NJSC "Satbayev University"

Chemical and Biological Technology Institute

CURRICULUM PROGRAM

«BIOECOLOGICAL ENGINEERING»
(Scientific and pedagogical area (2 years)

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

1st edition
In accordance with State Mandatory Standard of Higher Education 2018

Almaty 2020

Программа составлена и подписана сторонами:

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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:
7М05 – Естественные науки, математика и статистика
7М051 – Биологические и смежные науки (магистр)
7М052 – 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.

PROGRAM BRIEF DESCRIPTION

Educational program of Master's (hereinafter - EPM) "Bio-ecological engineering" in 7M051–"Biological and related sciences" and 7M052 - "Environment" training directions is developed at Kazakh National Research Technical University named after K.I. Satbayev.

1 Purpose of 'Bio-ecological Engineering' EPM

Training of highly qualified masters in natural sciences with fundamental scientific knowledge in the field of engineering biotechnology and engineering ecology, capable of implementing the knowledge gained in research, engineering design, scientific production and teaching.

2 Types of activity

Professional activities according to scientific and pedagogical Master's educational program in 7M051-'Biological and related sciences' and 7M052-'Environment' training directions:

- Organizational and managerial
- Research
- Design and engineering
- Production and technological
- Pedagogical

3 Professional activity objects

Professional activity objects of graduates are:

- natural and techno genic ecosystems; design, control, operation, monitoring and examination of environmental and biological processes in industrial production;
- biomass, construction and green technology for industrial bio technological processes;
- microorganism, cell cultures of plants and animals, biologically active substances;
- means of control quality of ecosystems, raw materials and products;
- Environmental and biotechnological regulations of production and products, international standards.

Professional activity sphere: energy, mining, mining and metallurgical, oil-gas and chemical industries, mechanical engineering, agro-industrial complex; scientific and

industrial laboratories; laboratories for control over the quality and safety of products; environmental and customs services and organizations; research and design industry institutes; secondary technical and higher educational institutions.

PASSPORT OF EDUCATIONAL PROGRAM

1 Program scope and content

The study duration in Master's is determined by the amount of academic credits acquired. In mastering the established amount of academic credits and achieving the expected study results to obtain Master's degree, Master's educational program is considered to be fully mastered. In scientific and educational Master's degree at least 120 academic credits for the entire period of study, including all types of undergraduates' academic and scientific activities.

Planning of the education content, the way in which the educational process is organized and carried out is executes by the university and the scientific organization independently based on credit study technology.

Master's degree in scientific and educational direction implements educational programs of postgraduate education to prepare academic and scientific-educational personnel for universities and scientific organizations with in-depth scientific- educational and research training.

Master's educational program content consists of:

1) Theoretical training that includes studying the cycles of basic and profiling disciplines

2) Practical training of undergraduates: different types of practices, scientific or professional internships

3) Research work, including the performance of a master's thesis - for a scientific and educational master's degree

4) Final appraisal.

Regulatory documents for developing the educational program

The regulatory legal framework to develop the given educational program is:

- Law of the Republic of Kazakhstan "On education" with amendments and additions within the framework of legislative changes to increase the independence and universities' autonomy" dated 04.07.18. # 171-VI.

- Law of the Republic of Kazakhstan "On amendments and additions to some RK legislative acts on expanding the academic and managerial independence of higher educational institutions" dated 04.07.18. # 171-VI;

- RK Education and Science Minister's decree dated 30.10.18. # 595 "On approval of standard rules of activity at educational institutions of corresponding types";

- State mandatory standard of postgraduate education (Annex 8 to the decree of Minister of Education and Science of the Republic of Kazakhstan # 604-dated 31.10.18;

- Decree of RK Education and Science Minister dated 20.01.15. # 19 "On approval of the rules for transfer and restoration of students by types of educational organizations with amendments and additions under #601 decree dated 31.10.18;

- Working curriculum of "Chemical engineering of hydrocarbon compounds" educational program for 2019-2020, approved by Rector of Kazakh National Research Technical University named after K. I. Satbayev;

- Documents of QMS system (Quality Management System) on organizing the educational process at Kazakh National Research Technical University named after K. I. Satbayev.

EP Content: EP " Bio-ecological Engineering " is implemented by Kazakh National Research Technical University named after K. I. Satbayev in 7M051 – 'Biological and related sciences' and 7M052 – 'Environment' training directions (Master's degree) and represents a system of documentation regulating the goals, establishes the necessary conditions, technologies and content of the educational process, which determines the quality of training for undergraduates.

EPM "Bio-ecological Engineering" provides the possibility of obtaining in-depth knowledge of key skills graduate and its further development in engineering of biotechnology and environmental engineering fields. The given EP is built taking into account the possibility of providing a master's student with a choice of an appropriate educational trajectory or a specific specialization based on the main educational program, but containing its own individual competencies, reflecting the specifics of a

particular specialization in two areas 7M051-‘Biological and related sciences’ and 7M052-‘Environment.’

EPM contains the following specializations:

- Engineering bio-technology
- Industrial bio-technology
- Engineering ecology
- Geo- ecology and environmental management.

"Bio-ecological Engineering" EPM provides an opportunity to obtain in-depth knowledge, key skills and abilities of the graduate and their further development inengineering of biotechnology and environmental engineering fields. The given EP is built taking into account the possibility of providing Master's student with a 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 within two areas: 7M051-‘Biological and related sciences’ and 7M052-‘Environment.'

Educational program objectives:

Master’s in 7M051-‘Biological and related sciences’ and 7M052-‘Environment’ training directions should be coached to solve the following professional tasks in accordance with EP and types of professional activities:

1 Design and engineering activities:

-Tocalculate the energy and material balances of eco logical and bio technological processes;

- Tocalculate the structural and technological parameters of the main and auxiliary equipment in eco and biotechnologies.
- To model, plan and optimize eco technological 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 environmentally friendly production technology for obtaining substances and biomaterials.
- To improve the technological schemes of existing industries with the introduction of new microorganisms.
- To draw up business plans for eco-technology and biotechnology projects.

- To develop energy and resource saving methods in the field of engineering biotechnology and engineering ecology.
- To develop measures to protect the environment 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 Research activities:

- To conduct theoretical research and patent search, andprepare reports on scientific research, information reviews and conclusions.
- To research, obtain and use enzymes, viruses, microorganisms, cell cultures of animals and plants, products of their biosynthesis and biotransformation.
- To create technologies for obtaining new types of products, including products gained using microbiological synthesis, bio-catalysis, bioengineering and bio-nanotechnology.
- To study genetic material with the purpose to apply the laws of heredity and variability in biotechnology.
- To analyze and generalize the results of the research, publish the results in the form of scientific articles and abstracts of reports, issue pre-patents and patents for inventions.

4 Organizational and managerial activities:

- To manage industrial and ecological biotechnological and production facilities.
- To carry out information support of production, labor and management.
- To implement activities for organizing the production in accordance with the regulations;
- To organize team activities, draw up work plans and set production goals.
- To resolve issues of material and technical support, control tasks execution.

5 Pedagogical activities:

- To teach biotechnological and environmental disciplines in colleges and universities.
- To manage the departments of retraining of middle technical personnel of environmental and biotechnological services and enterprises.
- To develop educational and methodological literature for conducting classes for students.

2 Requirements to applicants

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

The procedure for admission of citizens to Master's program is established in accordance with “Standard rules for admission to training in educational organizations that implement educational programs of postgraduate education".

