Mining and Metallurgical Institute named after O.A. Baikonurov
«Mine Surveying and Geodesy» department

EDUCATIONAL PROGRAM
6B07221 – «Mine Surveying»

Code and classification of the field of education: **6B07 Engineering, manufacturing and construction industries**
The code and classification of training areas: **6B072 Manufacturing and processing industries**
Group of educational programs: **B071 - "Mining and mining"**
NRK Level: 6
ORC Level: 6
Duration of study: 4 years
Volume of credits: 240

Almaty 2025

Educational program 6B07221 – «Mine surveying» was approved at a meeting of the Academic Council of KazNRTU named after K.I.Satbayev.
Protocol №6 of 31.03.2025
Considered and recommended for approval at a meeting of the Educational and Methodological Council of KazNRTU named after K.I.Satbayev.
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Educational program 6B07221 – «Mine surveying» developed by the academic committee in the direction of «Manufacturing and processing»

Full name	Academic degree/ academic title	Position	Place of work	Signature
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List of abbreviations and designations

Reduction	Full name
SU	Satbayev University
MSHE RK	Ministry of Science and Higher Education of the Republic of Kazakhstan
AS	Academic staff
EP	Educational program
WC	Working curriculum
GIS	Geographic information system
LOED	Learning outcomes of the educational program
BD	Basic discipline
PD	Profile discipline
TUC	The university component
CC	Component of choice
SDG	Sustainable Development Goals
TUN	The United Nations

The educational program "Surveying" contributes to the achievement of the priority Sustainable Development Goals approved by the United Nations through the training of highly qualified specialists with competencies in the field of surveying and geodetic support for mining, spatial analysis, digital modeling of the subsurface and the safe development of natural resources. Graduates of the program play a key role in ensuring rational subsoil use, environmental and industrial safety, as well as technological development of the mining industry. Their professional activities are directly related to monitoring the condition of the earth's surface and underground mining facilities, ensuring the sustainable development of territories and reducing man-made impacts on the environment. The OP contributes to the achievement of the following Sustainable Development Goals (SDGs):

SDG 4. Quality education is the formation of a sustainable system of high-quality, inclusive and affordable education that provides lifelong learning opportunities.

SDG 7 "Affordable and clean energy" — through participation in the design of a secure infrastructure for the extraction of energy resources.

SDG 9. Industrialization, innovation and infrastructure - the development of sustainable infrastructure and the introduction of scientific and technological innovations into the economy of the region and the country.

SDG 11 "Sustainable cities and human settlements" — through spatial analysis, monitoring the stability of buildings and underground structures;

SDG 12. Responsible consumption and production is the development of a system of environmentally responsible consumption and production based on the principles of reduction, reuse and recycling.

SDG 13. Combating climate change – using geospatial technologies to monitor changes in the environment;

SDG 15. Conservation of terrestrial ecosystems is the monitoring and assessment of land use aimed at protecting and restoring natural ecosystems.

1. Description of the educational program

Training of specialists engaged in surveying and geodetic control over the correct and high-quality mining operations with the introduction of digital technologies.

The purpose and objectives of the educational program

The purpose of the educational program: Purpose: the formation of students' professional competencies necessary for professional activity in the field of surveying. Acquisition of theoretical knowledge and practical skills of students engaged in activities related to the use of mineral resources and (or) the production of surveying work.

EP tasks: The field of professional activity of students who have completed the professional retraining program "Surveying" includes engineering support for human activities in the bowels of the Earth and on its surface during operations related to the use of the subsoil (hereinafter referred to as mining). The objects of professional activity are: the bowels of the Earth, production facilities in the bowels of the earth and on its surface, equipment, technical and technological systems for their development (hereinafter referred to as subsurface use facilities).

A student who has successfully completed training in this program must solve the following professional tasks in accordance with the type of professional activity: provide technical guidance for mining, blasting and surveying operations, as well as work to ensure the functioning of mining equipment and technical systems;develop, coordinate and approve regulatory documents regulating the procedure for mining, surveying, as well as work related to the processing and enrichment of solid minerals, the construction and operation of underground structures, the operation of equipment, ensure compliance with the requirements of technical documentation for the work, applicable norms, rules and standards; develop and implement measures to improve the level of environmental safety and safety of mining operations; be guided in practical engineering by the principles of integrated use of the geological resource potential of the subsurface; develop and implement measures to improve and enhance the technical level of mining production, ensure the competitiveness of the organization in modern economic conditions; determine the spatial and geometric position of objects, perform the necessary geodetic and surveying measurements, process and interpret their results; create and (or) operate equipment and technical systems to ensure the efficient and safe implementation of technological processes in mining operations; develop plans for the elimination of accidents and emergencies related to mining operations. In accordance with the "Surveying" specialization, a student who has successfully completed training in this program must solve the following professional tasks: conducting surveying and geodetic work, determining the spatial and temporal characteristics of the state of the Earth's surface and subsoil, mining and technical systems, underground and surface structures and facilities, processing and displaying the information received in accordance with with modern requirements; implementation of planning for the development of mining and surveying operations, surveying control of the condition

of mining operations, buildings, structures, facilities and the earth's surface at all stages of development of the subsoil, their protection and rational use to ensure industrial and environmental safety; the ability to draw up design documentation for the production of surveying (projects of surveying and other works); justification and the use of methods of geometrization, analysis and forecasting, the placement of mineral deposit indicators in space; analysis and typification of the conditions for the development of mineral deposits for their integrated use, performing various assessments of subsurface use and forecasting dangerous situations; organization of the activities of the organization's surveying services, including in emergency situations.

