

**NJSC "Satbayev University"  
Chemical and Biological Technology Institute**

**CURRICULUM PROGRAM  
«BIOECOLOGICAL ENGINEERING»  
(Specialized area (1,5 years))**

**Master in Natural Science in  
«7M05202, 7M05104 -Bioecological Engineering»**

1st edition  
in accordance with the State Education  
Standard of Higher Education 2018

**Almaty 2020**

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**Программа составлена и подписана сторонами:**

**от КазННТУ им К.Сатпаева:**

1. И.о. заведующего кафедрой «Биотехнология»  З.К. Туйебахова
2. Директор ИХиБТ  З.К. Туйебахова

**От работодателей:**

1. Главный специалист  
 ТОО «Казахстанское Агентство  
 Прикладной Экологии»,  
 ученый секретарь НТС, к.т.н.  Ж.А. Дюсенова

2. И.о.заведующего лаборатории  
 иммунологии и иммунобиотехнологии  
 РГП «Институт молекулярной биологии  
 и биохимии им. М.А. Айтхожина», к.б.н.  Р.Т.Тлеулиева

Утверждено на заседании Учебно-методического совета Казахского  
 национального исследовательского технического университета им К.И. Сатпаева.  
 Протокол №3 от 19.12.2019 г.

**Квалификация:**

- Уровень 7 Национальной рамки квалификаций:  
 7M05 – Естественные науки, математика и статистика  
 7M051 – Биологические и смежные науки (магистр)  
 7M052 – Окружающая среда (магистр)

**Профессиональная компетенция:** владение фундаментальными естественно-научными и биологическими знаниями современной инженерной биотехнологии и инженерной экологии и понимания их назначения для решения некоторых глобальных проблем человечества (экологической, энергетической, сырьевой, продовольственной); способность ориентироваться в вопросах общей экологии и общей биотехнологии, и отдельных ее направлений; знать и уметь использовать в науке и производстве технологические возможности биоэкологической инженерии; быть способным к реализации системы менеджмента качества экологизированных биотехнологий в соответствии с требованиями национальных и международных стандартов качества.

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## BRIEF DESCRIPTION OF THE PROGRAM

The Master's educational program (hereinafter referred to as OPM) "Bioecological Engineering" in the direction of training 7M051 - "Biological and related sciences" and 7M052 - "Environment" was developed by the K.I. Satpayev Kazakh National Research Technical University.

### 1 Objective of the OPM “Bioecological Engineering”

Preparation of highly qualified masters of natural sciences with professional knowledge in the field of engineering biotechnology and engineering ecology, who are able to implement the acquired knowledge in engineering design and research and production activities.

### 2 Types of work

Types of professional activity of the Master of Natural Sciences in the scientific and pedagogical direction of training 7M051 - "Biological and related sciences" and 7M052 - "Environment":

- organizational and managerial support,
- design and development department,
- production and technological infrastructure.

### 3 Objects of professional activity

The objects of professional activity of graduates are:

- natural and man-made ecosystems; design, control, operation, monitoring and expertise of ecological and biological processes in industrial production;
- biomass, structures and green technologies for industrial biotechnological processes;
- microorganisms, cell cultures of plants and animals, biologically active substances;
- quality control tools for ecosystems, raw materials and products;
- environmental and biotechnological regulations for the production of products, international standards.

Professional activities: power engineering, mining, mining and metallurgy, oil, gas and chemical industry, mechanical engineering, agro-industrial complex; scientific and production laboratories; laboratories for product quality and safety control; environmental and customs services and organizations; research and design industry institutes; secondary technical and higher educational institutions.

## PASSPORT OF THE EDUCATIONAL PROGRAM

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## 1 Scope and content of the program

The duration of the master's degree program is determined by the amount of acquired academic credits. Upon mastering the established number of academic credits and achieving the expected learning outcomes for obtaining a master's degree, the master's educational program is considered fully mastered. There are 60 academic credits in the specialized master's program with a 1-year study period.

Planning of the content of education, the method of organizing and conducting the educational process is carried out by the university and scientific organization independently on the basis of credit technology of training.