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

At “the entrance", Master's student must have all the prerequisites necessary for grasping the corresponding educational program of Master's degree. The higher education institution determines the list of prerequisites independently.

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

3 Requirements for study completion and obtaining a diploma

Awarded degree/qualifications: A graduate of educational program is awarded the academic degree "Master" of natural sciences in 7M051-‘Biological and related sciences’ and 7M052-‘Environment’directions.

A graduate who 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 activities, develop their innovative abilities;
- the ability to independently formulate research goals, establish the sequence of solving professional tasks;
- knowledge of fundamental and applied sections of disciplines that determine the orientation (profile) of Master's program;
- the ability to professionally select and creatively use modern scientific and technical equipment to solve scientific and practical problems;

- the ability to critically analyze, present, defend, discuss and disseminate their professional activities results;
- proficiency in preparing and executing the scientific and technical documentation, scientific reports, reviews, reports and articles;
- willingness to lead the team in the field of their professional activities, tolerantly perceiving social, ethnic, religious and cultural differences;
- Readiness for communication in oral and written forms in a foreign language to solve professional activity problems.

A graduate who obtained Master's program must have professional competencies, which correspond to professional activities' types that Master's program focuses on:

Research activities:

- ability to form diagnostic solutions to professional problems by integrating the fundamental sections of science and specialized knowledge in biotechnological sciences and environmental knowledge obtained while grasping the Master's program
- ability to independently conduct scientific experiments and research in the professional field, summarize and analyze experimental information, draw conclusions, formulate conclusions and recommendations;
- ability to create and research models of the studied objects based on the use of in-depth theoretical and practical knowledge in the field of bio-technology and ecology engineering;

Research and production activities

- ability to independently conduct production and research and production experimental, laboratory and interpretation work in solving practical problems;
- ability to professionally operate modern industrial and laboratory equipment and devices in the field of Master's degree program;
- Ability to use modern methods of processing and interpreting complex information to solve production problems.

Design and technological activities

- ability to independently draw up and present projects of research and production works;

- Readiness to design complex research and production works in solving professional problems.

Organizational and managerial activities:

- readiness to use practical skills in organizing and managing research and production activities in solving professional problems;
- readiness for the practical use of normative documents in the planning and organization of scientific and production works;

Scientific and pedagogical activity

- ability to conduct seminars, laboratory and practical classes;
- ability to participate in developing interactive teaching methods, educational and methodological documentation, multimedia materials and methods of monitoring training;
- Ability to participate in managing the students' scientific and educational work in petrochemical engineering field.

When developing Master's program, all general cultural and general professional competencies, as well as professional competencies related to the types of professional activities that Master's program focuses on, are included in the set of required results of grasping the Master's program.

4 Work curriculum of the educational program

4.1. Study duration - 2 years

Срок обучения: 2 года

Год обучения	Код	Наименование дисциплины	Компонент	Кредиты ECTS	Кредиты РК	Лк/лаб/пр	Пререквизиты	Код	Наименование дисциплины	Компонент	Кредиты ECTS	Кредиты РК	Лк/лаб/пр	Пререквизиты
1	1 семестр							2 семестр						
	LNG205	Иностранный язык (профессиональный)	БД ВК	5	3	0/0/3	LNG1055 LNG1056	BIO240	Оценка экологических рисков	БД КВ	5	3	2/0/1	
	HUM201	История и философия науки	БД ВК	4	2	1/0/1	HUM124	BIO253	Инженерная биотехнология	БД КВ	5	3	2/0/1	
	HUM205	Педагогика высшей школы	БД ВК	4	2	1/0/2	LNG102	BIO242	Биоэкотехнология производства продуктов в различных отраслях промышленности	ПД ВК	5	2	1/0/1	
	HUM205	Психология управлени	БД ВК	4	2	1/0/2			Электив	ПД КВ	4	2	1/0/1	
	BIO252	Экономическое регулирование ООС и природопользования	БД КВ	5	3	2/0/1			Электив	ПД КВ	4	3	2/0/1	
	BIO243	Биоэкотехнология в защите окружающей среды по отраслям промышленности	ПД ВК	5	3	2/0/1			Научно-исследовательская работа магистранта	НИРМ	7	2		
		Педагогическая практика	БД ВК	3	3									
		Всего:		30	18				Всего:		30	15		
2	3 семестр							4 семестр						
	BIO247	Биоэкоинженерные технологии и биобезопасность	ПД КВ	5	3	2/0/1			Научно-исследовательская работа магистранта	НИРМ	9	2		
		Электив	ПД КВ	5	3	2/0/1			Исследовательская практика	ПД	9	2		
		Электив	ПД КВ	4	2	1/0/1			Оформление и защита магистерской диссертации (ОиЗМД)	ИА	12	3		
		Электив	ПД КВ	4	2	1/0/1								
		Электив	ПД КВ	4	2	1/0/1								
		Научно-исследовательская работа магистранта	НИРМ	8	2									
		Всего:		30	14				Всего:		30	7		
									Итого:		120	54		

4.2. Catalogue of elective disciplines

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

	код	Наименование дисциплин	кредиты	Лк/лб/пр	семестр
1	BIO259	Микробиологические процессы в биогеотехнологиях	2	1/0/1	2
	BIO254	Методы и принципы культивировния клеток для биологической инженерии			
2	BIO269	Инженерная экология	3	2/0/1	2
	BIO266	Техногенные объекты и техносферная безопасность			
3	BIO257	Применение методов ДНК-технологий в биотехнологиях	3	2/0/1	3
	BIO262	Генетически-модифицированные организмы и биобезопасность			
4	BIO264	Технология возобновляемых источников энергии	2	1/0/1	3
	BIO268	Биотехнологические методы получения энергетических продуктов			
	BIO263	Энергоэффективность производства и потребления			
		Итого	10		

MODULAR CURRICULUM

Education program: *7M05101 "Bioecological Engineering"*
Group of Educational Programs M097 "Chemical Engineering and Processes"
Form of study: full Duration of training: 2 years *Academic degree: Master of technical science*

Thecycle	code	Nameofdisciplines	Semester	Acad. credits	lec.	lab.	prac	IWS	Type of control	Chair
Profile training module										
Basic disciplines (BD)(40 credits)										

