



Mining and metallurgical Institute named after O.A. Baykonurov
Department of Chemical Processes and Industrial Ecology

EDUCATIONAL PROGRAM
6B05206 «Engineering ecology»

Code and classification of the field of education: **6B05 «Natural Sciences, Mathematics and Statistics»**

Code and classification of the direction of personnel training: 6B052
«Environment»

Group of educational programs: B051 **«Environment »**

Level on NQF: **6**

Level on SQF: **6**

Period of study: **4**

Volume of the credits: **240**

Almaty 2023

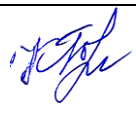
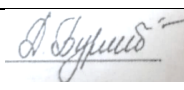
Educational program 6B05206 «Engineering ecology» approved at a meeting of the Academic Council of KazNTRU named after K.I. Satbayev.

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Considered and recommended for approval at a meeting of the Educational and Methodological Council of KazNRTU named after K.I. Satbayev.

Protocol № 3 от «17» november 2022 y.

Educational program 6B05206 «Engineering ecology» developed by the academic committee in the direction 6B052 «Environment».

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List of abbreviations and symbols

EP – educational program
BC – basic competencies
PC – professional competencies
LO – learning outcomes
MOOC – massive open online courses
NQF – National Qualifications Framework
SQF – Industry Qualifications Framework

1. Description of the educational program

The EP 6B05206 «Engineering ecology» determines the programmatic educational goals, student learning outcomes, the necessary conditions, content and technologies for the implementation of the educational process, assessment and analysis of the quality of students during training and after graduation.

EP includes the curriculum, discipline content, learning outcomes and other materials to ensure quality education for students.

Graduates of this EP in the field of education 6B052 Environment are engaged in:

- 1) analysis of existing and potential environmental risks;
- 2) development of measures for:
 - protection of objects of the natural environment - atmosphere, soil and water, flora and fauna,
 - rational use and restoration of natural resources and biodiversity,
 - counteraction to negative technological processes that can lead to an ecological catastrophe - land degradation, desertification, climate change, destruction of biodiversity and other negative consequences.

The professional activity of a graduate of this EP in the field of education 6B052 «Environment» is aimed at the implementation of the training of specialists in the field of ecology, ecoanalytics and environmental technology.

A graduate, after graduating from EP 6B05206 «Engineering Ecology» in the direction of personnel training 6B052 «Environment» can carry out professional activities:

- at industrial enterprises of various sectors of the economy and various forms of ownership, as well as in the sector of environmental monitoring, ecoanalytics;
- on the introduction of the most accessible technologies (equipment) in various industries and environmental and regulatory design of enterprises in various industries in accordance with the new Environmental Code of the Republic of Kazakhstan.

Objects of professional activity

The objects of professional activity are:

- manufacturing enterprises and laboratories of various industries;
- engineering companies;
- research institutes and laboratories;
- secondary technical and professional, post-secondary and higher educational institutions of biotechnological, biological, medical, agricultural and technical profiles;
- environmental, customs, sanitary and communal services.

Subjects of professional activity:

- natural environment, biodiversity conservation, homeostasis of natural ecosystems, sustainable development, ecoanalytics, implementation of the most accessible and green technologies in various industries.

Professional activities

A bachelor who graduated from the EP 6B05206 «Engineering Ecology» in

the direction of personnel training 6B052 «Environment», prepares for the following professional activities:

- production and technological,
- organizational and managerial,
- research,
- scientific and pedagogical,
- design and engineering.

2. Purpose and objectives of the educational program

Purpose of the EP: The purpose of the educational program 6B05206 «Engineering Ecology» is to train competitive specialists possessing knowledge in the field of environmental protection, modern ecoanalysis, capable of solving environmental problems, achieving the goals of sustainable development, the implementation of the most available technology in various industries, using the regulatory legal documents in their activities; competent in production, and research and teaching directions.

Objectives of the educational program:

- Studying the cycle of general education disciplines to ensure social and humanitarian education based on the laws of the socio-economic development of society, history, modern information technologies, the state language, foreign and Russian languages. - Studying the cycle of basic disciplines to provide knowledge of natural science disciplines, as the foundation of professional education. - Studying a cycle of major disciplines for the formation of theoretical knowledge, practical skills and abilities in the field of ecoanalytics and ecotechnologies, solving environmental problems, achieving sustainable development goals, introducing the most accessible technologies (techniques) in various industries, protecting and restoring the environment. - Study of disciplines that form knowledge, skills and abilities of planning and organizing environmental research, environmental design; acquisition of skills and abilities of modern eco-analytical quality control of environmental components. - Acquisition of skills for assessing the impact of economic and other activities on ecosystems, for environmental expertise and environmental risk assessment, for drawing up environmental regulatory documentation and all types of environmental reporting.

3. Requirements for assessing learning outcomes of an educational program

The educational program was developed in accordance with the State Compulsory Standards of Higher and Postgraduate Education, approved by Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2 (registered in the Register of State Registration of Normative Legal Acts under No. 28916) and reflects the learning outcomes on the basis of which curricula are developed (working curricula, individual curricula for students) and working curricula for disciplines (syllabuses). Mastering disciplines of at least

10% of the total credits of the educational program using MOOCs on the official platform <https://polytechonline.kz/cabinet/login/index.php/>.

Assessment of learning outcomes is carried out using developed test tasks within the educational program in accordance with the requirements of the state compulsory standard of higher and postgraduate education.

When assessing learning outcomes, uniform conditions and equal opportunities are created for students to demonstrate the level of their knowledge, skills and abilities.

When conducting intermediate certification online, online proctoring is used.

