechnological projects from the point of view of Sustainable Development Goals, taking into account their socio-economic and environmental impacts.

P09.implementation of teaching activities in higher educational institutions with the use of modern pedagogical technologies in Biotechnology and the introduction of scientific achievements in the educational process.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	8D05 Natural Sciences, Mathematics and Statistics
2	Code and classification of training areas	8D051 Biological and related sciences
3	Group of educational	D082 Biological and related sciences

	programs	
4	Name of the educational program	Biotechnology
5	Brief description of the educational program	The biotechnology degree program provides a deep understanding of how to design and use modern life science-based manufacturing processes, considering product quality, sustainability and finance. Graduates have the competencies and skills to use cells, cellular components and biomolecules to produce goods such as chemicals, food, biofuels and biomaterials to develop a sustainable society. The educational program includes advanced training courses on biotechnological tools used for the development of industrial processes, the sustainable production of goods and the impact of such processes on the environment and society.
6	The purpose of the EP	Training of highly qualified scientific and pedagogical personnel in the field of biotechnology, capable of solving practical problems in the field of biotechnological production, organizing and managing biotechnological production
7	Type of EP	New
8	Level according to the NQF	8
9	Level according to the IQF	8
10	Distinctive features of the EP	no
11	List of competencies of the educational program:	KK1. Communicativeness KK2. Basic literacy in natural sciences KK3. General engineering competencies KK4. Professional competencies KK5. Engineering and computer competencies KK6. Engineering and working competencies KK7. Socially-economic competencies
12	Learning outcomes of the educational program:	RO1. Systematically understand the basic concepts, scientific theories and concepts, critically assess their scientific significance, analyze concepts in the fields of biotechnology and adjacent Sciences. RO2. Put forward hypotheses, develop methodically based scientific projects, and determine the problem of research in the field of Biotechnology. RO3. Solving biotechnological problems using molecular, genetic, biochemical and bioinformatic methods. RO4. Analyze the obtained data, create scientific publications in accordance with international standards, present them in the scientific community and interpret the results of scientific research. RO5. To propose ways to apply scientific results in industrial, medical, agricultural and environmental systems and put them into practice, taking into account the possibilities of technology transfer. RO6. Introduce digital technologies and information resources into scientific and pedagogical processes, improve the efficiency of professional activities and use them RO7. Interact constructively in a professional environment, support the culture of the ethical scientific community, and comply with the norms of scientific ethics and the principles

		of academic integrity. RO8. Conduct an expert analysis and evaluate biotechnological projects from the point of view of Sustainable Development Goals, taking into account their socio-economic and environmental impacts. P09.implementation of teaching activities in higher educational institutions with the use of modern pedagogical technologies in Biotechnology and the introduction of scientific achievements in the educational process.
13	Form of training	Day time
14	Duration of training	3 years
15	Volume of loans	180
16	Languages of instruction	Kazakh, Russian, English
17	Academic degree awarded	PhD philosophy doctors
18	Developer(s) and authors:	Belkozhaev A.M.,Mangazbaeva R.A.,Sandybaeva S.K.

4.2. The relationship between the achievability of the formed learning outcomes according to the educational program and academic disciplines

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)								
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Cycle of basic disciplines University component												
1	Academic writing	Purpose: To form the system competencies of doctoral students and young researchers in the field of academic writing as a key tool for scientific communication and publication activities. Content: Scientific discourse and academic communication; Typology of scientific texts: from dissertation to publication; Creation of original scientific content; Scientific text: structure and logic of construction; Comparative analysis of sources and preparation of a literary review; Work with metadata and scientometric tools; Preparation of articles for international peer-reviewed journals; Work with reviews and the scientific community; Academic mobility and grant support for research; Annotations, patents, reports: science beyond the article; Planning of publication strategy and research career; English language of scientific communication.	5		v		**v**			v	**v**	
2	Methods of scientific research	Purpose: It consists in mastering knowledge about the laws, principles, concepts, terminology, content, specific features of the organization and management of scientific research using modern methods of scientometry. Contents: structure of technical sciences, application of general scientific, philosophical and special methods of scientific research, principles of organization of scientific research, methodological features of modern science, ways of development of science and scientific research, the role of technical sciences, computer science and engineering research in theory and practice.	3	**v**		**v**		v	v			