3. Requirements for the assessment of learning outcomes of an educational program

As a result of mastering the retraining program, the following professional competencies should be formed. General professional: the ability to solve professional tasks based on information and bibliographic culture using information and communication technologies and taking into account the basic requirements of information security; the willingness to communicate orally and in writing in Russian and a foreign language to solve the tasks of professional activity; willingness to lead a team in the field of their professional activities, to perceive social, ethnic, religious and cultural differences in a tolerant manner; willingness to evaluate the structure, chemical and mineral composition of the Earth's crust, morphological features and genetic types of mineral deposits from a natural scientific perspective when solving problems related to the rational and integrated development of the geological resource potential of the subsurface; willingness to use scientific laws and methods in the geological and industrial assessment of mineral deposits within the boundaries of mining allotments; willingness to use scientific laws and methods in assessing the state of the mining environment; ability to use a computer as a means of managing and processing source and received data from information arrays; ability to select and (or) develop the provision of integrated technological systems of mining industries, as well as enterprises for the construction and operation of underground and surface facilities with technical means high level of control automation; Proficiency in analysis methods, knowledge of the laws of the state and management of rock properties and the state of the massif in the mining operations. willingness to demonstrate skills in developing action plans to reduce the anthropogenic impact of production on the environment during mining operations; the use of regulatory legal acts and documents in the field of industrial safety, safe subsurface use, geological and surveying operations in the design, construction and operation of mining facilities and (or) subsurface use facilities the ability to determine the spatial and geometric position of objects, carry out the necessary surveying measurements, process and interpret their results; willingness to participate in the implementation of automated production management systems.

4. Passport of the educational program

4.1 General information

№	Field name	Note
1	Code and classification of the field of education	6B07 Engineering manufacturing and construction industries
2	Code and classification of training areas	6B072 Manufacturing and processing industries
3	Group of educational programs	B071 - "Mining and mining"
4	Name of the educational program	6B07221 Mine Surveying
5	Brief description of the educational program	The educational program "Surveying" is aimed at training specialists with knowledge and skills in the field of geodesy, cartography, mining and mining. Within the framework of the program, students study methods of geodetic and surveying work, design and safety control of mining enterprises, as well as the development of modern technologies used in the mining and construction industries. The program includes theoretical courses, practical exercises and internships at enterprises, which allows students to gain skills in working with high-tech equipment, as well as develop skills in solving problems related to measurements, design and monitoring of mining operations. Graduates of the program can work in mining companies, construction and geodetic organizations, as well as in other fields related to the use of surveying technologies.
6	The purpose of the educational program	The purpose of the educational program "Surveying" is to train highly qualified specialists with theoretical knowledge and practical skills in the field of surveying, geodesy and mining. The program is aimed at developing the professional competencies necessary to perform mine surveying in the mining and construction industries, ensure safety during mining, as well as use modern technologies and equipment for monitoring and managing mining processes. As a result of their studies, graduates should be ready to solve problems related to geodetic and surveying work, design and operation of mining facilities, as well as ensure the accuracy and safety of all processes related to the extraction and processing of natural resources.
7	Type of educational program	New educational program
8	The NRK level	6
9	ORC Level	6
10	Distinctive features of the educational program	No
11	List of educational program competencies:	**General cultural competencies (GCC)** **GCC-1**. Ability to communicate effectively in Russian, Kazakh and a foreign language in the professional and

		industrial environment of mining and surveying. **GCC-2**. Teamwork skills, interaction with engineering and technical specialists, workers, contractors and regulatory authorities. **GCC-3.** The ability to make informed decisions in non-standard and emergency situations during mining operations, developed critical thinking. **GCC-4.** The ability to organize working hours, set professional goals, and ensure personal and industrial discipline. **General Professional Competencies (GPC)** **GPC-1.** Knowledge of the regulatory framework in the field of surveying, mining and geodetic works, industrial and environmental safety. **GPC-2.** Knowledge of methods of geodetic and surveying measurements, including when conducting underground and open-pit mining. **GPC-3.** The ability to work with spatial data, make plans, maps, profiles and drawings of mountain objects. **GPC-4.**Application of methods for analyzing deformations of the Earth's surface, stability of workings and underground structures. **GPC-5.**Understanding of engineering, environmental, technical and economic aspects of mining activities. **Professional Competencies (PC)** **PC-1.** Conducting surveying support of mining operations at all stages: design, operation, conservation, liquidation. **PC-2.** Performing precise geometric constructions and determining the coordinates of objects in mountainous conditions, including complex spatial systems. **PC-3.** Carrying out surveying control over the stability of mine workings, buildings, structures and the earth's surface. **PC-4.** Processing of the results of surveying and geodetic measurements using specialized software. **PC-5.** Development of project documentation and technical specifications for the production of surveying work, including in emergency situations. **PC-6.** Participation in the preparation of mining plans, disaster management and measures to ensure industrial and environmental safety. **PC-7.** Organization and management of the activities of the surveying service at the enterprise. **Digital Competencies (DC)** **DC-1.** Proficiency in specialized CAD programs (AutoCAD Civil 3D, Micromine, Surpac, Credo, MapInfo, etc.) for surveying data processing. **DC-2.** The ability to work with digital models of terrain, underground workings and quarries, and use GIS technologies for spatial analysis. **DC-3.** Knowledge of GNSS navigation technologies, satellite geodesy, 3D scanning, photogrammetry and