4. Passport of Educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	6B05 «Natural Sciences, Mathematics and Statistics»
2	Code and classification of the direction of personnel training	6B052 «Environment»
3	Group of educational programs: B051	B051 «Environment»
4	Name of educational program	6B05206 «Engineering Ecology»
5	Brief description of the educational program	The EP 6B05206 «Engineering ecology» determines the programmatic educational goals, student learning outcomes, the necessary conditions, content and technologies for the implementation of the educational process, assessment and analysis of the quality of students during training and after graduation. EP includes the curriculum, discipline content, learning outcomes and other materials to ensure quality education for students. Graduates of this EP in the field of training 6B052 Environment are engaged in: 1) analysis of existing and potential environmental risks; 2) development of measures for: - protection of objects of the natural environment - atmosphere, soil and water, flora and fauna, - rational use and restoration of natural resources and biodiversity, - counteraction to negative technological processes that can lead to an ecological catastrophe - land degradation, desertification, climate change, destruction of biodiversity and other negative consequences.
6	Purpose of the EP	The purpose of the educational program 6B05206 «Engineering Ecology» is to train competitive specialists possessing knowledge in the field of environmental protection, modern ecoanalysis, capable of solving environmental problems, achieving the goals of sustainable development, the implementation of the most

		available technology in various industries, using the regulatory legal documents in their activities; competent in production, and research and teaching directions.
7	EP type	New EP
8	Level on NQF	6
9	Level on SQF	6
10	EP distinctive features	No
11	List of competencies of the educational program:	B - Basic knowledge, abilities and skills B1 - the use of the basic laws of natural sciences (biology, geography and chemistry) and the use of methods of mathematical analysis and modeling in solving problems in the field of ecoanalytics and ecotechnology, the ability to find solutions to environmental problems; B2 - the ability to use modern information technologies, to process information using application programs and databases for calculating technological parameters of equipment, indicators of technological processes in the field of ecology and monitoring of natural environments; B3 - possession of communication skills in the state, Russian and foreign languages; B4 - knowledge of all environmental problems and development prospects in the field of environmental and safe technologies for these problems; B5 - the ability to carry out environmental analysis and make appropriate decisions; B6 - skills in chemical analysis, methods of obtaining and researching substances and materials, studying ecology; B7 - skills of working on equipment during experiments, safe handling of various chemical and biological objects; B8 - knowledge of the basic methods and ways of developing environmental protection measures; understanding the essence and significance of the relationship between production processes and their impact on the safety of industrial production, allowing the rational use of natural resources and reduce the negative impact on the environment P - Professional competencies: P1 - a wide range of theoretical and practical knowledge in the field of ecoanalytics and ecotechnology; P2 - the ability to carry out the technological process in accordance with the regulations and use technical means to measure the main parameters of the technological process, the composition and properties of raw materials and finished products; P3 - the ability to participate in the improvement of existing and in the development of new technological processes from the standpoint of energy and resource conservation, the introduction of advanced green technologies, and minimization of environmental impact; P4 - the ability to carry out technological processes of various levels of complexity, equipment operation and ensuring their safe functioning;

	P5 - the ability to apply knowledge of modern trends in the development of the industry in production and technology, design, research and organizational and management activities; P6 - the ability to apply advanced green technologies to create low-waste and nonwaste technologies, knowledge of modern methods of qualitative and quantitative analysis of environmental components; P7 - the ability to carry out environmental monitoring of the state of the natural and man-made environment using innovative methods and means of control, independently draw up environmental passports, fill out environmental reporting forms; the ability to analyze and apply the Environmental Code and other regulatory and legislative documents during work. O - Human, socio-ethical competences: O1 - striving for self-development, improving their qualifications and skills; O2 - the ability to analyze socially significant problems and processes; O3 - the ability to perceive the diversity of cultural traditions and customs, the ability to tolerate views; O4 - knowledge of social and ethical values based on public opinion, traditions, customs, social norms and the ability to orientate themselves on them in their professional activities; O5 - knowledge of the tendencies of social development of society, the ability to adequately navigate in various social situations; O6 - understanding and practical use of healthy lifestyle norms, including prevention issues; O7 - proficiency in the state, Russian and one of the foreign languages at a level that ensures human communication; O8 - the ability to independently acquire with the help of information technologies and use in practice new knowledge and skills, including in new areas of knowledge that are not directly related to the field of activity. C - Special and management competencies: C1 - possession of the culture of thinking, the ability to generalize, analyze, perceive information, set a goal and choose ways to achieve it; C2 - the ability to find and make management decisions in the field of work organization and implementation of environmental protection measures; monitor the execution of tasks; C3 - the ability to analyze the technological process as a control object and draw up technical and economic documentation; C4 - knowledge of the basics of project management and decision-making methods used in the development, design
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		and operation of technological processes; C5 - knowledge of the principles of management, control and correction of activities in the context of teamwork, improving managerial and performing professionalism; C6 - ensuring technological discipline, sanitary and hygienic operation of the enterprise, maintaining technological equipment in proper condition, organizing compliance with industrial safety rules and environmental protection rules.
12	Educational outcome:	ON1: Demonstrate the ability to ensure the safe operation of technological equipment and the sanitary and hygienic regime of the enterprise as a whole, in compliance with industrial safety rules and environmental protection rules. ON2: Demonstrate in professional activities knowledge of social and ethical values and trends in the social, political and economic development of society, as well as leadership skills and readiness to maintain partnerships, while showing intolerance to any manifestations of corruption and a strong civil position. ON3: Possess knowledge of natural sciences (chemistry, mathematics, physics, geography and computer science) underlying the concepts, theories and principles of environmental engineering. ON4: Demonstrate the skills of conducting a chemical experiment and processing the results obtained to assess the pollution of environmental objects - soil, water and atmosphere. ON5: Have the skills to select methods, objects, materials and sampling for scientific monitoring and use them to determine the impact of industrial enterprises on various components of the biosphere and the health of workers. ON6: Use the skills of working on equipment during experiments, safe handling of various chemical and biological objects. ON7: Analyze socially significant local, regional and global environmental problems, processes of anthropogenic human activity. ON8: Possess knowledge of the theoretical foundations of industrial processes, technological schemes and the relationship of stages and features of technological processes in the field of ecoanalytics and ecotechnology. ON9: Own methods of environmental management and decision-making methods used in the development, design and operation of safe technological processes. ON10: Be able to apply innovative methods and means of control in environmental monitoring of the state of the natural and man-made environment, independently draw up environmental passports, fill out environmental reporting forms; analyze and apply the Environmental Code and other regulatory and legislative documents during work. ON11: To be able to develop advanced green technologies

		to create low-waste and zero-waste technologies based on knowledge of modern methods of qualitative and quantitative analysis of environmental components. ON12: Apply engineering skills in improving existing and in the development of new technological processes from the standpoint of energy and resource conservation, the introduction of advanced green technologies, and minimization of environmental impact. ON13: Demonstrate management decisions in the field of work organization and implementation of environmental protection measures; as well as the skills to control the execution of tasks. ON14: Apply knowledge of the main methods and ways of developing environmental protection measures; understanding the essence and significance of the relationship of production processes and their impact on the safety of industrial production, allowing the rational use of natural resources and reduce the negative impact on the environment.
13	Form of education	Full-time, online
14	Period of study	4
15	Volume of credits	240
16	Language of education	Kazakh, Russian, English
17	Degree to be conferred	Bachelor of natural sciences
18	Developer(s) and contributors:	Kubekova Sh., Elikbayev B., Nurmakova S., Kezembayeva G., Burlibayeva D.