Universitycomponent(UK) (18 credits)										
BD	HUM201	History and philosophy of science	1	4	1	0	1	2	Exam	SD
BD	HUM207	Higherschoolpedagogy	1	4	1	0	1	2	Exam	SD
BD	LNG202	Foreignlanguage (professional)	1	6	0	0	3	3	Exam	EL
BD	HUM204	Management psychology	1	4	1	0	1	2	Exam	SECPM
Practice-oriented module										
	AAP244	Pedagogicalpractice	2	4			2	2	Report	ChBE
Choicecomponent(CC) (18 credits)										
BD	BIO240	EnvironmentalRiskAssessment	2	6	2		1	3	Exam	ChPIE
BD	BIO266	Technogenic objects and technosphere safety								
BD	BIO252	The use of DNA technology in biotechnology	2	6	2		1	3	Exam	ChBE
BD	BIO257	The use of DNA technology in biotechnology								
BD	BIO215	Industrialbiotechnology	2	6	2		1	3	Exam	ChBE
BD	BIO118	Engineering biotechnology in the oil industry								
BD	BIO217	Engineering biotechnology of natural raw materials processing	2	6	2		1	3	Exam	ChBE
BD	BIO218	Engineering biotechnology for the processing of technogenic raw materials								
Majordisciplines (MD) (49 credits)										
Universitycomponent (UC) (42credits)										
MD		BiotechnologyDisciplinesModule								
MD	BIO249	* Engineeringbiogeotechnology	1	6	2		1	3	Exam	ChBE
MD	BIO254	Methods and principles of cell culture for biological engineering	2	4	1		1	2	Exam	ChBE
MD	BIO268	Biotechnological methods for producing energy products	2	4	1		1	2	Exam	ChBE
MD	BIO258	Modern methods, achievements and problems of biotechnology								
MD	BIO255	The scientific basis of biotechnology for the creation of functional foods	2	4	1		1	2	Exam	ChBE
MD	BIO265	Methodological foundations of biotechnology research								
MD	BIO253	*Biotechnology Engineering	3	6	2		1	3	Exam	ChBE
MD		EnvironmentaldisciplinesModule								
MD	BIO247	*Bio-environmental technology and biosafety	3	4	1		1	2	Exam	ChBE
MD	BIO264	Renewableenergytechnology	2	4	1		1	2	Exam	ChPIE
MD	BIO263	Energy Efficiency in Production and Consumption								
MD	BIO242	Bioecotechnology for the production of products in various industries	2	4	1		1	2	Exam	ChBE
MD	BIO269	Environmental Engineering								
MD	BIO297	Modern wastewater treatment methods	3	4	1		1	2	Exam	ChPIE
MD	BIO298	Solid Waste Recycling Engineering								
Practice-oriented module										

MD	AAP236	Researchpractice	4	7					Report	ChBE
ResearchModule (24 credits)										
MSSR	AAP242	Master's student scientific research	1	6					Report	ChBE
MSSR	AAP242	Master's student scientific research	2	6					Report	ChBE
MSSR	AAP242	Master's student scientific research	3	6					Report	ChBE
MSSR	AAP242	Master's student scientific research	4	6					Report	ChBE
Module of final attestation (12 credits)										
FA	ECA205	Registration and defense of the master's thesis	4	12					Defens eofdiss ertation	ChBE
		Total		**125**						

* Interdisciplinarydisciplines

5 Descriptors of the level and scope related to knowledge, skills, abilities and competencies

Requirements for training level of Master's student are determined based on Dublin descriptors of higher education's second level (Master's degree) and reflect the acquired competencies expressed in the achieved learning outcomes.

The results of training are formulated both at the level of the entire Master's degree educational program, and at the level of individual modules or academic discipline.

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

- To critically analyze and evaluate modern scientific achievements, generate new ideas when solving research and practical problems, including interdisciplinary areas.

- To apply their knowledge, understanding and abilities at a professional level to solve problems in a new environment, in a broader interdisciplinary context

- To collect and interpret information to form judgments based on social, ethical and scientific considerations

- To design and carry out complex research, including interdisciplinary

-To participate in the work of Kazakhstani and international research teams to solve academic and scientific-educational problems

- To clearly and unambiguously communicate information, ideas, conclusions, problems and solutions, both to specialists and non-specialists

- To use modern methods and technologies of scientific communication in the state and foreign languages

- To follow ethical standards in professional activities

- To plan and solve problems of their own professional and personal development.

6 Competencies upon the study end

6.1 Requirements for graduates' key competencies of *Scientific andPedagogical Magistracy*. The graduate must:

1) *to have an idea*

- on the role of science and education in public life;
- on current trends in scientific knowledge development;
- on current methodological and philosophical problems of natural (social, humanitarian, economic) sciences;
- on a higher school teacher's professional competence;
- on contradictions and socio-economic consequences of globalization processes;

2) *to know*

- methodology of scientific knowledge;
- principles and structure of organizing the scientific activities;
- psychology of students' cognitive activity in the learning process;
- psychological methods and means of improving the effectiveness and quality of training;

3) *to be able to*

- use the acquired knowledge for the original development and application of ideas in scientific research context;
- critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena;
- integrate knowledge gained from different disciplines to solve research problems in new unfamiliar environments;
- make judgments and decisions based on incomplete or limited information through integrating the knowledge;
- apply the knowledge of pedagogy and psychology at higher education in their teaching activities;
- apply interactive learning methods;
- conduct information-analytical and information-bibliographic work with the involvement of modern information technologies;

- think creatively and be creative in solving new problems and situations;
- be fluent in a foreign language at a professional level that allows them to conduct scientific research and teach special disciplines at universities;
- Summarize the results related to research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc.

4) *To have skills of*

- scientific research activity, decision of standard scientific tasks;
- implementing the educational and pedagogical activities on credit study technology;
- methods of teaching professional disciplines;
- using the modern information technologies in the educational process;
- professional communication and cross-cultural communication;
- oratory, correct and logical design of their thoughts in oral and written form;
- Expanding and deepening the knowledge necessary for daily professional activities and continuing education in the doctoral program.

5) *To be competent*

- in the field of research methodology;
- in the field of scientific and scientific-pedagogical activity in higher educational institutions;
- in matters of modern educational technologies;
- in the implementation of scientific projects and research in the professional field;
- In the ways to ensure continuous updating the knowledge, expanding professional skills and abilities.

B - Basic knowledge, skills and abilities

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

B2 - the ability to apply knowledge of chemical science methodology and chemical engineering to solve specific professional tasks and assess technological risks;

B3 is the ability to use psychological methods and means to improve the study effectiveness and quality.

P – Professional competencies:

P1 - the ability to independently analyze the available information, set goals and objectives and perform experimental research using modern tools and computational tools, to be responsible for research quality and scientific reliability of the results;

P2 - the ability to generate new ideas and methodical solutions;

P3 - the ability to professionally design, present and report the results of research and production and technology work on approved forms;

P4 - willingness to apply creatively modern computer technologies in collection, storage, processing, analysis and transmission of information to solve professional tasks in chemical engineering and chemical materials production fields;

P5 - the ability to plan and carry out measures to assess condition and environmental protection and organize environmental management activities;

P6 - mastering the skills of forming and presenting educational material in various forms, conducting laboratory and practical classes, readiness to teach in educational institutions and management of students' research work.

P7 - mastering the methods of conducting patent research, licensing and copyright protection when creating innovative products in professional activity sphere.

A - Human, social and ethical competences

O1 - knowledge of contemporary social and political problems;

O2 - ability to perceive intercultural differences, ability to comply with and maintain ethical norms and rules;

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

C - Special and Management Competencies:

C1 - ability to lead the workforce and provide safety measures;

C2 - ability to plan and organize professional events;

C3 - readiness to act in non-standard situations, to bear social and ethical responsibility for the decisions taken.

6.2 Requirements for Master student's research workin scientific and pedagogical Master's degree.

The research work of a graduate student should:

1) correspond to educational program profile of Master's degree, on which Master's thesis is performed and protected;

2) be relevant and contain scientific novelty and practical significance

3) be based on modern theoretical, methodical and technological advances in science and practice

4) be performed using modern methods of scientific research

5) contain research (methodological, practical) sections on the main protected provisions

6) Be based on international best practices in the field of biological science and environmental engineering.

6.3 Internship organization requirements:

The educational program of scientific and educational master's degree includes two types of practices, which are conducted in parallel with theoretical training or in a separate period:

1) Pedagogical in GD cycle - at the university;

2) Research in PD cycle - at the site of the dissertation.

Pedagogical practice is realized with the aim of forming practical skills of teaching and teaching methods. At the same time, undergraduates are involved in Bachelor degree at university discretion.

The uundergraduates' research practice undergoes in order to familiarize with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.