		remote sensing data processing. **DC-4.** The use of cloud platforms and Web-GIS for collaboration, storage and analysis of geospatial information in mining.
12	Learning outcomes of the educational program:	1.To prepare graduates for organizational and managerial activities, self-training, self-improvement, research work in solving problems related to the design, construction, operation and liquidation of enterprises for the extraction of minerals and underground facilities not related to the extraction of minerals. 2.To master the basic principles and methods of social, humanitarian and economic sciences in solving social and professional problems. 3.Monitor compliance with the established project ratio of geometric elements of buildings, structures, technological equipment and underground mine workings. 4.To understand the social significance of one's future profession and to be highly motivated to perform professional activities. 5.To create networks of reference and survey points on the earth's surface within the enterprise's mining allotment and in mine workings, to carry out surveys for the compilation and replenishment of plans of the earth's surface and mine workings. 6.Perform as-built surveys of both completed projects and at certain stages of construction. 7.To prepare graphic documents of the actual position of constructed structures and completed mine workings, as well as to replenish and update industrial site plans and surface plans at construction sites. 8.To determine the methods of establishing the spatial and temporal characteristics of the state of the Earth's surface and subsoil, mining systems, underground and ground structures and displaying information in accordance with modern regulatory requirements. 9.To determine the methods of establishing the spatial and temporal characteristics of the state of the Earth's surface and subsoil, mining systems, underground and ground structures and displaying information in accordance with modern regulatory requirements. 10.To determine the boundaries of safe mining operations and protective pillars, to mark out the sign boundaries in nature and to monitor their observance. 11.Conduct observations of the displacement of the earth's surface, rock mass, deformations of structures and mine workings during the development of mineral deposits and compile mining-graphic and technical documentation using general-purpose and special-purpose software products.
13	The form of education	Full-time

14	Duration of training	4 years
15	Volume of loans	240
16	Languages of instruction	russian, kazakh, english
17	Academic degree awarded	Bachelor of engineering and technology
18	Developers and authors:	Department of Surveying and geodesy

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

№	Name of the discipline	Brief description of the discipline	Number of credits	Formed learning outcomes (codes)											
				LR1	LR2	LR3	LR4	LR5	LR6	LR7	LR8	LR9	LR10	LR11	LR12
The cycle of general education subjects Required component															
1	Foreign language	After determining the level (according to the results of diagnostic testing or IELTS results), students are divided into groups and disciplines. The name of the discipline corresponds to the level of English language proficiency. When moving from level to level, the prerequisites and post-requirements of discipline are observed.	10	X											
2	Kazakh (Russian) language	The socio-political, socio-cultural spheres of communication and functional styles of the modern Kazakh (Russian) language are considered. The course highlights the specifics of the scientific style in order to develop and activate students' professional and communication skills. The course allows students to practically master the basics of scientific style and develops the ability to perform structural and semantic text analysis.	10	X											
3	Physical Culture	The purpose of the discipline is to master the forms and methods of forming a healthy lifestyle within the framework of the professional education system. Familiarization with the natural science foundations of	8	X											

		physical education, knowledge of modern wellness technologies, basic methods of independent physical education and sports. As part of the course, the student will master the rules of refereeing in all sports.													
4	Information and communication technologies (in English)	The objective of studying the discipline is to acquire theoretical knowledge about information processes, new information technologies, local and global computer networks, information security methods; to acquire skills in using text editors and tabular processors; to create databases and various categories of application programs	5				X								
5	History of Kazakhstan	The purpose of the discipline is to provide objective historical knowledge about the main stages of the history of Kazakhstan from ancient times to the present day; to acquaint students with the problems of the formation and development of statehood and historical and cultural processes; to promote the formation of humanistic values and patriotic feelings among students; to teach students to use the acquired historical knowledge in educational, professional and daily life; to assess the role of Kazakhstan in world history	5		X										
6	Philosophy	The purpose of the discipline is to teach students the theoretical foundations of philosophy as a way of cognition and spiritual exploration of the world; to	5				X								

		develop their interest in fundamental knowledge, stimulate the need for philosophical assessments of historical events and facts of reality, assimilate the idea of the unity of the world historical and cultural process while recognizing the diversity of his skills in applying philosophical and general scientific methods in professional activities.													
7	Module of socio-political knowledge (sociology, political science)	The objectives of the disciplines are to provide students with explanations on the sociological analysis of society, on social communities and personalities, factors and patterns of social development, forms of interaction, types and directions of social processes, forms of regulation of social behavior, as well as primary political knowledge that will serve as a theoretical basis for understanding socio-political processes, for the formation of political culture, the development of personal position and a clearer understanding of the measure of their responsibility; to help master the political, legal, moral, ethical, and socio-cultural norms necessary for acting in the interests of society, forming personal responsibility, and achieving personal success	3				X								
8	Module of socio-political knowledge (cultural studies, psychology)	The purpose of the disciplines is to study the real cultural processes of creative activity of people who create material and spiritual values, to identify the main trends and patterns of cultural	3			X									