Cycle of basic disciplines Selection component												
3	Bioinformatics and Big Data Analysis	The main goal of the course is to develop in doctoral students a comprehensive understanding of bioinformatics, methods for processing genomic, proteomic and metabolomic data, as well as mastering the tools of machine learning and artificial intelligence in biological and biotechnological research. The course is aimed at studying algorithms for analyzing big data used to study genetic sequences, proteins, metabolites, and modeling molecular interactions. Doctoral students will master bioinformatics databases, principles of working with NGS data, methods of structural bioinformatics, as well as approaches to systems biology and mathematical modeling of biological processes.	5			**v**	v		**v**		**v**	
4	Modern problems of biotechnology	The main objective of the course is to develop in doctoral students a deep understanding of modern problems and challenges in biotechnology, as well as methods for solving them based on advanced scientific achievements. The course is aimed at analyzing current trends and developments in biotechnology, including genetic engineering, synthetic biology, biopharmaceuticals, industrial biotechnology, ecobiotechnology and bioinformatics. Doctoral students will study key ethical, legal, economic and technological aspects of modern biotechnology, which will enable them not only to critically evaluate existing solutions, but also to develop innovative approaches to solving global biotechnological problems.	5	**v**	v			v		v	v	
5	Molecular biology and genetic engineering	The main objective of the course is to develop a deep understanding of the fundamental principles of molecular biology and genetic engineering in doctoral students, as well as master advanced methods of genome editing, molecular diagnostics and gene therapy. The course is aimed at studying modern strategies of gene modification, molecular mechanisms of gene expression, regulation of genetic	5			v	**v**		v			**v**

		activity and biotechnological applications of recombinant DNA technologies. During the training, doctoral students will become familiar with the key principles of genome editing (CRISPR-Cas, TALENs, ZFN), methods of proteomic and metabolomic analysis, bioengineering technologies for creating transgenic organisms and personalized therapy. The course also covers the ethical, legal and biosafety aspects of genetic engineering, which will allow future researchers not only to critically evaluate existing technologies, but also to develop innovative biomedical and biotechnological solutions.										
6	Sustainability Science	Objective: to develop a deep understanding among doctoral students of the interactions between natural and social systems, as well as to develop skills for identifying and developing strategies for sustainable development that promote long-term human well-being and environmental preservation. Content: complex interconnections between ecosystems and societies. An analysis of sustainability issues at local, national, and international levels.	5		v	v		v			v	
	CYCLE OF PROFILE DISCIPLINES University component											
7	Biotechnology of food and functional products	The main objective of the course is to develop fundamental knowledge and practical skills in doctoral students in the field of biotechnology of food and functional products, development and implementation of innovative technologies for obtaining products with high nutritional and biological value. The course is aimed at developing an innovative approach in the food industry, mastering advanced methods of biotechnological transformation of food components, which will allow doctoral students to develop new generation products with specified properties.	5	**v**				v		v		
8	Drug and pharmaceutical biotechnology	The main goal of the course is to develop in doctoral students an in-depth understanding of the biotechnological	5		v		**v**			**v**		

		principles of development, production and evaluation of drugs, as well as mastering advanced methods of bioengineering, gene and cell therapy, biopharmaceuticals and nanobiotechnology.										
9	Ecological biotechnology and bioenergy	The main objective of the course is to develop in doctoral students a deep understanding of biotechnological approaches to solving environmental problems and developing sustainable bioenergy systems, as well as mastering advanced methods of biotransformation, waste disposal, bioremediation and production of renewable energy sources.	5			**v**		**v**			**v**	
10	Modeling and scaling of biotechnological processes	The main goal of the course is to develop in doctoral students a deep understanding of the principles of mathematical modeling, optimization and scaling of biotechnological processes to increase their efficiency and industrial applicability.	6	v	v			**v**		**v**		