7Diploma supplement by ECTS standard

The supplement is developed according to the standards of European Commission, Council of Europe and UNESCO/SEPES. This document serves onlyfor academic recognition and is not an official confirmation of the document related to education. It is not valid without a higher education diploma. The purpose of filling out the European application is to provide sufficient data on the diploma holder, the qualification obtained, the level of this qualification, the training program content, the results, the qualification functional purpose, as well as information about the national education system. The

application model that will be used for the transfer of assessments uses 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 traveling abroad for professional recognition, additional legalization of the diploma of education will be required. The European diploma supplement is completed in English on an individual request and is issued free of charge.

FOREIGN LANGUAGE(PROFESSIONAL)

Professional English for Project Managers
CODE - LNG205
CREDITS - 3 (0/0/3)

PREREQUISIT- Academic English, Business English, IELTS 5.0-5.5

COURSE GOALS AND OBJECTIVES

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

COURSE BRIEF DESCRIPTION

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

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

Upon successful completion of the course, undergraduates are expected to be 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. As well as 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, speak about various business situations using appropriate business vocabulary and grammatical structures - in pairs and groups discussions, meetings and negotiations.

HISTORY AND PHILOSOPHY OF SCIENCE

CODE - HUM201
CREDITS – 2 (1/0/1)
PREREQUISIT - HUM124

COURSE GOALS AND OBJECTIVES - to reveal the connection between philosophy and science, to highlight philosophical problems of science and scientific cognition, the main stages of the science history, leading concepts of the science philosophy, modern problems of developing the scientific and technical reality.

COURSE SHORT DESCRIPTION - the subject of science philosophy, science dynamics, the specifics of science, science and prescience, antiquity and formation of theoretical science, the main stages related to historical development of science. As well as features of classical science, non-classical and post-classical science, philosophy of mathematics, physics, technology and engineering, the specifics of engineering sciences, science ethics, the scientist's and engineer's social and moral responsibility.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION To know and understand philosophical questions of science, the main

historical stages of science growth, leading to science philosophy concept. To be able to critically evaluate and analyze scientific and philosophical problems, to understand the specifics of engineering science, possess the skills of analytical thinking and philosophical reflection, to be able to justify and defend their position, to possess the techniques of conducting the discussion and dialogue, to master the skills related to communicativeness and creativity at their professional work.

PEDAGOGY OF HIGHER EDUCATION

CODE-HUM205

CREDITS – 3 (1/0/2)

PREREQUISITE: LNG102

COURSE PURPOSE AND OBJECTIVES. The course aims at studying psychological and pedagogical essence of the educational process at higher school; the formation of ideas about the main trends of higher education development at the present stage. As well as consideration of methodical bases of training process at high school, and psychological mechanisms influencing the success of learning, interaction, management subjects of the educational process. Development of undergraduates' psychological and pedagogical thinking.

COURSEBRIEF DESCRIPTION

The subject of higher education pedagogy, methodology of pedagogical science, aspects and trends in the development of modern education, pedagogical activity, the personality of a higher school teacher, the essence and structure of pedagogical activity, modern requirements for competence, communicative competence of a higher school teacher, didactics of higher school, modern pedagogical technologies, educational high school process. Active methods andteaching forms in training the future specialists, educational work in higher education, organization of students' independent work in credit technology conditions, organization of pedagogical control in credit technology conditions.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

To know and understand the actual problems of pedagogical science, pedagogical theories laws, the essence of the university teacher's pedagogical activity. To master the skills of designing the educational process based on new concepts of teaching and education as well as forming a creative and developing environment in teaching and upbringing process. To be competent in solving problems of higher pedagogical education and prospects for its further development; in applying the effective university teaching technologies; the main types of pedagogical communication interaction, organization and management of students' activities.

Economic regulation of environmental protection and environmental management
CODE - BIO252
CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

The study of economic and industrial relations, economic consequences of industrial production, methods of ensuring the natural resources'rational use and environmental protection, as well as provision of theoretical and practical training in the methods of environmental management and environmental management.
The use of economic methods in environmental protection field, and ensuring rational use of natural resources.

COURSE SHORT DESCRIPTION

"Economic regulation of environmental protection and environmental management" discipline gives an idea of environmental planning activities, payments for emissions into environment, payments for the use of natural resources' certain types; economic incentives for environmental protection, environmental insurance, management of emissions into environment, reduction of emissions and absorption of greenhouse gases, economic assessment of damage to environment.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

To have an idea of the role related to economy in environmental problems, the main problems of developing environmental and economic assessment of environmental management; the role of system analysis in solving social and economic problems in rational nature management and resource conservation fields.

To know: basic methods of natural resources' economic assessment; methods for determining the real damage from the irrational use of natural resources; methods for determining the economic efficiency of environmental protection; methods of environmental and economic assessment of designed solutions;

To be able to: make calculations of payments for emissions in the environment, environmental, economic and actual prevented damage when organizing environmental protection measures, the effectiveness of environmental protection measures; use the normative literature and documentation in all environmental protection areas.

Bio-eco-technology in environmental protection through industry

CODE - BIO243
CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE GOALS AND OBJECTIVES

Goals:

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.

Tasks:

- To consider the engineering and technological aspects of environmental biotechnologies' use
- 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 removing such contaminants as oil and oil products, heavy metals, as well as biodegradation and bio-corrosion of various materials, bio-deterioration and bio fouling.

COURSE SHORT DESCRIPTION

The course of discipline lectures 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 sufficiently considered; vermicomposting and cultivation; classification of methods and technologies for soil bioremediation; non-biological methods and technologies of bioremediation; biological and combined methods of remediation. Specialized bio-preparations of domestic and foreign production are presented, due to which it is possible to carry out successfully bioremediation of soil, water contaminated with oil and heavy metals.

Topics of lectures are characterized by novelty, advantage in content and significance for the development of bio-eco-technology in the Republic of Kazakhstan.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION*to be able*

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

Assessment of environmental risks
CODE - BIO240
CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE GOAL AND OBJECTIVES
Goal

Mastering undergraduates of the basics of knowledge and skills necessary to address issues of effective environmental risk management.

Tasks

- studying the conceptrelated to risk, features of environmental risk and their classification
- mastering the methods of risk assessment, contributing to qualitative and quantitative assessment;
- studyingthe analysis of theoretical and practical issues on environmental risk management
- Studying the patterns in identifying environmental risks in the energy industry, in mining, metallurgyand mining, machine building, oil production and other industries.

COURSE SHORT DESCRIPTION

The methodology and approaches to solving the problems on environmental risks, methods and methods of risk assessment, as well as the use of these methods in carrying out a qualitative and quantitative risk assessment, modeling and forecasting the development of risk situations in order to improve optimal solutions are considered.The course provides examples of tasks and suggests ways and methods of their solution. Teaching the theory and practice of environmental risk management, both in general terms and in implementation of some specific activities. Described circuit stages, steps, and procedures associated with planning the activities of driving NIJ environmental risks directed to reducing their level.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

- To monitor the parameters and the level of negative impacts for their compliance with regulatory requirements
- To predict the development and assessment of emergency situations
- To collect, select and use the knowledge and apply them effectively in writing the master's work
- To acquire practical skills in the use of technical and reference literature.

Engineering biotechnology
CODE - BIO253
CREDIT - 3 (2/0/1)
PRE-REQUISIT - no

COURSE PURPOSE AND OBJECTIVE

Purpose

Formation of students' basic ideas on functioning of cell populations and the possibility of managing them in industrial production.