		development, the change of cultural epochs, methods and styles, their role in the formation of man and the development of society, as well as to master psychological knowledge for the effective organization of interpersonal interaction, social adaptation in the field of their professional activities.													
The cycle of general education subjects Component of choice															
9	Fundamentals of anti-corruption culture and law	Purpose: to increase public and individual legal awareness and legal culture of students, as well as to form a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Content: improvement of socio-economic relations of the Kazakh society, psychological features of corrupt behavior, formation of an anti-corruption culture, legal responsibility for acts of corruption in various fields	5			X									
10	Fundamentals of economics and entrepreneurship	Purpose: To form basic knowledge about economic processes and business skills. Content: The discipline is studied in order to develop skills in analyzing economic concepts such as supply and demand, market equilibrium. The basics of business creation and management, development of business plans, risk assessment and strategic decision-making are included.	5											X	X

11	Fundamentals of scientific research methods	The purpose of the discipline "Fundamentals of scientific research methods" is to develop students' skills and abilities in the field of scientific cognition methodology. A brief description of the discipline. Methodological foundations of scientific knowledge. The concept of scientific knowledge. Methods of theoretical and empirical research. Choosing the direction of scientific research. Stages of scientific research work. The research topic and its relevance. Classification, types and objectives of the experiment. Metrological support of experimental research. A computational experiment. Methods of processing experimental results. Registration of the research results. Presentation of a research paper	5			X									
12	Ecology and life safety	Purpose: formation of ecological knowledge and consciousness, obtaining theoretical and practical knowledge on modern methods of rational use of natural resources and environmental protection. Contents: study of the problems of ecology as a science, the laws of the functioning of natural systems and aspects of environmental safety in working conditions, environmental monitoring and management in the field of its safety, ways to solve	5			X									

		environmental problems; safety of life in the technosphere, natural and man-made emergencies													
13	Basics of financial literacy	The goal: to form financial literacy of students based on building a direct link between the acquired knowledge and their practical application. Content: practical use of various financial management tools, saving and increasing savings, competent budget planning, obtaining practical skills in calculating and paying taxes and correctly completing tax reports, analyzing financial information and navigating financial products to choose an adequate investment strategy	5											X	X
The cycle of basic disciplines The university component															
14	Mathematics I	Purpose: to introduce students to the fundamental concepts of linear algebra, analytic geometry and mathematical analysis. Develop the ability to solve typical and applied tasks of the discipline. Content: Elements of linear algebra, vector algebra and analytic geometry. Introduction to analysis. Differential calculus of a function of one variable. The study of functions using derivatives. Functions of several variables. Partial derivatives. The extremum of a function of two variables	5								X				

15	Mathematics II	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the original. To teach how to apply a certain integral to solve practical problems. Contents: integral calculus of a function of one and two variables, theory of series. Indefinite integrals and methods of their calculation. Certain integrals and applications of certain integrals. Improper integrals. Theory of numerical and functional series, Taylor and Maclaurin series, application of series to approximate calculations	5								X				
16	Chemistry	Purpose: to develop knowledge on fundamental issues of general chemistry and skills of their application in professional activities. Summary of the laws, theoretical provisions and conclusions that underlie chemical disciplines; properties and relationships of chemical elements based on the periodic law of D.I.Mendeleev and on modern concepts of the structure of matter; fundamentals of chemical thermodynamics and kinetics; processes in solutions; the structure of complex compounds	5											X	
17	Physics	Purpose: to form ideas about the modern physical worldview and scientific worldview, the ability to	5	X											

		use knowledge of fundamental laws, theories of classical and modern physics. Contents: physical foundations of mechanics, fundamentals of molecular physics and thermodynamics, electricity and magnetism, vibrations and waves, optics and fundamentals of quantum physics													
18	Engineering and computer graphics	Purpose: To develop students' knowledge of drawing construction and skills to develop graphic and textual design documentation in accordance with the requirements of the standards. Content: Students will study ESCD standards, graphical primitives, geometric constructions, methods and properties of orthogonal projection, Monge plots, axonometric projections, metric problems, types and features of connections, sketching of parts and assembly drawings, detailing, as well as the creation of 3D complex solid objects in AutoCAD	5	X											
19	Geodesy	Purpose: To study the geometric characteristics of the Earth's parameters with the definition of specific points in a three-dimensional coordinate system for constructing graphical documentation of mining enterprises. Content: As a result of mastering the discipline, the student	5					X				X	X		