The Master's degree program in the profile direction implements educational programs of postgraduate education for the training of managerial personnel with in-depth professional training.

The content of the Master's degree program consists of:

- 1) theoretical training, including the study cycles of basic and major disciplines;
- 2) practical training of undergraduates: various types of practices, scientific or professional internships;
- 3) experimental research work, including the implementation of a master's project - for a specialized master's degree;
- 4) final certification.

**The content of the PSO.** OPM "Bioecological Engineering" is implemented by K.I. SatpayevKazNRTU in the direction of training 7M051 - "Biological and related sciences" and 7M052 - "Environment" and represents a system of documentation that regulates the goals, establishes the necessary conditions, technologies and content of the educational process, which determines the quality of training for undergraduates.

OPM "Bioecological Engineering" provides an opportunity to gain in-depth knowledge, key skills and abilities of the graduate and its further development in the field of engineering biotechnology and environmental engineering. This OP is based on the possibility of providing a master's student with the choice of an appropriate educational trajectory or a specific specialization based on the main educational program, but containing their own individual competencies that reflect the specifics of a particular specialization in two areas: 7M051 - "Biological and related sciences" and 7M052 - "Environment".

The OPM contains the following specializations:

- Engineering biotechnology;
- Industrial biotechnology;
- Engineering ecology;
- Geoecology and environmental management.

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**Objectives of the educational program:**

The Master's degree in 7M051 - "Biological and related sciences" and 7M052 - "Environment" should be prepared to solve the following professional tasks in accordance with the direction of the OP and types of professional activity:

*1 Design and development activities:*

- to calculate energy and material balances of ecological and biotechnological processes;
- to calculate the structural and technological parameters of the main and auxiliary equipment in eco and biotechnology;
- to model, plan and optimize ecotechnological and biotechnological processes;
- to develop an instrumental and technological scheme of the process;
- to design workshops and structures of ecological production facilities and biotechnologies by industry.

*2 Design and technological activities:*

- to develop an eco-friendly technology for the production of chemicals and biomaterials;
- to improve the technological schemes of existing production facilities with the introduction of new strains of microorganisms;
- to create business plans for eco-technological and biotechnological projects;
- to develop energy-and resource-saving methods in the field of engineering biotechnology and environmental engineering;
- to develop environmental protection measures for enterprises of various profiles;
- to introduce the results of scientific research into production;
- to process the results of observations and experiments using modern methods and analysis tools.

*3 Organizational and managerial activities:*

- to manage industrial eco-friendly biotechnological industries;
- to carry out information support of production, labor, and management;
- to carry out activities for the organization of production in accordance with the regulations;
- to organize the activities of the team, draw up work plans and set production goals;
- to resolve issues of material and technical support, control the tasks implementation.

**2 Requirements for applicants**

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The previous level of applicants is higher professional education (bachelor's degree). The applicant must have a diploma of the established sample and confirm the level of knowledge of the English language with a certificate or diplomas of the established sample.

The procedure for admitting students to a magistracy is established in accordance with the "Standard rules for admission to training in educational organizations that implement educational programs of postgraduate education."

The formation of a contingent of undergraduates is carried out by placing a state educational order for the training of scientific and pedagogical personnel, as well as paying for training at the expense of students' own funds and other sources. The state provides citizens of the Republic of Kazakhstan with the right to receive, on a competitive basis, in accordance with the state educational order, free postgraduate education, if they receive education of this level for the first time.

At the "entrance", a master's student must have all the prerequisites necessary for mastering the corresponding educational master's program. The list of required prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, the master student is allowed to master them on a paid basis.

### **3 Requirements for completing studies and obtaining a diploma**

**Degree/qualifications awarded:** The graduate of this educational program is awarded the academic degree “Master of natural sciences” in the field of 7M051- “Biological and related sciences” and 7M052- “Environment”.