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

№	Name of discipline	Brief description of the discipline	Credits	Formative learning outcomes (code)													
				ON1	ON2	ON3	ON4	ON5	ON6	ON7	ON8	ON9	ON10	ON11	ON12	ON13	ON14
Cycle of general education disciplines																	
Required Component																	
1	English	English is a compulsory subject. According to the results of placement test or IELTS score, students are placed into groups and disciplines. The name of the discipline corresponds to the level of English. When passing from level to level, prerequisites and postrequisites are respected.	10		v												
2	Kazakh (Russian) language	In this course author considers socio-political, socio-cultural spheres of communication and functional styles of the modern Kazakh (Russian) language. The course covers the specifics of the scientific style to develop and activate professional communication skills and abilities of students. Also it allows students to learn the basics of scientific style practically and develop the ability of production structural and semantic text analysis.	10		v												
3	Physical Culture	The purpose of the discipline is the practical use of skills in performing the basic elements of athletics, sports games, gymnastics and a set of standards for general physical training, including professionally applied physical training or	8		v												

		one of the sports, methods of conducting independent physical exercises.															
4	Information and communication technology (MOOC)	The aim of the course is to gain theoretical knowledge in information processing, the latest information technologies, local and global networks, the methods of information protection; Getting the right use of text editor editors and tabulators; creation of base and different categories of applications.	5		v												
5	History of kazakhstan	The course studies historical events, phenomena, facts, processes that took place on the territory of Kazakhstan from ancient times to the present day. The discipline sections include: introduction to the history of Kazakhstan; the steppe empire of the Turks; early feudal states on the territory of Kazakhstan; Kazakhstan during the Mongol conquest (XIII century); medieval states in the XIV-XV centuries. The main stages of the formation of Kazakh statehood are also considered: the era of the Kazakh Khanate of the XV-XVIII centuries. Kazakhstan within the Russian Empire; Kazakhstan in the period of civil confrontation and in the conditions of a totalitarian system; Kazakhstan during the Great Patriotic War; Kazakhstan during the formation of independence and at the present stage.	5		v												
6	Philosophy (MOOC)	Philosophy forms and develops critical and creative thinking, worldview and culture, provides knowledge about the	5		v												

		most common and fundamental problems of life and gives them a methodology for solving various theoretical and practical issues. Philosophy expands the horizon of vision of the modern world, forms citizenship and patriotism, promotes self-esteem, awareness of the value of human existence. It teaches to think and act correctly, develops skills of practical and cognitive activity, helps to look for and find ways and ways of life in harmony with yourself, society, with the world around you.														
7	Module of socio-political knowledge (sociology, political science)	The discipline is designed to improve the quality of both general humanitarian and professional training of students. Knowledge in the field of sociology and political science is the key to effective professional activity of a future specialist, as well as for understanding political processes, for the formation of political culture, developing a personal position and a clearer understanding of the measure of their responsibility.	3		v											
8	Module of socio-political knowledge (cultural studies, psychology)	Module of socio-political knowledge (cultural studies, psychology) is designed to familiarize students with the cultural achievements of mankind, on their understanding and assimilation of the basic forms and universal laws of the formation and development of culture, on the development of their aspirations and skills to independently comprehend the entire wealth of values of world culture	5		v											

		for self-improvement and professional growth. During the course of cultural studies, the student will consider the general problems of the theory of culture, leading cultural concepts, universal patterns and mechanisms of the formation and development of culture, the main historical stages of the formation and development of Kazakhstani culture, its most important achievements. In the course of studying the course, students acquire theoretical knowledge, practical skills and abilities, forming their professional orientation from the standpoint of psychological aspects.															
Cycle of general education disciplines Component of choice																	
9	Fundamentals of anti-corruption culture and law	The course introduces students to the improvement of socio-economic relations of Kazakhstan society, psychological features of corrupt behavior. Special attention is paid to the formation of an anti-corruption culture, legal responsibility for acts of corruption in various spheres. The purpose of studying the discipline «Fundamentals of anti-corruption culture and law» is to increase public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Expected results: to realize the values of moral consciousness and follow moral norms in	5		v												

		everyday practice; to work on improving the level of moral and legal culture; to use spiritual and moral mechanisms to prevent corruption.															
10	Fundamentals of research methods	The purpose of the discipline "Fundamentals of research methods" is the formation of students' skills and abilities in the field of methodology of scientific knowledge. Brief description of the discipline. Methodological foundations of scientific knowledge. The concept of scientific knowledge. Methods of theoretical and empirical research. Choice of the direction of scientific research. Stages of research work. Research topic and its relevance. Classification, types and tasks of the experiment. Metrological support of experimental studies. Computational experiment. Methods for processing the results of the experiment. Formulation of research results. Presentation of research work.	5				v		v								
11	Fundamentals of economics and entrepreneurship	Discipline studies the foundations of economics and entrepreneurial activity from the point of view of science and law; features, problematic aspects and development prospects; the theory and practice of entrepreneurship as a system of economic and organizational relations of business structures; The readiness of entrepreneurs for innovative susceptibility. The discipline reveals the content of entrepreneurial activity, the	5			v											

		stages of career, qualities, competencies and responsibility of the entrepreneur, theoretical and practical business planning and economic examination of business ideas, as well as the analysis of the risks of innovative development, the introduction of new technologies and technological solutions.															
12	Ecology and life safety	The discipline studies the tasks of ecology as a science, environmental terms, the laws of the functioning of natural systems and aspects of environmental safety in the conditions of labor activity. Monitoring of the environment and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to solve environmental problems; life safety in the technosphere; natural and man-made emergencies	5	v				v		v							
Cycle of general education disciplines University component																	
13	Analytical Chemistry	The purpose of the course: the development of chemical methods of analysis of substances and their application to solve problems in professional activity. The course discusses ways to identify chemical compounds, principles and methods for determining the chemical composition of substances and their structure. Application of chemical analysis in product quality control in various industries.	5				v	v									