		should be able to work with geodetic instruments, measure horizontal and vertical angles, as well as distances, perform desk processing of field data to obtain reliable data on terrain, ground structures, and other objects.													
20	Fundamentals of Geology	"Fundamentals of Geology" is teaching students the skills of studying field methods of the material composition of the Earth's crust, the ability to study and observe the processes that form the Earth's crust. During the course, students will gain an understanding of current theoretical developments explaining the formation of the universe, the Solar system, the Earth, the atmosphere, the hydrosphere, and the conditions of the geological environment.	5			X									
21	Shattering process	Purpose: to study the physical essence of the processes of explosive destruction of rocks in the extraction of solid minerals, technology and rules of technical and environmental safety in the production of blasting. Content: classification of methods of drilling boreholes and boreholes; classification of explosions, detonation, poisonous gases in the explosion; the field of application of explosives; initiating explosives; requirements for industrial explosives; methods and means of	5			X									

		blasting; electronic schemes for switching charges of explosives.													
22	The theoretical mechanics	The purpose of the discipline is to form the foundations of engineering thinking among students by studying the basics of mechanics and mastering the basic principles and laws of theoretical mechanics The content of the discipline: the basic laws of mechanical motion and mechanical interaction of material bodies; the basic concepts of the law of mechanics, methods for studying the equilibria of motion of a material point, a solid and a mechanical system	5		X				X					X	X
23	Physics of rock mass	Objective: to study the influence of physical, mechanical and chemical properties of rocks on mining operations. Contents: compilation of a rock strength passport using the Coulomb-Mohr method, mechanical properties of rocks, stresses in rocks and Deformations; acoustic, electrical, magnetic and thermal properties of rocks, the influence of external factors on these properties; the use of active teaching methods such as analyzing specific situations, solving problematic problems, brain training The assault	5	X											
24	Electrical engineering	The purpose of the discipline is to master the theoretical foundations of electrical engineering, acquire	5				X								

		knowledge about the structures, principles of operation, parameters and characteristics of various electrical circuits and electrical devices, and prepare students to understand the principle of operation of modern electrical equipment.													
25	Financial and economic model of a mining enterprise	Purpose: to teach how to perform a technical and economic assessment of mining development options in market conditions and plan appropriate investments to reach the production capacity of a mining enterprise. Contents: calculation of the cost of production; criteria for assessing non-recurring costs and incomes; net present value, payback period, profitability level of production, internal profit margin; structure and content of the financial and economic model of a mining enterprise	5											X	X
The cycle of basic disciplines Component of choice															
26	General course of surveying	Objective: to study the methods of creating underground surveying support and survey networks, methods of measuring horizontal angles, methods of geometric orientation of underground surveys using modern technology and technology. Content: As a result of mastering the discipline, the student must know and be able to perform geometric orientation of mining	5	X		X		X			X	X	X		

		operations, be able to build mining operations in horizontal and vertical planes based on field data.													
27	Mine surveying drawing in CAD systems	Objective: To master the methods of creating and editing mine surveying documentation using modern CAD systems, as well as automating graphic tasks in mine surveying. Content: Studying the basics of working with CAD systems, creating mining plans, cross-sections, and profiles, processing geodetic data, developing digital models of terrain and objects, and preparing mine surveying documentation.	5	X				X			X	X			
28	Analysis of the accuracy of surveying operations during open-pit mining	To study methods for assessing the accuracy of surveying measurements during open-pit mining to ensure the reliability of geospatial data and improve mining safety. Fundamentals of error theory, analysis of the accuracy of geodetic and surveying surveys, control of the geometry of mine workings, methods of processing and leveling measurements, assessment of systematic and random errors, the use of modern GIS, digital technologies and laser scanning to improve the accuracy of surveying.	5	X		X					X	X	X		
29	Mathematical processing of surveying and geodetic measurements	Objective: mathematical processing of surveying and geodetic measurements is based on obtaining and consolidating knowledge on the elements of probability theory, measurement	5	X				X			X	X			

		classification, random measurement errors, the law of their distribution, and the properties of random errors. Contents: measures of accuracy of measurement results, substantiation of the least squares method, measurement weights, statistical totality and distribution, statistical studies of a number of random measurement errors, equation calculations													
30	Analysis of the accuracy of surveying operations during underground mining	To study methods for assessing the accuracy of mine survey measurements in underground mining to ensure safety, optimize mining operations and control the geometry of workings. Error theory and accuracy assessment methods, analysis of geodetic networks in underground conditions, control of mine workings, alignment of measurements, assessment of systematic and random errors, application of digital technologies, GIS and laser scanning to improve the accuracy of surveying.	5	X		X		X			X	X	X		
31	Surveying-geodesy instruments	Purpose: to study the design of optical-mechanical surveying and geodetic instruments, the features of modern electronic devices and work with satellite and laser-electronic technologies. Content: as a result of studying the subject, the student should know the principles of device design and operation, be able to carry out a range of field and desk work when	5	X								X			

		performing surveying and geodetic measurements.													
	Fundamentals of sustainable development and ESG projects in Kazakhstan	Purpose: the goal is for students to master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Contents: introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.	5													
	Surveying in geotechnical engineering surveys	Formation of in-depth knowledge and practical skills in the field of surveying necessary for effective engineering and geological surveys. This discipline is aimed at studying the methods and technologies used to obtain, process and analyze spatial information on the geological structure and conditions of mineral occurrence, as well as to assess the stability and safety of engineering structures.	6													
	Unmanned technologies in mine surveying support of mining operations	To provide students with in-depth knowledge and practical skills in the application of unmanned technologies to improve the efficiency, accuracy and safety of surveying operations in the mining industry. In this course, students	6													