A graduate who has completed master’s degree programs must have the following general professional competencies:

- the ability to independently acquire, comprehend, structure, and use new knowledge and skills in professional activity, to develop their innovative abilities;
- the ability to independently formulate research goals, establish a sequence for solving professional problems;
- the ability to apply in practice the knowledge of fundamental and applied disciplines that determine the focus (profile) of the master's program;
- the ability to professionally choose and creatively use modern technical equipment for solving scientific and practical problems;
- the ability to critically analyze, represent, defend, discuss, and disseminate the results of their professional activities;
- proficiency in compiling and preparation of scientific and technical documentation, scientific reports, reviews, reports and articles;
- willingness to lead a team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional, and cultural differences;

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- readiness for communication in oral and written forms in a foreign language to solve problems of professional activity.

A graduate who has completed the master's program must have professional competencies corresponding to the types of professional activity that the master's program is focused on:

***production activities***

- the ability to independently carry out production, field and laboratory and interpretation work in solving practical problems;
- the ability to professionally operate modern area and laboratory equipment and instruments in the field of the mastered master's program;
- the ability to use modern methods of processing and interpreting complex information to solve production problems;

***project activities:***

- the ability to independently compose and submit projects of the research work;
- readiness to design complex research work in solving professional tasks;

***organizational and managerial activities***

***organizational and management activities:***

- willingness to use practical skills of organizing and managing research work in solving professional problems;
- readiness for practical use of regulatory documents in the planning and organization of scientific and industrial work;

When developing a master's program, all general cultural and professional competencies, related to those types of professional activities for which the master's program is oriented, are included in the set of required results of mastering the master's program.

## **4 Working curriculum of the educational program**

### **4.1. Study period 1 year**

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Duration of training: 1 Year.

Year of study	Code	Names of the discipline	Component	Credits		Lec/lab/pr	Prerequisites	Code	Names of the discipline	Component	Credits		Lec/lab/pr	Prerequisites
				ECTS	RK						ECTS	RK		
<b>1 semester</b>														
1	LNG205	Foreign language (professional)	BD UC	5	3	0/0/3			Experimental research work of a master's student	RWN	6	4		
	MNG230	Project management (management + management psychology)	BD UC	3	2				Industrial practice	CD	10	6		
	BIO258	Modern methods, achievements and problems of biotechnology	BD CC	4	2				Preparation and defense of a master's dissertation (PaDMD)	FA	12	7		
	BIO252	Economic regulation of environmental protection and environmental management	CD UC	5	3									
	BIO243	Bioecotechnology in environmental protection by industry	CD UC	5	3									
	BIO270	Technology of basic production in nature management	CD UC	5	3									
		Experimental research work of a master's student	ERWM	7	4									
		<b>Total:</b>				<b>34</b>	<b>20</b>			<b>Total:</b>		<b>28</b>	<b>17</b>	
									<b>Total:</b>		<b>62</b>	<b>37</b>		

#### 4.2. Catalog of elective disciplines

##### КАТАЛОГ ЭЛЕКТИВНЫХ ДИСЦИПЛИН

Образовательная программа "Биоэкологическая инженерия"  
 на базе специальностей 6М0701000-Биотехнология, 6М060800-Экология

	код	Наименование дисциплин	кредиты	Лк/лб/пр	семестр
1	BIO259	Микробиологические процессы в биотехнологиях	2	1/0/1	2
	BIO254	Методы и принципы культивирования клеток для биологической инженерии			
2	BIO269	Инженерная экология	3	2/0/1	2
	BIO266	Техногенные объекты и техносферная безопасность			
		<b>Итого</b>	<b>5</b>		

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## **5 Descriptors of the level and scope of knowledge, skills, abilities and competencies**

The requirements for the level of preparation of a master's student are determined based on the Dublin descriptors of the second level of higher education (master's) and reflect the acquired competencies, expressed in the achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire educational program of the master's program, and at the level of individual modules or academic discipline.

Descriptors reflect learning outcomes that characterize the student's abilities:

1) to demonstrate a knowledge and present the understanding in the field of biocotechnology of solid waste processing, biotechnology in environmental protection, technologies of basic industries in environmental management, etc., based on advanced knowledge in the field of biotechnology and ecology in the development and (or) application of ideas in the context research;

2) to apply at a professional level their knowledge, understanding and ability to solve problems in a new environment, in a broader interdisciplinary context;

3) to collect and interpret information to form judgments, taking into account social, ethical and scientific considerations;

4) clearly and unambiguously communicate on the given information, ideas, conclusions, problems and solutions, both to specialists and non-specialists;

5) to obtain learning skills necessary for self-continued further education in the field of bioecological engineering.