Objective

Formation of engineering and biological skills of master's students in mastering the methods currently taking place in engineering biotechnology.

COURSE SHORT DESCRIPTION

Scientific foundations of engineering biotechnology. Specificity of design and application of equipment for the implementation of biotechnological processes. Elements of control and management of biotechnological processes. Material and energy balance of microorganism growth. Equipment for biotechnological industrial production. Design, construction and operation of bio-scrubbers, bioreactors of single and cascade type in biotechnology.

Biotechnology in traditional energy. Biotechnology in thermal power engineering, hydropower engineering, nuclear power engineering. Block diagram of uranium ore bioleaching. Biotechnology in alternative renewable energy. Sources of alternative energy: biofuel, bioethanol, biogas, biodiesel fuel, bacterial biomass from waste gases, dimethyl ether, bio-hydrogen, etc.: production flowcharts. Biotechnology for rational use of coal resources: Biotechnology for removing methane by methane-oxidizing bacteria from coal seams and biotechnology for improving the coal quality. Flow chart of biotechnology for removing coal bed methane.

Biotechnology for increasing oil production. Biotechnology of processing and disposal of waste petroleum products. Principles of biotechnology for processing oil waste. Block diagram of complex biotechnology of soil cleaning from oil products. Processing of organic oil waste, flowcharts: aerobic and anaerobic degradation of organic matter in a comparative aspect. Waste oil of various technologies. Fundamental methods of reducing and eliminating pollution of soils and techno genic soils with oil and oil products. Neutralization and disposal of oily waste. Block diagram of an integrated oil sludge treating technology. Biological utilization of oil waste. Biotechnological production of bioethanol and biodiesel used for internal combustion engines; biotechnology in the chemical industry (1-butanol, acetone). Biotechnology for producing the technically significant biopolymers.

Bio-production technologies in metallurgy: Bio-production technologies in ferrous and non-ferrous metallurgy. Producers-microorganisms used in biotechnology for extracting the metals and technological parameters of the process. The use of bacterial oxidation of sulfide minerals in the mining industry. Bacterial leaching of heaps and dumps: a heap of ore for leaching gold with traditional sodium cyanide as an analogue for bioleaching. Typical scheme for processing heaps or dumps of copper ore by

leaching. Characteristics of bio-metallurgical technologies for processing ores and concentrates of copper, gold. Biotechnology in mechanical engineering: biotechnology of production of means related to protection against biological damage.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

After completing the course, the master student must:

- know the engineering foundations of biotechnology
- have skills in the design and operation of biotechnological processes and devices, depending on the type of raw materials and industry direction
- be able to use research and production tools to improve the productive qualities of biological objects

Bio-eco-technological production in various industry branches
CODE - B IO242
CREDIT - 3 (2/0/1)
PRE-REQUISIT - no

COURSE PURPOSE AND OBJECTIVES

The purpose of the course: providing deep fundamental knowledge of the basics of biotechnological production and modern applied aspects of developing the bio-eco-technology for producing the products in various industries, promising areas, problems of creating waste-free technologies, the formation of skills in applying the knowledge gained in professional activities.

Objectives:

- The formation of an individual capable of self-improvement and professional growth with versatile humanitarian and natural-scientific knowledge and interests;
- The ability to rethink critically the accumulated experience, change, if necessary, the profile of their professional activities, awareness of social significance in their future profession, possessing high motivation to perform professional activities;
- The ability to participate in scientific research with the subsequent application of the results in practice, the desire for self-development, improving their qualifications and skills;
- Preparation for continuing education at the next level;
- Acquisition of a high level of subject-specific competencies.

COURSE SHORT DESCRIPTION

"Bio-eco-technology for products production in various industries" course is compiled based on modern scientific provisions, and contains urgent problems studied in all areas of bio-eco-technology development for products manufacturing in various industries. Lecture topics presented in the given course are relevant; contain modern scientific data on current trends in developing biotechnological production of products in different industries.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

Due to mastering the discipline, students *should know*:

- The main directions of biotechnological production;
- Bio-eco-technology for producing the biotechnological products;
- The main raw materials of biotechnological production;
- Modern trends in elaborating the waste-free bio-eco-technology for products production in various industries.

Be able:

- To use the knowledge gained in practical work
- To use the knowledge acquired to interpret the obtained practical and experimental data.

Possess skills of

- navigating in modern information flows of knowledge on bio-eco-technology and adapt to dynamically changing phenomena and processes;
- mastering the fundamentals, modern achievements and current problems ofbio-eco-technology for products production in various industries.

Bioengineering technologies and biosafety
CODE - BIO247
CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE AIMS AND OBJECTIVES

The *aim* of teaching "Bioengineering Technologies and Biosafety" course is to give students a theoretical basis in the field of environmental biotechnology, aimed at developing engineering technologies for environmental protection, preservation of biological diversity and sustainable development of society.

Tasks

- To study methods and technologies for removal of such contaminants as oil and oil products, heavy metals, as well as biodegradation and bio-corrosion of various materials, bio-deterioration.
- To investigate the specifics of various organisms and their communities intended for biological purification of water and soil media, air, processing of various wastes of human activity.
- To develop technologies for obtaining genetically modified organisms and using microbiological synthesis, bio-catalysis, genetic engineering and nana biotechnology.

COURSE SHORT DESCRIPTION

The course of lectures contains materials on the basics of bioengineering technologies and biosafety, including development, research and production of drugs, new type of vaccines, antibiotics and bacteriophages, medical enzymes. Development of in-vitro diagnostic kits, molecular diagnostics, cell technologies, biocompatible materials, systems medicine and bioinformatics, development of banks of biological samples, infrastructure support for animal research; ensuring safety in the field of biological protection of plants, plant varieties created using biotechnology methods. Transgenic and cloned animals; in the field of microbiological quality control and safety of water resources, habitat; in the field of application of biotechnology in the mining industry; in the field of oil and gas processing and storage.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

- To choose reasonably the tasks set, be able to predict the results of their professional activities.
- To carry out a comprehensive analysis of bioecotechnology objects and predict these objects'productivity.
- To summarize the results of experimental research and analytical work in the form of a master's thesis, article, report, etc.

Microbiological processes in bio-geo-technology
CODE - BIO259
CREDIT - 2 (1/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

Purpose: To study microorganisms, their biological diversity, enzymatic activity and features of their application in bio-geo-technology.

Tasks: To understand the peculiarities of anthropogenic circulation of xenobiotic; to study the enzymatic activity of microorganisms taking part in bio-industrial geo-technology; study the technologies used in biotechnology.

COURSE SHORT DESCRIPTION

Microorganisms important for bio-metallurgy and promising areas of their application. Mechanisms of bacterial oxidation of minerals. Microorganisms that reduce sulfide minerals, sulfates and other sulfur compounds; reducing chromium (Cr^{6+}) and oxidizing arsenic (As^{3+}); dissolving, accumulating and precipitating gold; participating in the destruction of silicates; accumulating metals from solutions. Technologies for using the microorganisms in metal extraction practice. Microbiological enzymatic processes in bio-geo-technology. Tank, underground and heap bacterial leaching, bacterial leaching in dumps. Bioaccumulation and deposition of metals by microorganisms. Bio-sorption of metals. Damage by microorganisms to materials and methods of their protection.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

To know the microbiological foundations of bio-geo-technologies and engineering solutions for their implementation.

To be able to use biochemical potential of microorganisms in bio-geo-technology.