		will learn modern methods and tools used in surveying, as well as their integration with unmanned aerial vehicles (UAVs) and other automated systems.													
	Modeling and spatial analysis of the mining condition	The purpose of studying the discipline is to master the methods of modeling and spatial analysis necessary for assessing, forecasting and managing the condition of mine workings in various mining and geological conditions. Content: The study of mathematical models describing the processes of deformation and destruction of rocks. Mastering the methods of numerical modeling of the stress-strain state of the array. The use of GIS and software systems for spatial analysis and monitoring of mining operations. Assessment of the sustainability of workings and development of measures to maintain them. Risk analysis and forecasting of possible emergency situations.	6												
	Digital technologies and artificial intelligence in mine surveying	The purpose of studying the discipline is to master modern digital technologies and artificial intelligence (AI) methods in surveying to improve the accuracy, speed and automation of geodetic and surveying work. Contents: Fundamentals of digital technologies and application of artificial intelligence in surveying Modern technologies of data collection and processing for	6												

		automation of surveying operations to ensure cybersecurity of surveying data													
The cycle of specialized disciplines The university component															
33	Processing and enrichment of minerals	Purpose: to study a set of methods and processes of primary processing of mineral raw materials for the extraction of valuable minerals from waste rock, as well as the mutual separation of valuable minerals. Contents: Physico-chemical bases of mineral processing. Processes, apparatuses and technologies of preparation of mineral raw materials for separation of minerals. Processes, apparatuses, and technologies for the enrichment and processing of minerals. Technically and environmentally safe ways of working on mineral processing	4		X									X	
The cycle of specialized disciplines Component of choice															
34	Geomechanics	Purpose: geomechanics is aimed at obtaining knowledge about the mechanical properties and mechanical condition of a rock mass and the processes of deformation and destruction (geomechanical processes) occurring in it under certain natural conditions under the influence of mining (technological) factors. Content: using modern geophysical instruments, it will make it possible to organize monitoring of the movement of the rock mass relative to the outcrops of the mine workings at existing mining enterprises.	5		X			X			X		X		

35	GIS Cartography in mining	Purpose: to study the mathematical basis of maps and types of cartographic projections for mapping land use, and land cadastral plans. Content: To study methods for determining distortions on maps of angles, shapes, and areas to assess the quality of cadastral plans and maps. To master cartographic methods of depicting the relief and the situation for the compilation of agrochemical and agro-climatic maps when solving various land management tasks, when assessing natural resources, land	5	X				X			X	X	X		
36	Web-GIS basics	Purpose: Master the acquisition of theoretical and practical skills of working in WEB-geoinformation systems and modern geoinformation technologies. Contents: possess the skills of using software and working in computer networks, the ability to create databases and use Internet resources, WEB portals, own software and software, GIS technologies, be able to work with information from various sources to solve professional and social problems.	5			X		X			X	X	X		
37	Web-cartography	Objective: Learn the concept of creating maps and designing cartographic materials on the web. To master the systems and algorithms of web architecture, in order to design and create interactive maps and web applications. Gain skills in using the basics of computer networks and how	5			X		X			X	X	X		

		they work, and analyze how GIS servers and JavaScript work. Create CSS styles, graphic design, animation and effective interaction of geospatial information through a web browser.													
38	Legal regulation of intellectual property	Purpose: the goal is to form a holistic understanding of the system of legal regulation of intellectual property, including basic principles, mechanisms for protecting intellectual property rights and features of their implementation. Content: The discipline covers the basics of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, and consider legal disputes and methods for resolving them.	5	X				X			X	X			
39	ESG principles in inclusive culture	Purpose of the course: It focuses on studying ESG (Environmental, Social, Governance) principles and their interaction with the creation of an inclusive culture within an organization. Content: Students will gain knowledge on how implementing ESG principles contributes to corporate social responsibility, sustainable development, and equal opportunities for all employees, including those who may face various forms of discrimination. The course will help students understand the importance of an	5	X				X			X	X	X		

		inclusive culture in achieving long-term business goals and ensuring sustainable organizational development.													
40	Automation of topographic and geodetic production	Purpose: of studying the discipline is to obtain theoretical knowledge and practical skills on how to automate topographic and geodetic work in solving applied problems in the design and construction of engineering structures. Contents: Particular attention during the passage of this discipline is paid to the training of modern automated geodetic instruments, the study of the principle of conducting topographic surveys using terrestrial laser scanning, the introduction of UAVs for the effective acquisition of geodetic data, as well as the use of satellite technologies.	5			X		X			X	X	X		
41	Automation of mine surveying works	The purpose of teaching the discipline "Automation of surveying operations" is to teach effective and accurate performance of surveying processes in the mining industry using modern technologies. This course allows students to perform surveying measurements in automatic mode, work with digital models, process and analyze geospatial data using modern software.	5	X				X			X		X		
42	Bases of mining (Introduction to specialty)	The aim of the course is to master mining terminology and features of mining operations in open, underground and borehole mining of mineral	5			X		X			X	X			