## **6 Competencies obtained in master's program training**

6.1 Requirements for key competencies of graduates of a specialized master's program must:

1) have a view:

- on current trends in the development of scientific knowledge;
- on specific methodological and philosophical problems of natural (social, humanitarian, economic) sciences;
- on the contradictions and socio-economic consequences of globalization processes;
- on the current state of the economic, political, legal, cultural and technological environment of the world business partnership;
- about the organization of strategic enterprise management, innovation management, leadership theories;
- on the main financial and economic problems of the functioning of enterprises.

2) know:

- the methodology of scientific knowledge;
- the major driving forces and challenges in the structure of the economy;
- the features and rules of investment cooperation;

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- at least one foreign language at a professional level, allowing for scientific research and practical activities.

3) be able to:

- apply scientific methods of cognition in professional activities;
- critically analyze existing concepts, theories and approaches to the study of processes and phenomena;
  - integrate the knowledge gained in different disciplines, use it to solve analytical and managerial problems in new unfamiliar conditions;
  - conduct a microeconomic analysis of the economic activity of the enterprise and use its results in the management of the enterprise;
  - obtain information about the source text;
  - post a review;
  - apply in practice new approaches to the organization of marketing and management;
  - make decisions in difficult and non-standard situations in the field of organization and management of economic activities of an enterprise (firm);
  - apply in practice the norms of the legislation of the Republic of Kazakhstan in the field of regulation of economic relations;
  - think creatively and be creative in solving new problems and situations;
  - carry out information-analytical and bibliographic works with the involvement of modern information technologies;
  - summarize the results of experimental research and analytical work in the form of a master's thesis, research article, report, analytical note, etc.

4) have skills:

- in solving standard scientific and professional problems;
- in conducting scientific analysis and solutions of practical problems in the organization and management of economic activities in organizations and enterprises;
  - to investigate the problems in the field of management and marketing and use the results to improve the methods of enterprise management;
  - of professional communication and intercultural communication;
  - of oratory, correct and logical design of thoughts in oral and written form;
  - in expanding and deepening the knowledge necessary for daily professional activities and continuing education in doctoral studies;
  - in the use of information and computer technologies in the field of professional activity.

5) be competent:

- in the field of research methodology in the specialty;

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- in the field of contemporary problems of the world economy and the participation of national economies in world economic processes;
- in the organization and management of the enterprise;
- in the implementation of industrial relations with various organizations, including public service bodies;
- in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.

**B - Basic knowledge, abilities and skills**

B1. - the ability to use the philosophical concepts of natural science to form a scientific worldview;

B2 - the ability to apply knowledge of methodology in bioecological engineering to solve specific professional problems and assess technological risks.

**P - Professional competencies:**

P.1 - the ability to collect and analyze the initial data required for calculation, modeling and experiment;

P.2 - the ability, on the basis of standard techniques and the current regulatory framework, to calculate profitability and economic indicators characterizing the implementation and operation of the object;

P.3 - the ability to collect, analyze and process the data necessary for solving the specific research tasks, using the data bases of Kazakhstani and international organizations;

P.4 - the ability to analyze and interpret the research results and other information contained in the reporting of organizations, departments and use the information obtained for decision-making;

P.5 - the ability to use modern technical means and information technologies to solve analytical and research problems;

P.6 - the ability to organize and manage the activities of a small group created for the implementation of a specific project;

P.7 - master the methods of conducting patent research, licensing and copyright protection when creating innovative products in the field of professional activity.

**O - Universal, social, and ethical competencies**

O1 – knowledge of contemporary social and political problems;

O2 –the ability to perceive intercultural differences, the ability to observe and maintain ethical norms and rules;

O3 - communication skills in a foreign language, the ability to work in an international context

**C– Special and managerial competencies:**

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- C1 - the ability to lead team work and ensure industrial safety measures;
- C2 - ability to plan and organize professional events;
- C3 - readiness to act in non-standard situations, to have social and ethical responsibility for the decisions made.