5. Curriculum of the educational program

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 21.04.2025 Minutes № 13

WORKING CURRICULUM

Academic year	2025-2026 (Autumn, Spring)
Group of educational programs	D082 - "Biotechnology"
Educational program	8D05101 - "Biotechnology"
The awarded academic degree	Doctor of Philosophy PhD
Form and duration of study	full time (scientific and pedagogical track) - 3 years

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters						Prerequisites
									1 course		2 course		3 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
CYCLE OF BASIC DISCIPLINES (BD)															
M-1. Basic training module (university component)															
MET322	Methods of scientific research		BD, UC	5	150	30/0/15	105	E	5						
LNG305	Academic writing		BD, UC	5	150	0/0/45	105	E	5						
HBI300	Modern problems of biotechnology	1	BD, CCH	5	150	30/0/15	105	E	5						
HBI301	Molecular biology and genetic engineering	1	BD, CCH	5	150	30/0/15	105	E	5						
HBI302	Bioinformatics and Big Data Analysis	1	BD, CCH	5	150	30/0/15	105	E	5						
M-2. Module of professional activity (component of choice)															
MNG350	Sustainability Science	1	BD, CCH	5	150	30/0/15	105	E	5						
M-3. Practice-oriented module															
AAP350	Pedagogical practice		BD, UC	10				R		10					
CYCLE OF PROFILE DISCIPLINES (PD)															
M-2. Module of professional activity (component of choice)															
HBI303	Biotechnology of food and functional products	1	PD, CCH	5	150	30/0/15	105	E	5						
HBI304	Drug and pharmaceutical biotechnology	1	PD, CCH	5	150	30/0/15	105	E	5						
HBI305	Ecological biotechnology and bioenergy	2	PD, CCH	5	150	30/0/15	105	E	5						
HBI306	Modeling and scaling of biotechnological processes	2	PD, CCH	5	150	30/0/15	105	E	5						
M-3. Practice-oriented module															
AAP355	Research practice		PD, UC	10				R			10				
AAP347	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	20				R			20				
M-4. Experimental research module															
AAP336	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	5				R	5						
AAP347	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	20				R		20					
AAP356	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	30				R				30			
AAP356	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	30				R					30		
AAP348	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	18				R						18	
M-5. Module of final attestation															

ECA325	Final examination (writing and defending a doctoral dissertation)		FA	12											12		
Total based on UNIVERSITY:									30	30	30	30	30	30			
									60		**60**		**60**				

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	University component (UC)	Component of choice (CCH)	Total
GED	Cycle of general education disciplines	0	0	0	0
BD	Cycle of basic disciplines	0	20	5	25
PD	Cycle of profile disciplines	0	10	10	20
Total for theoretical training:		**0**	**30**	**15**	**45**
RWDS	Research Work of Doctoral Student				123
ERWDS	Experimental Research Work of Doctoral Student				0
FA	Final attestation				12
TOTAL:					**180**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 6 dated 18.04.2025

Decision of the Academic Council of the Institute. Minutes № 6 dated 26.02.2025

Signed:

Governing Board member - Vice-Rector for Academic Affairs	Uskenbayeva R. K.
Approved:	
Vice Provost on academic development	Kalpeyeva Z. B.
Head of Department - Department of Educational Program Management and Academic-Methodological Work	Zhumagaliyeva A. S.
Director - Geology and Oil-gas Business Institute named after K. Turyssov	Auyelkhan Y. .
Department Chair - Chemical and biochemical engineering	Mangazbayeva R. A.
Representative of the Academic Committee from Employers ____Acknowledged____	Dzhamalova G. A.