To be proficient in the use of bacterial leaching techniques.

Methods and principles of cultivated and Nia cells for Biological Engineering
CODE - BIO254
CREDIT - 2 (1/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

*Purpose:*To help students master the theoretical and applied foundations and methodological principles of technologies for cultivation of viruses, cells ofAchaea bacteria, plants and animals, tissues and organs of higher plants and animals.

Tasks: studying the patterns of development, selection, storage of culture related to viruses, cells, tissues and organs; the prospects for using cellular technologies in science and production; forming the skills to use the acquired knowledge and skills in professional activities.

COURSE BRIEF DESCRIPTION

Basics of cultivation technology. Culture of viruses, Achaeabacteria, plant and animal cells: principal features and differences, growth cycles and their analysis and control. Technique of dissociation and reseeding of the cell monolayer. Primary cells. Cultivation methods. Methods for counting, storage, karyotyping and cell imaging. Bacterial contamination. Synchronization of cells in culture. The use of radioactive isotopes in cell culture. Cell mutants and hybrid cells. Differentiation in cell cultures. Tissue culture of plants and animals.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

To know modern methods and approaches for cultivation of viruses, cells, tissues and organs; cell culture manipulation technologies; the possibilities of using cellular technologies in fundamental and applied sciences.

*To be able to*apply knowledge about the patterns of cultivation related to viruses, cells, tissues and organs to create genetic diversity during cultivation, carry out the analysis according to the work results.

To obtain methods of culturing viruses, cells, tissues and organs, obtaining regenerates and their cytogenetic analysis; methods of cell technologies for obtaining valuable genotypes, creating cell populations with altered genetic characteristics and biochemical properties; methods of mathematical processing of the results obtained based on cellular technologies.

Engineering ecology
CODE - BIO269
CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

Purpose: Formation in students the knowledge necessary to reduce negative impact of techno sphere on the natural environment through the rational and integrated use of raw

materials and energy resources or when creating new eco-protective devices and technologies. Environmentally friendly production processes, with combination and cooperation of industries, as well as in working out the ecological production development strategies and policies.

Objective: The acquisition by future specialists of theoretical and practical skills necessary for making environmentally, technically and economically sound decisions in the operation of technological processes, industries, industrial facilities and complexes.

COURSE SHORT DESCRIPTION

The place of engineering ecology in the system of knowledge about man and nature. Environmental engineering concept. Techno-genic impact (chemical, radioactive pollution; noise, vibration, electricity and electromagnetic radiation) on environmental objects. Combustion and explosion in the environment. Environmental monitoring. Techno-genic means and methods of protection. General characteristics of production processes and their environmental features. Solid and liquid industrial waste, lithosphere pollution, waste reduction methods. Environmentally friendly production, closed production cycles. Emissions of techno-sphere objects into the air, pollution zones, methods of protection against emissions. Discharges of industrial facilities into hydrosphere, pollution zones, wastewater treatment systems. Environmental indicators and economic assessment of environmental protection measures.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

After completing the course, the master student must:

- know the engineering fundamentals of ecology
- have skills in elaborating the projects for new industrial facilities and individual industries and processes that affect the quality of the environment
- be able to manage environmental protection activities

Techno-genic objects and techno-sphere safety
CODE - BIO266
CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE GOAL AND OBJECTIVES

Goal: Forming in the undergraduate solid theoretical knowledge and practical skills in the assessment of manufactured objects and techno-sphericalsafety processes.

Tasks:

- To study the main techno sphere hazards, their properties and characteristics.
- To study the issues of the current state of environmental and techno-spherical safety, its theoretical foundations and environmental and technospheric threats on geosphere envelope.
- To calculate the main technological parameters of systems for ensuring the environmental safety of man-made objects;
- To teach the basic methods and systems to ensure technospheric security;

COURSE SHORT DESCRIPTION

The current state of environmental and techno-sphere safety. The main directions of achieving technospheric safety; eco-bio-protective equipment; protecting urbanized areas and natural areas from harmful effects of the techno-sphere (regional protection). Minimization of anthropogenic and techno-genic hazards. Understanding the probable measure of danger on causing harm to the natural environment and health of the population living in regions with different degrees of anthropogenic pressure. The impact of natural and manufacturedfactors on the components of environment and society at the global, regional and local levels. To consider the aspects of functioning related to ecosystems, techno-systems and ecological technological systems.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

By the end ofmastering the discipline, a graduate *must*:

- know the basics of functioning of fabricated objects.
- know the main technospheric hazards, their properties and characteristics.
- know the current system of normative legal acts in techno-sphere safety field
- predict the negative impacts and assess their consequences
- optimize measures to ensure techno sphere safety
- possess knowledge in the field of ecology, ecological safety and interaction of natural and manufactured objects and have skills of systemic research and safety improvement related to functioning of techno- genic objects
- identify the causes and sources of technospheric hazards.

Application of DNA technology methods in biotechnology
CODE - BIO257

CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

The purposeof the course: providing deep fundamental knowledge in the field of DNA technology and formation of modern knowledge and current trends in developing the methods and methodology of molecular biology and genetic engineering, problems and prospects of using DNA technology in biotechnology and formation of skills for their application in professional activities.

Course objectives:

- Formation of an individual capable of self-improvement and professional growth with versatile humanitarian and natural science knowledge and interests.
- The ability to rethink critically the accumulated experience, change, if necessary, the profile of their professional activities, awareness of social significance in their future profession, possessing high motivation to perform professional activities.
- The ability to participate in scientific research with the subsequent application of the results in practice, the desire for self-development, improving their qualifications and skills.
- Preparation for continuing education at the next level.
- Acquisition of a high level of subject-specific competencies

COURSE SHORT DESCRIPTION

"Application of DNA technology methods in biotechnology" course is compiled based on fundamental and modern scientific provisions, and contains topical issues studied in all areas to develop DNA technology. The topics of the lectures presented in the given course are relevant, contain the latest scientific data and are necessary for study; contain modern basic concepts that underlie the discipline study.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

Due to mastering the discipline, students *shouldknow:*

- Basic terms and concepts for DNA technology
- Different levels of organization of living matter
- Living conditions and properties of biological objects
- Patterns of influence of environmental factors on biological objects
- DNA repair processes.

Should be able to:

- use the knowledge gained on the subject in practical work

- use the knowledge gained to interpret the obtained practical and experimental data

Should possess skills:

- To navigate in modern information flows of knowledge on DNA technology and adapt to dynamically changing phenomena and processes.
- To master the fundamental principles, modern achievements and problems of DNA technology.

Genetically modified organisms and biosafety
CODE - BIO262
CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

Purpose: To familiarize undergraduates with the technologies for creating transgenic organisms, identifying transgenes in plants and raw materials, assessing the biosafety of genetically modified plants and products derived from them, as well as with the problems that arise in connection with development and implementation of genetically modified organisms in recent years.

Tasks:

- to consider genetically engineering aspects of creating genetically modified organisms and genetically modified products;
- to study the methods and technologies for producing GMOs in agriculture, veterinary medicine;
- to study the impact of GM products on human and animal health, as well as the risks associated with their use on the environment, biodiversity of plants, animals and microorganisms;
- Tostudy the Kazakhstani legal framework on GMO biosafety and its implementation.

COURSE SHORT DESCRIPTION

When creating the course, the latest scientific advances in genetic and cellular engineering, molecular biology, biochemistry and plant physiology were used, as well as the latest data obtained in the field.