6.2 Requirements for the experimental research work of a master student in a specialized master's program:

- 1) corresponds to the profile of the master's educational program, according to which the master's project is carried out and defended;
- 2) is based on modern achievements of science, technology and production and contains specific practical recommendations, independent solutions to management problems;
- 3) it is performed using advanced information technologies;
- 4) contains experimental and research methodological, practical sections on the main protected provisions.

6.3 Requirements for the organization of practices:

The educational program of the profile master's degree includes industrial practice in the PD cycle.

Industrial practice in the PD cycle is carried out with the aim of consolidating the theoretical knowledge gained in the learning process, acquiring practical skills, competencies and experience of professional activity in the taught educational program of the magistracy, as well as mastering advanced experience.

**7 Appendix to the ECTS Diploma**

The application is developed according to the following Standards of the European Commission, Council of Europe and UNESCO/CEPES. This document is for academic recognition only and is not an official proof of education. It is not valid without a higher education diploma. The purpose of completing the European Annex is to provide sufficient information about the holder of the diploma, the qualification obtained, the level of this qualification, the content of the study program, the results, the functional purpose of the qualification, as well as information about the national educational system. The application model that will be used to translate grades uses the European Credit Transfer or Transfer System (ECTS).

The European Diploma Supplement provides an opportunity to continue education at foreign universities, as well as to confirm national higher education for foreign employers. When going abroad for professional recognition, additional legalization of the educational diploma will be required. The European Diploma Supplement is completed in English upon individual request and is issued free of charge.

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**Foreign language (professional)**

Professional English for Project Managers

CODE – LNG205

CREDIT – 3 (0/0/3)

PREREQUISITES – Academic English, Business English, IELTS 5.0-5.5

**THE AIM AND OBJECTIVES OF THE COURSE**

The aim of the course is to develop students' knowledge of the English language for their ongoing academic research and improve their performance in the field of project management.

**BRIEF DESCRIPTION OF THE COURSE**

The course is aimed at developing vocabulary and grammar for effective communication in the field of project management and improving reading, writing, listening and speaking skills at the "Intermediate" level. Students are expected to acquire additional vocabulary in Business English and learn grammatical structures that are often used in the context of management. The course consists of 6 modules. The 3rd module of the course ends with an intermediate test, and the 6th module is followed by a test at the end of the course. The course ends with a final exam. Master students also need to study independently (MIS). MIS is an independent work of undergraduates under the guidance of a teacher.

**KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE**

Upon successful completion of the course, students are able to recognize the main idea and message as well as specific details while listening to monologues, dialogues and group discussions in the context of business and management; understand written and spoken English on topics related to management; write management texts (reports, letters, emails, minutes of meetings), following a generally accepted structure with a higher degree of grammatical accuracy and using business words and phrases, talk about various business situations using appropriate business vocabulary and grammatical structures - in pairs and groups discussions, meetings and negotiations.

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**Project Management**

CODE MNG230

CREDIT 2 (1/0/1)

**PREREQUISITES:** The discipline "Project Management" is based on the knowledge gained as a result of studying disciplines for undergraduate courses

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**THE AIM AND OBJECTIVES OF THE COURSE**

The aim of teaching the discipline "Project Management" is to master the methodology of project management in various fields of activity, learning a culture adequate to modern project management and information technology, create conditions for the introduction of new information technologies in the implementation of projects. The course is based on international guidelines for project management (Project Management Body of Knowledge).

**BRIEF DESCRIPTION OF THE COURSE**

The content of the discipline is aimed at studying modern concepts, methods, project management tools in order to apply them in the further practical activities of a specialist to solve problems of planning and implementing projects.

**KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE.**

Be able to:

- prepare documents for the initialization phase of the project, such as a feasibility study, project charter, etc.
- develop and analyze documents related to the planning of project activities, apply various methods of decision support;
- operatively control the work implementation and follow deadlines;
- select personnel, resolve contradictions between team members;
- to manage the risks arising from the implementation of projects.

Know:

- Modern standards in the area of project management and their characteristics;
- PMI approach to project management;
- Investment planning;
- Accounting for project risks;
- Methods for optimizing the use of available resources;
- Ways of resolving conflict situations;
- Analysis of actual indicators for timely adjustment of the work progress.