		deposits. Course objectives: to study the main production processes in the development of deposits by open pit, underground methods and in borehole mining on the basis of existing and prospective means of mechanization; give basic concepts for the processing and enrichment of mined minerals; gain skills in displaying mine workings and means of mechanization.													
43	Geoinformatics	Purpose: to form a set of knowledge in the field of GIS use, when creating digital models, to acquire knowledge and skills in using modern GIS in various types of professional and social activities.	5	X				X			X		X		
	Mine Survey of underground development systems	The purpose of the discipline: to study the methods of performing geometric orientation from the lower horizon of an underground mine to the overlying horizon, conducting mine workings with counter faces, performing surveying measurements of mine workings and production volumes using the example of underground mining systems. Content: As a result of mastering the discipline, he must be able to solve standard surveying tasks on a geometric basis in relation to the conditions of underground mining.	5	X		X			X	X					
	Mine surveying at underground mining	Underground horizontal shooting. Mining theodolites and requirements should be presented to them. Methods	5	X		X			X	X					

		of measuring angles and distances. Theodolite based in the mine. The goal and purpose backsight shots. Orientation through a single barrel. Connection of underground settlements plumbs ways of connecting a triangle and of a quadrilateral. Orientation two barrel. The purpose and tasks of vertical shooting, the definition of the difference between the heights through the vertical development of the mine belt, tape or dlinomer YES-2. Geometric and trigonometric leveling in underground workings. General information about film works. Surveying measurements. Surveying work when conducting underground mining. Surveying measurements, mining and graphical documents.													
	Aerology of consessions	Miner air. Change of air composition at its movement on excavations. Constituents of miner air. Poisonous and radioactive impurity of miner air. Gas content of the mine and pits. Methane. Physicomechanical properties of a methane. Types of a methane exhalation. Admissible standards of the methane contents in miner air. Decontamination of excavations. Miner dust. The combustible, explosive properties and factors influencing an explosibility of dust mixes. Thermal conditions of mines and pits. Microclimate of excavations.	6	X		X			X	X					

		Thermomoist parameters of mine air. Conditioning of mine air. Constitutive equations of a miner aerostatics. Types of pressure in moving air. Constitutive equations of a miner aerodynamics. Modes of air driving and types of airflows. Similarity of mine ventilating streams. Ventilation of blind drifts. Schemes and ways of mines ventilation. Choice of the mines ventilation scheme.													
	Technology of Terrestrial and Airborne Laser Scanning	Objective: To equip students with knowledge and practical skills in modern laser scanning technologies. Mastering the principles of acquiring high-precision 3D data, methods for planning and executing fieldwork, as well as algorithms for processing, analysis, and visualization to solve research tasks. Contents: Physical principles and classification of LSS. Fieldwork methodologies. Data formats. Stages of point cloud post-processing. Use of specialized software. Overview of practical applications in geodesy, mine surveying, construction (BIM).	5	X		X			X	X					
	Photogrammetric analysis and 3D modeling	Purpose: To create digital copies of objects for use in the field of architecture and urban planning, territorial planning and mapping. Prepare them for the processes of collecting and processing photogrammetric data and creating 3D models.	5	X		X			X	X					

		Content: Processing of aerospace images, creation of realistic 3D models of objects using GIS technologies. Visualization of models in graphical programs. Formation of 3D point clouds from the obtained images, analysis and processing of point cloud geometry.													
	Remote sensing of the earth	Purpose: The purpose of the discipline is to master the methods of processing and analyzing satellite imagery data in solving cartographic, geodetic and environmental problems. Contents: Students will be able to understand the results of remote sensing of the Earth, use modern sensors operating in active and passive modes. They will master satellite imagery processing technology, including image enhancement and image interpretation methods, and learn how to select remote sensing data processing methods for solving geological and environmental problems.	5	X		X			X	X					
	Geometry of subsoil	The purpose of the discipline: To study the theory and practice of mathematical modeling of field indicators, the construction of mining and geometric models based on geological surveying surveys and source documentation. Content: As a result of mastering the discipline, the student should be able to solve various mining and geometric problems for the geometrization of folded faults, tectonic disturbances and	6	X		X			X	X					

		fractures of a rock mass, to determine the capacity of a deposit, the construction of toposurfaces and mathematical actions with them													
	Mine survey software	Purpose of the discipline: obtaining knowledge of modern methods and means of computer technology surveying support at mining facilities, skills in the field of technology processing surveying information to solve production problems using specialized software. Content: after completing the course, the student should be able to independently solve problems arising in surveying support and operation of deposits, quarries and mines, perform engineering calculations and work in specialized software.	5	X		X			X	X					
	Mine surveying for the construction of mines	The purpose of the discipline: to study the methods of carrying out design data in kind when laying a mine shaft and building surface structures on the earth's surface, compiling data for terrain planning, splitting and fixing the centers and axes of mine shafts, transferring design contours and axes of structures to the terrain, servicing work on installing a copra and installing lifting equipment. Content: As a result of mastering the discipline, the student must know and be able to perform the elements of center work, tasks for underground	5	X		X			X	X					

		mining, and conduct surveying documentation of filming.													
	Mine surveying of the construction of tunnels	Purpose: knowledge of regulatory documents and basic rules for conducting surveying work on the construction of the subway and tunnel. Content: as a result of studying the discipline, the student must master determining the position of coordinates in the project plan, transferring the angle and distance of the project to the surface, performing design work, calculating attenuation curves in tunnels and measuring the direction to underground mining, as well as performing work on surveying a straight-line station conveyor.	5	X		X			X	X					