14	Introduction to the specialty (engineering ecology)	The main trends in the development of chemical production in the Republic of Kazakhstan: the current state, problems and ways of development. Integrated and rational use of raw materials of chemical production. Water and air in the chemical industry. Fundamentals of industrial water treatment. Industrial water treatment. Characteristics of fuel and energy resources. Secondary energy resources as alternative energy sources. General characteristics of the main processes of chemical technology. Environmental safety of production facilities: classic examples of methods of neutralization and methods of disposal of harmful solid, liquid and gaseous emissions.	5			v				v	v						
15	Geocology	The purpose of mastering the course is to acquire practical and theoretical knowledge about the current state of the biosphere, about the relationship between the components of the Earth's geospheres and human activities: about the main types of pollution of the oceans, the problem of desertification. The course examines the impact of human activities on the atmosphere, hydrosphere, lithosphere, as well as the principles of rational use of mineral resources. Geocological aspects of the functioning of natural-technogenic systems. Modern landscapes as a result of anthropogenic	5							v							v

		transformation of natural geosystems. Methodology of ecological zoning.															
16	Engineering and computer graphics (MOOC)	The discipline is aimed at the study of methods for the image of objects and the general rules of drawing, using computer graphics; the study of the basic principles and geometric modeling approach and methodology for developing applications with a graphical interface; the formation of skills in the use of graphic systems for the development of drawings, using 2D and 3D modeling methods	5			v		v	v								
17	Research in Environment and Natural Resources	The discipline "Research in the field of the environment and natural resources" provides detailed information on the mechanisms of the spread of pollutants, special attention is paid to the natural resource potential of the Earth and its conservation, principles and methods of environmental management, and also presents a methodology for conducting environmental research using biological, geoecological, geochemical, geophysical and other methods.	5					v	v	v							
18	Mathematics I (MOOC)	The course is devoted to the study of the basic concepts of higher mathematics and its applications. The main provisions of the discipline are applied in the teaching of all general education engineering and special disciplines taught by graduate departments. The course sections include elements of linear algebra and analytical geometry, an introduction to analysis, differential calculation of functions of	5			v			v								

		one and several variables. Methods for solving systems of equations, problems of using vector calculations in solving problems of geometry, mechanics, and physics are considered. Analytical geometry on a plane and space, differential calculation of functions of one variable, derivatives and differentials, study of the behavior of functions, derivative and gradient in direction, extremum of a function of several variables.															
19	Mathematics (MOOC)	II	The discipline is a continuation of Mathematics I. sections of the course include integral calculus of a function of one variable and several variables, series theory. Indefinite integrals, their properties and methods of their calculation. Certain integrals and their application. Incorrect integrals. Numerical series theory, functional series theory, Taylor and Macloren Series, application of series to approximate calculations.	5			v		v								
20	Inorganic Chemistry (MOOC)		The purpose of the course: the formation of concepts about the theoretical foundations of the discipline, its features, connections with other sciences and practical significance in the future profession. The course outlines the basic laws and concepts, the nomenclature of inorganic compounds, the structure of the atom, the theory of chemical bonding, as well as the chemistry of elements and	5			v	v									

		their role in chemical processes. Forecasting the properties of elements and their compounds. Methods for obtaining the most important inorganic substances and materials, analytical methods for studying their properties.															
21	General chemical technology	The purpose of the discipline is the formation of students' systematic technological thinking, the provision of professional education in the field of chemical production, theoretical knowledge and practical skills for work in the industrial sphere and scientific research, the training of leading specialists to work at chemical enterprises. In the process of mastering this discipline, the student forms and demonstrates competencies that allow to apply the basic scientific and theoretical knowledge obtained to solve scientific and practical problems.	6				v					v					v
22	General Chemistry (MOOC)	The purpose of the discipline is to study the basic concepts and laws of chemistry; fundamental laws of chemical thermodynamics and kinetics; quantum mechanical theory of atomic structure and chemical bond. Solutions and their types, redox processes, coordination compounds: formation, stability and properties. The structure of matter and the chemistry of the elements.	4				v	v									
23	Organic Chemistry	The aim of studying the course "Organic chemistry" - to give the fundamentals of organic chemistry, to show its importance	5				v	v									

		and role as a theoretical basis of the most important branches of the chemical industry.															
24	Physics (MOOC)	The course studies the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics as a science on the development of technology; the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. The course covers the following sections: mechanics, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, electrostatics, direct current, electromagnetism, geometric optics, wave properties of light, laws of thermal radiation, photoelectric effect.	5			v		v									
25	Physical chemistry	The course physical chemistry allows students to form the ability to understand the physico-chemical essence of processes and use the basic laws of physical chemistry in complex production and technological activities. In the course of training, the student studies the laws of thermodynamics; basic equations of chemical thermodynamics; methods of thermodynamic description of chemical and phase equilibria in multicomponent systems; properties of solutions; fundamentals of electrochemistry; basic	5					v	v	v							

		concepts, theories and laws of chemical kinetics and catalysis.															
26	Environmental assessment and expertise	The course is devoted to an environmental document, the literacy of the practical preparation of which depends on the regulatory framework of the Republic of Kazakhstan. An EIA project is mandatory for any enterprise conducting economic activities in order to determine the environmental and other consequences of options, management and economic decisions taken, develop recommendations for improving the environment, preventing the destruction, degradation, damage and depletion of natural ecological systems.	5					v		v		v					
27	Environmental monitoring	The purpose of the course is to train specialists with knowledge of the organization of environmental monitoring, environmental problems of nature management, the causes and consequences of the adverse impact of anthropogenic sources of pollution on the environment. The course examines the objectives of environmental monitoring, the basic concepts, tasks and scheme of environmental monitoring, the classification of environmental monitoring systems and the classification of priority pollutants by priority classes. A special place is given to information and software for monitoring and state environmental monitoring in the Republic of Kazakhstan.	5					v		v			v				