Have skills:

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- project management in accordance with modern project management requirements;
- apply in the project management process using MS Project software

**Economic regulation of environmental protection and environmental management**

CODE-BIO252

CREDIT – 3 (2/0/1)

PREREQUISITE: none

**THE AIM AND OBJECTIVES OF THE COURSE**

**Aim:** the study of economic and industrial relations, the economic consequences of industrial production, methods of ensuring the rational use of natural resources and environmental protection, as well as provides theoretical and practical training in the method of environmental management.

**Objectives:** Use of economic methods in the field of environmental protection and ensuring rational use of natural resources.

**BRIEF DESCRIPTION OF THE COURSE**

The discipline "Economic regulation of Environmental management and environmental management" provides an overview of environmental planning activities, payment for emissions to the environment, payment for the use of certain types of natural resources; economic incentives for environmental management, environmental insurance, environmental emissions management, reduction of greenhouse gas emissions and absorption, economic assessment of environmental damage.

**KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE**

Have an understanding of: the role of the economy in the OS problems, the main problems of development of ecological and economic estimation of natural resources; the role of systems analysis in solving social and economic tasks in the field of rational nature management and resource saving.

**Know:** basic methods of economic assessment of natural resources; methods for determining real damage from the irrational use of natural resources; methods for determining the economic efficiency of environmental protection activities; methods of environmental and economic assessment of projected solutions;

**Be able to:** calculate payments for emissions to the OS, environmental, economic and actual prevented damages in the organization of environmental protection measures, the

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effectiveness of environmental protection measures; use regulatory literature and documentation in all areas of environmental protection activities.

**Modern methods, achievements, and problems of biotechnology**

CODE-*BIO258*

CREDIT – 2 (1/0/1)

PREREQUISITE: none

**THE AIM AND OBJECTIVES OF THE COURSE**

**Aim:** To provide students with the knowledge about modern methods and achievements in the field of fundamental and applied biotechnological science, to ensure the formation of undergraduates' ideas about modern problems in the field of cellular and molecular biotechnology.

**Objectives:** Formation of undergraduates' knowledge and skills in developing competencies in the field of engineering biotechnology and the latest technologies to produce biotechnological products in compliance with national and international quality standards.

**BRIEF DESCRIPTION OF THE COURSE**

Modern achievements, methods, and problems of medical, pharmaceutical and food biotechnology. Features of the research development and commercialization of biotechnology in different countries of the world. Target products of biotechnology: recombinant DNA, genetically engineered proteins, monoclonal antibodies, edible vaccines, antibodies, biomaterials. The market for the latest biotechnological products, its structure, and dynamics. Social, legislative, and ethical issues of modern biotechnology.

Biotechnology of new molecules and materials: biosynthesis, properties, applications. World trends in the development of biomaterial science. Problems of synthesis of biomaterials and the validity of increasing the rate of production growth; producers (natural and genetically modified organisms), synthesis technology substrates. Modern methods of research of target products of biotechnology. Methods for the isolation and purification of cellular macromolecules to obtain the target biotechnological product. Biotechnology is the basis of scientific and technological progress and improving the quality of human life under conditions of increasing anthropogenic load.

**KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE**

After completing the course, the master's student must:

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Know the achievements of modern bioengineering, general principles of designing new organisms for biotechnology, genetic methods of medical diagnostics and therapy, problems of modern medical biotechnology;

Master the scientific basics of modern methods for analyzing the most important cellular macromolecules and target products of biotechnology, the methodology of bioengineering cells, tissues and organs, the concept of the need to comply with ethical standards and risk strategies in the development of biotechnological technologies.

Be able to navigate modern trends and methods of biotechnology (genomics, proteomics, genetic engineering, biomaterial science) and use the knowledge gained when writing scientific articles and research projects.

### **Bioecotechnology in environmental protection by industry**

CODE - BIO243

CREDIT - 3 (2/0/1)

PREREQUISITES: no

#### **THE AIM AND OBJECTIVES OF THE COURSE**

**Aim:** Mastering knowledge on the applied application of biotechnology in solving environmental problems by specific biotechnological methods that combine chemical, biological and engineering knowledge in different industries.