The topics of the lectures are characterized by novelty, advantage in content and significance for developing the bioecotechnology in the Republic of Kazakhstan.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

Due to mastering the discipline, students *shouldbe able:*

- to give an economic and environmental assessment of bio-production technologies for producing GMOs and products;
- to conduct a comprehensive analysis of GMO products and predict the productivity of their use;
- Tosummarize the results of experimental research and analytical work in the form of a master's thesis, article, report, etc.

Renewable energy technology
CODE - BIO264
CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

The purpose of the course is to provide deep fundamental knowledge in the field of biotechnology for obtaining alternative energy and formation of modern knowledge and current trends in developing the biotechnological methods for making the renewable energy sources. As well as problems and prospects for the use of biotechnological methods of obtaining energy and formation of skills for their use in professional activities.

Course objectives:

- Formation of a personality capable of self-improvement and professional growth with versatile humanitarian and natural - scientific knowledge and interests.

- The ability to rethink critically the accumulated experience, change, if necessary, the profile of their professional activities, awareness of social significance in their future profession, possessing high motivation to perform professional activities.

- The ability to participate in scientific research with the subsequent application of the results in practice, the desire for self-development, improving their qualifications and skills.

- Preparation for continuing education at the next level.

- Acquisition of a high level of subject-specific competencies.

COURSE SHORT DESCRIPTION

"Technology of renewable energy sources" course is based on fundamental and modern scientific provisions, contains topical issues and problems studied in all areas of development of biotechnology for obtaining renewable energy sources. The topics of the lectures presented in this course are relevant, contain the latest scientific data and are necessary for study; contain modern basic concepts that underlie the study of the discipline.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

Due to mastering the discipline, students *should know:*

- Basic terms and concepts on biotechnology for obtaining alternative energy sources
- Different levels of living matter organization
- Living conditions and properties of biological objects
- Patterns of influence of environmental factors on biological objects
- Biotechnological processes of renewable energy sourcesformation
- Waste-free production technologies.

Should be able to:

- use the knowledge gained on the subject in practical work
- use the knowledge gained to interpret the obtained practical and experimental data.

Should possess the skills:

- To navigate in modern information flows of knowledge on biotechnology for obtaining alternative energy sources and adapt to dynamically changing phenomena and processes.
- To master the fundamental principles, modern achievements in creating waste-free production and the problems of biotechnology for obtaining renewable energy sources.

Biotechnological methods of obtaining energy products
CODE - BIO268
CREDIT - 2 (1/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

The aim of teaching "Biotechnological methods of obtaining energy products" course is to give undergraduates the knowledge aimed at developing new and effective methods of producing energy carriers in connection with an acute shortage of raw materials and energy on a global scale and increasing requirements for environmental safety of technologies.

Tasks:

- To consider the ways and mechanisms of energy transformation in biological systems;
- To study the scientific and analytical foundations of bioenergy;
- To elaborate new methods of obtaining energy products.

COURSE SHORT DESCRIPTION

The course of lectures is intended to provide an in-depth study of methods for direct production of biofuels using bacterial fermentation. Biogas plants - methane tanks - using communities of anaerobic methane-forming bacteria, globally the only source of biological methane on Earth, two main directions of converting organic waste into technically convenient fuels and energy: - thermochemical conversion, direct combustion, pyrolysis, gasification, liquefaction, synthesis. Bioconversion related to hydrogen, biogas, organic acids, vegetable oils, parallel production of fertilizers.

The topics of the lectures are characterized by novelty, advantage in content and significance for developing the bioecotechnology in the Republic of Kazakhstan.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

The course allows the undergraduates to use the laws of biology in the production of products using the latest technologies:

- processes of converting biomass into energy – bio-methane genesis;
- biotechnological process of ethanol production;
- biotechnological process for obtaining liquid hydrocarbons;
- Biological production of hydrogen.

Energy efficiency of production and consumption
CODE - BIO263
CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

The aim of the course is to train undergraduates the theory, methodology and practice of increasing the efficiency of fuel and energy resources use to train a new generation of specialists in the field of rational and efficient use of natural resources.

Tasks:

- To form basic knowledge about renewable (alternative) energy sources, energy efficiency, energy saving in production and consumption.

- To contribute to formation of undergraduates' understanding of the state's sustainable prosperity through energy efficiency, energy conservation and the use of renewable energy sources;

- To develop competencies for making decisions at all levels of fuel and energy resources use.

- To prepare a competitive individual, ready for active participation in social, economic and political life of the country, capable of making responsible decisions.

COURSE SHORT DESCRIPTION

The discipline focuses on improving the economic, social and environmental components in training the technical specialists and is based on the knowledge gained in the study of socio-economic, natural science and general education disciplines.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

The course gives the undergraduates to gain the following:

-understanding the consequences of the decisions made and the inertia of their manifestation

-identifying benchmarks and prospects for energy supply, including the use of renewable energy sources, energy efficiency and energy saving based on the achieved world experience

-using knowledge in situations related to the efficient use of fuel and energy resources and developing possible ways to improve the energy system

-applying the indicator methods of statistical ecology based on monitoring studies results

-analyzing the processes in technological, environmental, energy efficient and economic aspects

-elaborating the evaluation criteria for energy efficiency and energy saving in technological processes and consumption of fuel and energy resources

- setting specific tasks and priorities in environmental and energy saving activities and using the knowledge gained to solve them

-Having an idea of conducting energy-saving surveys of enterprises and technological processes.

Modern methods, achievements and problems of biotechnology
CODE - BIO258
CREDIT - 2 (1/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

Purpose: To provide students with 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 cellular and molecular biotechnology field.

Objective: Formation of knowledge and skills among undergraduates in the disclosure of competencies in engineering biotechnology sphere and the latest technologies for producing the biotechnological products in compliance with national and international quality standards.

COURSE SHORT DESCRIPTION

Modern achievements, methods and problems of medical, pharmaceutical and food biotechnology. Features of development of research and commercialization related to biotechnology in different countries of the world. Target products of biotechnology: DNA recombinant, genetically engineered proteins, monoclonal antibodies, edible vaccines, antibodies, biomaterials. The market for the latest biotechnological drugs and 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 biomaterials science. Problems of synthesis of biomaterials and the validity of increasing the rate of growth of production; producers (natural and genetically modified organisms), synthesis technology substrates. Modern research methods for targeted biotechnology products. Methods for 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 UPON THE COURSE COMPLETION

After completing the course, the master student *should know:*

- The success of modern bioengineering, general principles of designing new organisms for biotechnology, genetic methods of medical diagnostics and therapy, problems of modern medical biotechnology.

Should master:

- The scientific foundations of modern methods of analysis related to the most important cellular macromolecules and target products of biotechnology, the methodology of bioengineering of cells, tissues and organs, the concept of the need to comply with ethical norms and risk strategies in developing the biotechnological technologies.

Should be able to:

- Navigate in modern trends and methods of biotechnology (genomics, proteomics, genetic engineering, biomaterials) and use the knowledge gained when writing scientific articles and scientific projects.

Methodological foundations of biotechnology research

CODE - BIO265
CREDIT - 3 (2/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

Purpose:

Development and deepening of knowledge in the field of methodology of theoretical, fundamental and applied biotechnological research. Formation of skills in planning and performing scientific research biotechnological works, presenting the results obtained in the form of scientific and technical documentation, publications. Mastering theoretical and practical knowledge in the form of methods and techniques used in cell and molecular biology, cell and genetic engineering, as well as basic methods of bio-informatics data analysis.