28	Environmental legislation	Legal framework for environmental management and environmental management. The main provisions of the Environmental Code of the Republic of Kazakhstan as a legal basis for environmental protection management, the concept of natural resource and environmental legislation, responsibility for its violation and international legislation in the field of environmental protection. The course of lectures will help to form students' ecological and legal worldview, and to apply theoretical knowledge in practice.	5								v			v				v	
29	Ecology and environmental economics	Natural environment, natural conditions, natural resources, rational use of natural resources. Socio-economic prerequisites and consequences of environmental destabilization. Ecological and economic aspects of the development of natural resources. Environmental production costs and ways to reduce them. Damage from environmental pollution. Economic optimum of environmental pollution. Economic analysis of environmental management methods. Foreign experience of economic regulation of environmental problems.	5								v			v				v	
30	Educational practice	The purpose of educational practice is to deepen, supplement and consolidate theoretical knowledge in the main disciplines of the course acquired during the learning process. Educational practice involves introducing the student into a	2			v													

		professional environment, obtaining primary professional environmental skills.															
Cycle of basic disciplines Component of choice																	
31	Urban ecology	The study of the main abiotic and biotic components of the environment, the mechanisms of adaptation of living organisms to changes in the natural environment in conjunction with natural and anthropogenic ecosystems in the aspect of reviewing the main environmental problems of the city. The course deals with general issues and principles of ecology and their systemic relationship with the environment and interaction with humans, environmental features and problems of the city and the place of humans in it, biodiversity conservation	5			v		v		v							
32	Remote sensing of the state of the environment	Aerospace photography of the Earth's surface makes it possible to assess the state of ecosystems and analyze the dynamic processes of a natural and anthropogenic nature. Observations made using various sensors provide operational information about emergency situations or allow you to study the trend of long-term processes and predict future risks. Based on satellite imagery data, it is possible to evaluate natural resources and investigate environmental problems.	5			v		v					v				
33	Green chemistry	The discipline "Green Chemistry" is the basis for studying a new approach to	5			v				v	v						

		chemistry as a science capable of ensuring the production and consumption of chemical products with minimal risks to the environment. The discipline examines new schemes of chemical reactions and processes that contribute to the maximum reduction of damage to the environment at all stages of large-scale chemical production.															
34	Modeling and optimization of chemical technological processes (MOOC)	The purpose of the course: Acquaintance of students with the principles and methods of modeling and optimization of chemical-technological processes using modern information technologies. The course outlines the basic concepts, classification and general principles of modeling and optimization of chemical and technological processes. Fundamental foundations and laws of the theory of mathematical modeling of chemical and technological processes. Methods of physical and chemical modeling of processes underlying chemical engineering. Optimization of typical chemical-technological processes in the production of inorganic substances and new materials.	5			v		v	v				v				
35	Fundamentals of Ecology	The course introduces students to the basic concepts, laws and principles of ecology. The discipline covers such topics as the interaction of living organisms with each other and with the environment, environmental factors, the organization and functioning of	5			v				v							

		biosystems at various levels (populations, communities, ecosystems), evolution and homeostasis of the biosphere.															
36	Soil science and remediation methods	The course on soil, its composition, properties, functions, distribution, use, degradation and application of various methods of restoration, remediation and reclamation. Students study in depth the diagnostics and monitoring of eroded, disturbed, polluted soils; remediation of contaminated lands; methods and stages of remediation of contaminated lands; reclamation of various disturbed lands; methods and stages of reclamation of various disturbed lands.	5			v		v		v							
37	Industrial and environmental safety	The aim of the course is to prepare a new generation of specialists with a developed general ecological culture of the individual. The course deals with environmental protection and environmental safety, the system of documentation on environmental protection issues, the basics of environmental regulation of technogenic loads on ecosystems in the zones of influence of industrial enterprises. Hazardous production facilities and ensuring industrial safety. Registration of hazardous production facilities. Requirements for technical devices used at a hazardous production facility. Production control over compliance with industrial safety requirements. Expertise of industrial safety.	5							v		v					v

38	Industrial ecology	Formation of students' basic knowledge of environmental protection activities at industrial enterprises, as well as cause-and-effect relationships of emergency factors in the field of industrial safety. The classification of industrial pollutants, measures for the protection of atmospheric air, water and land resources are considered. Processes and apparatus for ensuring environmental safety and resource-saving technologies. Industrial injuries and occupational morbidity at work. Working conditions and basic requirements for ensuring safe working conditions.	5								v				v		v
39	Industrial ecology and industrial safety (MOOC)	Formation of students' basic knowledge of environmental protection activities at industrial enterprises, as well as cause-and-effect relationships of emergency factors in the field of industrial safety. The classification of industrial pollutants, measures for the protection of atmospheric air, water and land resources are considered. Processes and apparatus for ensuring environmental safety and resource-saving technologies. Industrial injuries and occupational morbidity at work. Working conditions and basic requirements for ensuring safe working conditions.	5								v		v				v
40	Sustainability and ESG	The purpose of the course: to form students' ideas about the goals and principles of sustainable development and ESG criteria in the environmental,	5	v									v				v

		social and economic spheres of the country.															
41	Ecological chemistry	The purpose of the discipline is to develop students' understanding of the basic patterns of the functioning of the biosphere and the chemical processes occurring in it, the place and role of man in it. As a result of studying the discipline, students should: know the subject, goals and objectives of environmental chemistry; have a general idea of the geospheres of the Earth; migration of chemical elements in the natural environment and their entry into the human body; primary and secondary pollution; be able to use theoretical knowledge in practical activities; have the skills to apply the acquired knowledge in the characterization of specific environmental objects.	5			v	v	v									
42	Environmental problems of our time and Sustainable Development	The purpose of this course is to acquaint students with the environmental problems of our time, their causes and ways of resolving, to form an idea of the unity of society and nature, the ways of sustainable development of civilization. The subject of the study of the discipline is the classification of environmental problems, the establishment of links between environmental and social problems, the formation of ideas about the links between society and nature, the study of types of environmental consciousness, their distinctive	5							v		v					

		characteristics, to give the first idea of the sustainable development of society.															
43	Ecology of soils	The purpose of the discipline – the formation of the ability to develop measures for the rational use and protection of soil and to restore soil fertility. The course examines the laws of formation of soil cover, soil classification, legal aspects of soil protection, causes, sources and consequences of negative impact on the soil, stages of reclamation of disturbed lands. The course forms the basis of effective technologies for the improvement of degraded and restoration of disturbed lands for use, as well as their involvement in the turnover.	5			V		V									V
Cycle of profile disciplines University component																	
44	Global ecology and biodiversity	Evolution of the current state of the environment. Mechanisms of biosphere and OS stability. Anthropogenic impacts on the biosphere and global environmental problems. Measurement and assessment of biodiversity. Alpha, beta, and gamma variety. Man-made disasters are a threat to biodiversity. Stability and sustainability of biosystems. Biodiversity dynamics under conditions of global and local environmental pollution. Environmental protection, conservation of biological diversity in Kazakhstan.	4					V		V							