**Objectives:**

to consider the engineering and technological aspects of the use of environmental biotechnologies;

to study the methods and principles of operation of the most important structures of industrial devices and biological treatment facilities;

to study the specifics of various organisms and their communities intended for biological treatment of water and soil media, air, natural reservoirs, processing of various wastes of human activity;

to study methods and technologies for the removal of such contaminants as oil and oil products, heavy metals, as well as biodegradation and biocorrosion of various materials, biodeterioration and biofouling.

#### **BRIEF DESCRIPTION OF THE COURSE**

The course of lectures of the discipline is based on topical problems of environmental biotechnology, aimed at solving environmental problems by biotechnological methods in the field of wastewater treatment, aerobic and anaerobic biological methods, deodorization of air-gas emissions, microbiological processing of organic waste, principles of organizing low-waste production. The issues of anaerobic digestion and methane generation are

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sufficiently considered; vermicultivation and vermicomposting; classification of methods and technologies for soil bioremediation; non-biological methods and technologies of bioremediation; biological and combined methods of remediation. Topics of lectures are characterized by novelty, advantage in content and significance for the development of biocotechnology in the Republic of Kazakhstan.

### KNOWLEDGE, ABILITIES AND SKILLS AT THE END OF THE COURSE

be able to:

- reasonably choose objects and research methods for solving the assigned tasks;
- predict the results of their professional activities;
- to give an economic and environmental assessment of various bio-production technologies;
- carry out a comprehensive analysis of biocotechnology objects and predict the productivity of these objects;
- to summarize the results of experimental research and analytical work in the form of a master's thesis, article, report, etc.

### TECHNOLOGY OF BASIC PRODUCTION IN NATURE USE

CODE - BIO 270

CREDIT - 3 (2/0/1)

PREREQUISITES: no

### THE AIM AND OBJECTIVES OF THE COURSE

Formation of undergraduates' understanding of the technologies of the main industrial industries, the knowledge of which is necessary for the ability to navigate in them, as well as for the development and justification of environmental projects and biological technologies.

### BRIEF DESCRIPTION OF THE COURSE

In-depth theoretical knowledge of the foundations and applied technological principles of mining, mineral processing, metallurgy, mechanical engineering, oil and gas production, oil and gas processing, chemical production. Methods and technologies for effective work with industrial objects and materials. Fundamentals of transportation and storage of industrial materials. Review of the possibility of using new technologies of biological origin. Justification and scope of application of environmentally friendly alternative technologies.

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**Objectives:**

- be guided by the concept of environmental acceptability of applied production solutions, the use of natural technological principles and solutions;
- develop skills in the development of innovative technologies of biological origin, as well as innovative technologies that reduce the negative impact on the natural environment.

**KNOWLEDGE, ABILITIES, SKILLS AT THE END OF THE COURSE**

- to know traditional and new technologies of mining, ore dressing, ore processing into metal, machine building and other industries, transport.
- to be able to choose environmentally acceptable technologies using various methods, to define tasks for the rational use of natural processes.
- to possess the skills to analyze the environmental friendliness of technologies, the essence of natural processes and technologies of biological origin for use in industrial production.

**Master's project defense**

CODE - ECA2013

CREDIT –12

The aim of the master's thesis/project is:

demonstration of the level of scientific/research qualifications of a master student, the ability to independently conduct a scientific search, test the ability to solve specific scientific and practical problems, knowledge of the most general methods and techniques for their solution.

**BRIEF DESCRIPTION**

Master's thesis/project is a final qualifying scientific work, which is a generalization of the results of independent research by a master's student of one of the topical problems of a particular specialty of the corresponding branch of science, which has internal unity and reflects the course and results of the development of the chosen topic.

Master's thesis/project is the result of the research/experimental research work of the master's student, carried out during the entire period of study of the master's student.