Task:

Studying and mastering new research methods, planning and conducting research in biotechnology field. Formation of skills and abilities to present the results of scientific work in the form of reports, reviews, scientific reports and publications. Mastering skills in the field of control over biotechnological production.

COURSE SHORT DESCRIPTION

"Methodological foundations of biotechnology research" discipline is aimed at forming an idea about modern achievements and scientific approaches used in biotechnology, about methods of studying cells and tissues, molecular biological research methods, methods of cellular and genetic engineering. Molecular medicine and cloning issues, about the possibilities of application methods of bioinformatics data analysis in biotechnological research, about possible options for presenting the research results in the form of reports, reviews, scientific reports and publications.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

Graduates *should have an idea* about: modern methods and approaches used to solve urgent biotechnological problems, the relationship between the development of various areas of industrial biotechnology with advances in molecular biology, cellular and molecular biochemistry, microbiology, molecular immunology and bioinformatics.
Graduates *should havethe skills* of research and teaching.
Graduates *should know*: basic methods and techniques of experimental research in biotechnology field; methodological theories and principles of modern science; rules for the effective operation of devices, production controls in accordance with technical data sheets and instructions.
Graduates *should be able to* independently develop plans for scientific research and evaluate the results obtained. As well as to conduct methodological justification, planning and conducting scientific research; use modern information technology capabilities for statistical processing of experimental data, for the analysis of technological processes in manufacturing the various types of biotechnological products, be able to apply standards and technical conditions for product quality control.

Scientific bases of biotechnology for creating functional food
CODE - BIO255
CREDIT - 2 (1/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

Purpose: To provide theoretical and practical knowledge of the basics of physical, chemical and biochemical production technologies and safety of the most important food products of animal and plant origin.

Tasks:

- To study the basics of biological processes in the processing of raw materials of animal and plant origin.
- To investigate microbiological processes when obtaining food products based on raw materials of animal and vegetable origin.
- To consider food standards and certifications.

COURSE SHORT DESCRIPTION

The course of lectures on the discipline is aimed at studying the achievements of modern biotechnology, with the goal of supplying food to a rapidly growing population. The lecture course examines scientific and technical prerequisites for creating the food products. Areas of food biotechnology. The role of microorganisms in

food production technology. Conditions and factors of biotechnological processes in food production. Fermentation. Alcohol production. Wine production technology. Beer production technology. Sour milk fermentation. Bakery. General principles of microbiological control of food production. The concept of food safety, the essence and ways of achieving. The most important food problems in Kazakhstan and in the world. Hygienic examination of materials. Sanitary and hygienic requirements for food enterprises. Foodborne diseases and their prevention.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

Graduates *should be able:*

- To use modern methods of analysis in assessing the properties, tissue and chemical composition, nutritional and biological value of sources of raw materials of animal and plant origin
- To apply the knowledge gained about the effect of enzymes on the quality and properties of biological raw materials and food products based on it
- To apply the acquired knowledge and skills in the future specialty of a biotechnologist.

Biotechnology in solving problems of biodiversity conservation
CODE - BIO256
CREDIT - 2 (1/0/1)
PREREQUISIT: no

COURSE PURPOSE AND OBJECTIVES

The purpose of the course: providing deep fundamental knowledge in the use of biotechnological methods of preserving biological diversity and formation of modern knowledge and current trends in developing the biotechnological methods of clonal micro- propagation of valuable plant genotypes. As well as problems and prospects for the use of biotechnological methods related to cryopreservation, the formation of skills for their use in professional activities.

Course objectives:

- Formation of a personality capable of self-improvement and professional growth with versatile humanitarian and natural science knowledge and interests.

- Ability to rethink critically the accumulated experience, change, if necessary, the profile of their professional activities, awareness of social significance in their future profession, possessing high motivation to perform professional activities.
- Ability to participate in scientific research with the subsequent application of the results in practice, the desire for self-development, improving their qualifications and skills.
- Preparation for continuing education at the next level.
- Acquisition of a high level of subject-specific competencies.

COURSE SHORT DESCRIPTION

"Biotechnology in solving problems of biodiversity conservation" course is compiled based on fundamental and modern scientific provisions, and contains topical problems studied in all development areas and use of biotechnological methods for conservation of biological diversity. The topics of the lectures presented in the given course are relevant, contain the latest scientific data and are necessary for study; contain modern basic concepts that underlie the discipline study.

KNOWLEDGE, SKILLS AND ABILITIES UPON THE COURSE COMPLETION

Due to mastering the discipline, students should*know:*

- Basic terms, concepts and methodology on biotechnology for conservation of biological diversity
- Living conditions and properties of biological objects
- Patterns of influence regarding the environmental factors on biological objects
- Biotechnological methods of cryopreservation of valuable genotypes.

Should be able to:

-use the knowledge gained on the subject in practical work

-apply the knowledge gained to interpret the obtained practical and experimental data.

Should obtain skills:

- To navigate in modern information flows of knowledge on biotechnology related tobiodiversity conservation and adapt to dynamically changing phenomena and processes
- to master the fundamental foundations and modern achievements in elaborating the methods and methodology for conservation of biological diversity and the problems of biotechnology of cryopreservation and clonal micro-propagation of valuable and disappearing genotypes and endemics.

MASTER'S THESIS DEFENSE

CODE - ECA2013

CREDITS - 12

PURPOSE AND OBJECTIVES

The purpose of Master's thesis is to demonstrate the level of scientific/research qualification of the master's student, the ability to conduct independently scientific research, test the ability to solve specific scientific and practical problems, knowledge of the most general methods and techniques for solving them.

BRIEF DESCRIPTION

Master's thesis is the graduation qualification scientific work, which is a generalization of independent studies' results by an undergraduate one of the pressing problems of a particular specialty relevant branch of science that has internal unity and reflects the progress and results of the chosen topic development.
Master's thesis is the result of research/experimental research work of a master's student, conducted during the entire study period of a master's student.
Master's thesis defense is the final stage of training a master student. Master's thesis must meet the following requirements:
- The work must conduct research or solve current problems in the target field.
- The work should be based on identifying important scientific problems and solving them.
- The decisions must be scientifically sound and reliable, have internal unity.
- The dissertation work must be written individually.

Comprehensive exam
CODE - ECA201
CREDIT - 1

The purpose of the comprehensive exam:

Demonstration of the level of master students' theoretical training.

SHORT DESCRIPTION

The state exam is included in the final state certification of a graduateand is designed to determine master students' theoretical preparedness to perform professional tasks established by the state educational standard.

The state exam is admitted to master students who have successfully completed the full basic educational program course in the specialty developed by the university in accordance with the requirements of the state educational standard of higher professional education. The admission of master students to the given exam is formalized due to University Rector's decree.

The state exam in the specialty is interdisciplinary and is implementedbased on programs of major disciplines identified as a mandatory component.

Content

4 Working curriculum of the educational program
5 Descriptors of the level and scope of knowledge, skills, abilities and competencies
6 Competencies upon the study end
7 Diploma supplement by ECTS standard

СӘТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

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
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СӘТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

РЕЦЕНЗИЯ
на образовательную программу «Биоэкологическая инженерия»
для магистратуры
Института химических и биологических технологий
КазНИТУ 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 (объём, 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 КазНИТУ имени К.И. Сатпаева.

Директор НАО «Национальный аграрный
научно-образовательный центр»
ТОО «Каскеленское опытное хозяйство» _____ **Алишеров Ж.Д.**