45	Best available technology in various industries	The relationship between the best available technologies and environmental permits, elements of assessing the effectiveness of BAT policies, a description of technological processes in various industries. Methodology for analyzing the dynamics of emissions at the facility level Contents of handbooks of the best available technologies in the field of environmental protection and their structure. Primary copper and aluminum production process, production of ammonia, building materials, etc.	6									v	v		v		
46	Fundamentals of Radiation Ecology	The course "Fundamentals of Radiation Ecology" is aimed at studying the fundamentals of radiation safety. The content of the discipline "Fundamentals of Radiation Ecology" sets out the objectives of the course, which make it possible to highlight the following issues: classification of protection against the main types of radiation. Physical bases of registration and dosimetry of ionizing radiation. Scintillation, luminescent and photographic dosimetry methods. Devices and principle of operation of radiation monitoring devices.	4		v								v			v	v
47	Restoration technologies for damaged ecosystems	Fundamental questions of the interrelated study of the ways of using natural resources and measures for the restoration, transformation and protection of these resources and the human environment. The course contributes to	4									v	v			v	v

		the development of an ecological worldview among future specialists, which is based on the idea of the unity of the interrelationships of all natural processes occurring in the biosphere, their change under the influence of anthropogenic factors.														
48	Industrial practice I	Industrial practice is an important stage in the training of specialists in the field of ecology and environmental management, which ensures that students acquire practical skills in conducting monitoring studies, assessing the state of components of the natural environment, developing and implementing measures to protect the natural environment from man-made impacts of production facilities of the mineral resource complex.	2							v	v	v				
49	Industrial practice II	To familiarize students with the practice of functioning of production enterprises, design and research organizations in the mining, metallurgical or oil and gas fields, as well as housing and communal services facilities.	3							v	v	v				
Cycle of profile disciplines Component of choice																
50	Fundamentals of Designing Chemical Industry Enterprises	The discipline studies the basics of design, engineering calculations, the main methods and stages of design of enterprises, as well as methods of reconstruction or construction of a new enterprise.	6								v	v			v	
51	Fundamentals of Environmental Design	To teach students the principles of creating design objects from the	6								v	v			v	

	and Environmental Engineering	standpoint of a harmonious balance of the interaction of life and human activity with wildlife. The course discusses the basic principles and methods of designing environmentally sound objects and environments, the design features of design objects, taking into account their environmental feasibility. Designing design objects from the standpoint of the harmonious interaction of human activity and the environment.														
52	Air-pollution control (MOOC)	The purpose of this course is to prepare in the field of engineering protection of the environment of cities and towns from pollutants coming from stationary sources of pollution. The course deals with methods of dust and gas cleaning: dry and wet dust collectors, aerosol filtration, deposition of particles in an electrostatic field. Adsorption and absorption purification of gases. Patterns of distribution of pollutants in the atmosphere. Calculation of dispersion of harmful emissions in the atmosphere. Clarification of the boundaries of the sanitary protection zone of the enterprise.	6								v	v		v		
53	Systemic risks in the field of environmental protection	The course presents current approaches and methods in the field of systemic risk management, provides information on modern data, on the factors and conditions for the occurrence of risk, on the classification of man-made risks and environmental impacts, on identification methods and the procedure for managing	4					v		v						v

		systemic risks in the field of environmental protection for industrial enterprise, as well as information on the methods of analysis and assessment of industrial safety.															
54	Cleaning technology systems and use of exhaust gas	The purpose of this course is to familiarize students with the methods and means of cleaning emissions from industrial enterprises from gas components; chemical cleaning of gases. The course deals with the processes of gas solubility in liquids, absorption, adsorption, chemisorption. Technological systems for gas purification at mining enterprises. Technological ventilation systems for gas purification at ferrous and non-ferrous metallurgy enterprises. Protection of the air basin from emissions from thermal power plants. Reducing emissions of harmful substances into the atmosphere during the extraction and processing of oil and gas. Constructions of gas ducts, sewerage of gases.	6									v			v	v	
55	Fundamentals of Industrial Technologies (MOOC)	It is aware physical and chemical basics, processing equipment of productions of the main inorganic and organic synthesis, production of mining and metallurgical and machine-building complexes are covered.	5									v	v			v	v
56	Natural and waste water treatment technology	The purpose of mastering the course is to study the technologies and processes of natural water purification for drinking water supply and technological needs, as	5									v	v			v	v

		well as wastewater treatment schemes. The course examines the sanitary and economic implications of improving water quality. Assessment of water quality and basic methods of its treatment. Requirements for the quality of drinking water. Methods and technological processes of water treatment. Basic technological schemes of water treatment and principles of their selection. General issues of designing water treatment complexes. Justification of the choice of site for the placement of water treatment facilities.														
57	Reagent production technology, wastewater treatment	The purpose of this course is to prepare a specialist with the necessary knowledge and skills in the field of natural and waste water treatment for the calculation, design, construction and operation of facilities used in modern water treatment technologies. The course deals with wastewater treatment by the method of reagent treatment with coagulants based on Fe^{3+} , Al^{3+} salts, hydroxychloride and Al oxychloride, lime, polymeric flocculants. Electrocoagulation, heavy metals, oil products; membrane separation: ultrafiltration for the extraction of high-molecular soluble components, reverse osmosis for water demineralization.	5								v	v			v	v
58	Waste management	The purpose of this course is to study the sources of formation and classification of solid waste, the basic concepts of waste,	5								v	v			v	v