The defense of a master's thesis is the final stage of the master's preparation. Master's thesis/project must meet the following requirements:

- the thesis should conduct the research or solve topical problems in the field of bioecological engineering;

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- the thesis should be based on the definition of important scientific problems and their solution;
- the decisions must be scientifically grounded and reliable, have internal unity;
- the thesis/project must be written individually;

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**Рецензия**  
**на образовательную программу «Биоэкологическая инженерия»**  
**для магистратуры**  
**Института химических и биологических технологий**  
**КазННТУ имени К.И. Сатпаева**

Представленная образовательная программа (ОП) "Биоэкологическая инженерия» магистратуры Института химических и биологических технологий (ИХиБТ) включает систему документов, разработанных высшим учебным заведением с учетом приоритетных направлений наук и технологий в области биологических и смежных наук, отраженных в требованиях ГОСО высшего образования по указанному направлению подготовки.


Рецензируемая ОП содержит комплекс основных характеристик образования (объем, содержание, планируемый результат), организационные условия, квалификацию, компетенции, краткое описание программы, нормативные документы, характеристику профессиональной и научно-педагогической деятельности, которыми должен обладать магистрант в результате освоения образовательной программы «Биоэкологическая инженерия». В рецензируемой ОП определены:

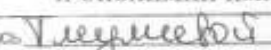

- планируемые результаты освоения образовательной программы;
- компетенции обучающихся, установленные образовательным стандартом;
- планируемые результаты обучения по каждой дисциплине;
- знания, умения и навыки, характеризующие этапы формирования компетенций и обеспечение достижений, планируемых в результате освоения образовательной программы.

В общей характеристике ОП указаны: квалификация, присваиваемая выпускникам; виды профессиональной деятельности, к которой готовятся выпускники; направленность образовательной программы, необходимой для реализации образовательного процесса.

На основании вышеизложенного считаю, что образовательная программа "Биоэкологическая инженерия» может быть реализована на базе Института химических и биологических технологий КазННТУ имени К.И. Сатпаева.

**Рецензент,**  
 И.о.заведующего лаборатории  
 иммунологии и иммунобиотехнологии  
 РГП «Институт молекулярной биологии  
 и биохимии им. М.А. Айтхожина», к.б.н.

 **Р.Т.Тлеулиева**

Подпись   
 Заверяю Главный специалист по кадрам  
 Института молекулярной биологии и биохимии  
 им. М.А. Айтхожина КН МОИР РК  


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**РЕЦЕНЗИЯ**  
**на образовательную программу магистратуры**  
**«Биоэкологическая инженерия»**

Рецензируемая образовательная программа (ОП) «Биоэкологическая инженерия» квалификации «7М051 Биологические и смежные науки» и «7М052 Окружающая среда» (магистр естествознания) национальной рамки квалификации представляет собой описание образовательной подготовки, разработанной на основе Государственного общеобразовательного стандарта высшего образования Республики Казахстан (магистратура).

Содержание и структура ОП по направлению подготовки «7М051 Биологические и смежные науки» и «7М052 Окружающая среда» отвечает основным требованиям стандарта и содержит следующую информацию: цели и задачи ОП, характеристику профессиональной деятельности выпускника, академические требования к поступающим, требования для завершения обучения и получение диплома, рабочий учебный план, дескрипторы уровня и объема знаний, умений, навыков и полный перечень общечеловеческих, социально-этических, базовых, профессиональных и специальных компетенций.

Структура Учебного плана ОП «Биоэкологическая инженерия» логично и последовательна. Дисциплины учебного плана раскрывают сущность актуальных на сегодняшний день проблем.

Сильными сторонами рецензируемой ОП является:

- - освоение выпускниками современных методов обучения в высших учебных заведениях, способствующих формированию творческого, инновационного подхода к пониманию профессиональной деятельности;
- - развитие самостоятельности мышления и умение принимать оптимальные решения в определенных ситуациях.

На основании вышесказанного считаю, что образовательная программа «Биоэкологическая инженерия» направления подготовки «7М051 Биологические и смежные науки» и «7М052 Окружающая среда» может быть рекомендована для внедрения в учебный процесс.

**Главный специалист**  
**ТОО «Казахстанское Агентство**  
**Прикладной Экологии»,**  
**ученый секретарь НТС, к.т.н.**



**Ж.А. Дюсенова**

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