		the analysis of existing production and consumption waste management systems abroad and in the CIS countries. The course covers the concepts of production and consumption waste management (zero waste, "eternal" disposal), technologies for processing waste from ferrous and non-ferrous metallurgy, thermal power engineering, the phosphorus industry, the oil and gas complex, as well as municipal solid waste.															
59	Disposal, disposal and disposal of industrial waste	The purpose of this course is to familiarize students with the technologies and methods of recycling, neutralization and disposal of industrial waste. The course discusses the main technological schemes and parameters of processing solid industrial waste in various industries, technologies for processing substandard raw materials. Fundamentals of studying the morphological and qualitative composition of industrial waste, studying the complexity of solid waste processing, acquiring skills in calculating waste disposal standards, and determining the hazard class.	5								v	v			v		v
60	Ecoanalytics and environmental protection measures	The course "Ecoanalytics and environmental protection measures" is aimed at forming ideas about the current state of the environment, taking into account the ever-increasing anthropogenic impact on it; familiarization of students with the main	5								v	v			v		v

		provisions of environmental research in order to obtain optimal information about the state of the environment and its components when justifying and clarifying environmental forecasts.															
61	Ecologic basis of industrial technologies	Environmental issues of mining, mineral processing, metallurgical and machine-building complex are studied. Attention is paid to fuel and energy complex, technology of production, transportation and storage of naphtha. Technogenic impacts of oil fields on a surrounding medium are described. Chemical and petrochemical industry: level of development and geography of the main productions, technologies, inventory.	5								v	v					v
62	Human ecology	The course on patterns and processes of human interaction with the environment. The discipline considers the following topics: human adaptation to environmental changes; the role of man in maintaining or destroying ecosystems; new adaptive problems in urban and other anthropogenic environments; interrelations of technological and ecological changes; development of unifying principles in the study of biological and cultural adaptation, etc.	4			v		v									
63	Ecological and normative documentation at the enterprise	Legislative and regulatory framework of the RK in the field of environmental protection. Executive body in the field of environmental protection of the RK. Methodology for the implementation of the MPD project for pollutants and the	5							v			v				

		MPE project. Statistical reporting. Organization of industrial environmental control and State environmental control of enterprises.															
64	Ecotechnology and green energy	The purpose of this course is to develop interdisciplinary competencies on the use of non-traditional power plants and alternative energy facilities. The course deals with the formation of biosphere homeostasis. Stages of technological development of civilization: World, Megaworld and Nanoworld. traditional energy. Energy decarbonization. Green energy. New energy saving and energy storage technologies. Biofuel. Water saving technologies. Waste recycling. Nanomaterials. Green space. Green transport. Green City.	5								v	v		v			v

5. Educational program curriculum



KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATBAYEV



CURRICULUM
of Educational Program on enrollment for 2023-2024 academic year
Educational program 6B05206 - "Engineering ecology"
Group of educational programs B051 - "Environment"

Form of study: full-time

Duration of study: 4 years

Academic degree: Bachelor of natural sciences

Form of study: full-time		Duration of study: 4 years		Academic degree: Bachelor of natural sciences															
Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount lec/lab/pr	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on courses and semesters											
								I course		II course		III course		IV course					
								1	2	3	4	5	6	7	8				
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																			
M-1. Module of language training																			
LNG 108	English language	GED, RC	10	300	0/0/6	210	E	5	5										
LNG 104	Kazakh (Russian) language	GED, RC	10	300	0/0/6	210	E	5	5										
M-2. Module of physical training																			
KFK 101-104	Physical Culture	GED, RC	8	240	0/0/8	120	Difcredit	2	2	2	2								
M-3. Module of information technology																			
CSE 677	Information and communication technologies	GED, RC	5	150	2/1/0	105	E				5								
M-4. Module of socio-cultural development																			
HUM137	History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE		5										
HUM 132	Philosophy	GED, RC	5	150	1/0/2	105	E				5								
HUM 120	Socio-political knowledge module (sociology, politology)	GED, RC	3	90	1/0/1	60	E				3								
HUM 134	Socio-political knowledge module (culturology, psychology)		5	150	2/0/1	150	E			5									
M-5. Module of anti-corruption culture, ecology and life safety base																			
1201	Elective	GED, CCH	5	150		150	E				5								
CYCLE OF BASIC DISCIPLINES (BD)																			
M-6. Module of physical and mathematical training																			
MAT 101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5											
PHY468	Physics	BD, UC	5	150	1/1/1	105	E	5											
MAT 102	Mathematics II	BD, UC	5	150	1/0/2	105	E		5										
M-7. Module of basic training																			
GEN429	Engineering and computer graphics	BD, UC	5	150	1/0/2	105	E	5											
M-8. Module of Basic Chemical Training																			
CHE815	General Chemistry	BD, UC	4	120	2/1/0*	75	E	4											
CHE193	Inorganic Chemistr	BD, UC	5	150	2/1/0*	105	E		5										
CB1108	Analytical Chemistry	BD, UC	5	150	1/1/1	105	E			5									
CHE582	Organic Chemistry	BD, UC	5	150	2/1/0*	105	E				5								
CHE127	Physical chemistry	BD, UC	5	150	1/1/1	105	E				5								
CHE837	General chemical technology	BD, UC	6	180	2/1/1	120	E				6								
2201	Elective	BD, CCH	5	150		105	E			5									
M-9. Module of General environmental training																			
CHE850	Introduction to the specialty (engineering ecology)	BD, UC	5	150	1/0/2	105	E			5									
HPP130	Research in Environment and Natural Resources	BD, UC	5	150	1/0/2	105	E				5								
CHE601	Geoeology	BD, UC	5	150	2/0/1	105	E				5								
CHE438	Environmental assessment and expertise	BD, UC	5	150	2/0/1	105	E				5								
CHE647	Ecology and environmental economics	BD, UC	5	150	2/0/1	105	E				5								
2301	Elective	BD, CCH	5	150		105	E				5								
2302	Elective	BD, CCH	5	150		105	E				5								
2303	Elective	BD, CCH	5	150		105	E				5								
2304	Elective	BD, CCH	5	150		105	E				5								
2305	Elective	BD, CCH	5	150		105	E				5								
CHE644	Environmental monitoring	BD, UC	5	150	2/0/1	105	E				5					5			
CHE437	Environmental legislation	BD, UC	5	150	2/0/1	105	E				5					5			
CIV784	Educational practice	BD, UC	2							2									
CYCLE OF PROFILE DISCIPLINES (PD)																			
M-10. Module of professional activity																			
CHE858	Global ecology and biodiversity	PD, UC	4	120	2/0/1	75	Э								4				
CHE859	Fundamentals of Radiation Ecology	PD, UC	4	120	2/0/1	75	Э								4				

3301	Elective	PD, CCH	4	120		75	3						4		
HPP131	Restoration technologies for damaged ecosystems	PD, UC	5	150	2/0/1	105	3							5	
CHE860	Best available technology in various industries	PD, UC	6	180	2/0/2	120	3							6	
3401	Elective	PD, CCH	6	180		120	3							6	
3402	Elective	PD, CCH	5	150		105	3							5	
3403	Elective	PD, CCH	6	180		120	3							6	
3404	Elective	PD, CCH	5	150		105	3							5	
3405	Elective	PD, CCH	5	150		105	3							5	
3406	Elective	PD, CCH	5	150		105	3							5	
CIV785	Production practice I	PD, UC	2									2			
CIV786	Production practice II	PD, UC	3										3		
M-11. Module of final attestation															
ECA108	Defense of the thesis (project)	FA	8												8
M-12. Module of additional types of training															
AAP500	Military affairs	ATT	0												
Total based on UNIVERSITY:												31	29	27	33
												60	60	60	60

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
		required component (RC)	university component (UC)	component of choice (CCH)	Total
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of basic disciplines		87	30	117
PD	Cycle of profile disciplines		23	36	59
	<i>Total for theoretical training:</i>	<i>51</i>	<i>110</i>	<i>71</i>	<i>232</i>
FA	final attestation	8			8
	TOTAL:	59	110	71	240

Decision of the Academic Council of KazNRTU named after K.Satbayev. Protocol № 5 24 november 2022 y.

Decision of the Educational and Methodological Council of KazNRTU named after K.Satbayev. Protocol № 3 17 november 2022 y.

Decision of the Academic Council of the Mining and Metallurgical Institute. Protocol № 3 or "15" 11 2022 y.

Vice-Rector for Academic Affairs

Director of the Mining and Metallurgical Institute

Head of the Department of Chemical Processes and Industrial Ecology

Specialty Council representative from employers

B. Zhautikov

K. Rysbekov

Sh. Kubekova

D. Burlibayeva



KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY after K. SATBAYEV



MAJOR ELECTIVE DISCIPLINES educational program for the 2023-2024 academic year admission
Educational program 6B05206 - "Engineering ecology"
Group of Educational programs B051 - "Environment"

Full-time study

Study duration : 4 years

Academic degree: bachelor of natural sciences

Study duration : 4 years										Academic degree: bachelor of natural sciences	
Year of study	Code of elective	Code of discipline	Name of discipline	Semestr	Cycle	Credits	Total hours	lec/lab/pr	SIW (including SIWT) in hours		
2	M-5. Module of anti-corruption culture, ecology and life safety base										
	1201	HUM 136	Fundamentals of Anti-Corruption Culture and Law	3	GED, CCH	5	150	2/0/1	150		
		MNG 489	Fundamentals of Economics and Entrepreneurship								
		HPP128	Scientific research methods								
		CHE 656	Ecology and life safety								
	M-8. Module of Basic Chemical Training										
	2201	CHE436	Green chemistry	3	BD, CCH	5	150	1/0/2	105		
		BIO408	Ecological chemistry					2/0/1			
		HPP132	Fundamentals of Ecology					2/0/1			
	3	M-9. Module of General environmental training									
2301		CHE852	Industrial and environmental safety	5	BD, CCH	5	150	2/0/1	105		
		HPP100	Industrial ecology and industrial safety					1/0/2			
2302		CHE645	Industrial ecology	5	BD, CCH	5	150	2/0/1	105		
		CHE853	Urban ecology								
2303		MAP577	Remote sensing of the state of the environment	5	BD, CCH	5	150	2/0/1	105		
		CHE421	Modeling and optimization of chemical technological processes								
2304		CHE856	Soil ecology	6	BD, CCH	5	150	2/0/1	105		
	HPP133	Soil science and remediation methods									
4	2305	CHE605	Environmental problems of our time and Sustainable Development	7	BD, CCH	5	150	2/0/1	105		
		CHE884	Sustainable Development and ESG								
3	M-10. Module of professional activity										
	3301	HPP134	Human ecology	6	ПД KB	4	120	2/0/1	75		
		HPP135	Systemic risks in the field of environmental protection								
	3401	CHE857	Fundamentals of Environmental Design and Environmental Engineering	7	ПД KB	6	180	2/0/2	120		
		CHE843	Fundamentals of Designing Chemical Industry Enterprises								
	3402	CHE862	Reagent production technology, wastewater treatment	7	ПД KB	5	150	2/1/0	105		
		CHE863	Natural and waste water treatment technology								
	3403	CHE864	Air-pollution control	7	ПД KB	6	180	2/0/2	120		
		CHE865	Cleaning technology systems and use of exhaust gas								
	3404	CHE446	Ecoanalytics and environmental protection measures	8	ПД KB	5	150	2/0/1	105		
		HPP138	Ecological and normative documentation at the enterprise								
		CHE447	Ecotechnology and green energy								
	3405	BIO161	Disposal, disposal and disposal of industrial waste	8	ПД KB	5	150	2/0/1	105		
		CHE441	Waste management								
	3406	BIO139	Fundamentals of Industrial Technologies	8	ПД KB	5	150	2/0/1	105		
		BIO141	Ecologic basis of industrial technologies								

Credits numbers of elective disciplines over the entire period of study	
Cycle of disciplines	Credits
Cycle of general education disciplines (GED)	5
Cycle of basic disciplines (B)	30
Cycle of special disciplines (S)	36
Overall:	71

Decision of the Academic Council of Mining and Metallurgical Institute, Protocol № 3 - 15-11 2022 y.

Head of the department "Chemical Processes and Industrial Ecology" *Kubekova Sh.N.*

Representative of Specialty council *D. Burlibayeva*