5. The curriculum of the educational program

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 31.03.2025 Minutes № 12

WORKING CURRICULUM

Academic year — 2025-2026 (Autumn, Spring)
Group of educational programs — B071 - "Mining and mineral extraction"
Educational program — 6B07221 - "Surveying business"
The awarded academic degree — Bachelor of engineering and technology
Form and duration of study — full time - 4 years

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters								Prerequisites
									1 course		2 course		3 course		4 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	7 sem	8 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																	
M-1. Module of language training																	
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E	5								
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E	5								
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E		5							
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E		5							
M-2. Module of physical training																	
KFK101	Physical culture I		GED, RC	2	60	0/0/30	30	E	2								
KFK102	Physical culture II		GED, RC	2	60	0/0/30	30	E		2							
KFK103	Physical culture III		GED, RC	2	60	0/0/30	30	E			2						
KFK104	Physical culture IV		GED, RC	2	60	0/0/30	30	E				2					
M-3. Module of information technology																	
CSE677	Information and communication technology		GED, RC	5	150	30/15/0	105	E				5					
M-4. Module of socio-cultural development																	
HUM120	Module of socio-political knowledge (sociology, political science)		GED, RC	3	90	15/0/15	60	E	3								
HUM137	History of Kazakhstan		GED, RC	5	150	15/0/30	105	GE		5							
HUM134	Module of socio-political knowledge (cultural studies, psychology)		GED, RC	5	150	30/0/15	105	E			5						
HUM132	Philosophy		GED, RC	5	150	15/0/30	105	E				5					
M-5. Module of anti-corruption culture, ecology and life safety base																	
CHE656	Ecology and life safety	1	GED, CCH	5	150	30/0/15	105	E				5					
MNG489	Fundamentals of economics and entrepreneurship	1	GED, CCH	5	150	30/0/15	105	E				5					
PET519	Fundamentals of scientific research methods	1	GED, CCH	5	150	30/0/15	105	E				5					
HUM136	Fundamentals of anti-corruption culture and law	1	GED, CCH	5	150	30/0/15	105	E				5					
MNG564	Basics of Financial Literacy	1	GED, CCH	5	150	30/0/15	105	E				5					
CYCLE OF BASIC DISCIPLINES (BD)																	
M-6. Module of physical and mathematical training																	
MAT101	Mathematics I		BD, UC	5	150	15/0/30	105	E	5								
MAT102	Mathematics II		BD, UC	5	150	15/0/30	105	E		5							MAT101

PHY468	Physics		BD, UC	5	150	15/15/15	105	E			5						
M-7. Module of basic training																	
GEN429	Engineering and computer graphics		BD, UC	5	150	15/0/30	105	E	5								
MAP519	Geodesy		BD, UC	5	150	15/0/30	105	E	5								
AAP401	Training practice		BD, UC	3				R		3							
MIN442	Shattering process		BD, UC	5	150	15/15/15	105	E			5						
CHE495	Chemistry		BD, UC	5	150	15/30/0	105	E			5						
GEN412	The theoretical mechanics		BD, UC	5	150	30/0/15	105	E			5						
MAP598	Mine surveying drawing in CAD systems		BD, UC	3	90	0/0/30	60	E			3						
MAP530	General course of surveying		BD, CCH	5	150	15/0/30	105	E				5					
MIN447	Physics of rock mass		BD, CCH	5	150	15/30/0	105	E				5					
GEO475	Fundamentals of Geology		BD, UC	5	150	30/15/0	105	E					5				
MAP520	Surveying-geodesy instruments		BD, UC	5	150	15/0/30	105	E					5				
MAP114	Geoinformatics		BD, UC	5	150	15/0/30	105	E					5				CSE174
MAP601	Analysis of the accuracy of surveying operations during open-pit mining	1	BD, CCH	5	150	15/0/30	105	E					5				
MAP600	Analysis of the accuracy of surveying operations during underground mining	1	BD, CCH	5	150	15/0/30	105	E					5				
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan	1	BD, CCH	5	150	30/0/15	105	E					5				
MAP596	Surveying in geotechnical engineering surveys	2	BD, CCH	6	180	30/0/30	120	E					6				
MAP597	Unmanned technologies in mine surveying support of mining operations	2	BD, CCH	6	180	30/0/30	120	E					6				
ELC105	Electrical engineering		BD, UC	4	120	15/15/15	75	E						4			
MAP135	Mathematical processing of surveying and geodetic measurements		BD, UC	6	180	15/30/0	135	E						6			
MAP599	Modeling and spatial analysis of the mining condition	1	BD, CCH	6	180	30/0/30	120	E						6			
MAP594	Digital technologies and artificial intelligence in mine surveying	1	BD, CCH	6	180	30/0/30	120	E						6			
MAP590	Financial and economic support of mine surveying operations.		BD, UC	4	120	15/0/30	75	E							4		
SAF149	Occupational health and safety at industry		BD, UC	5	150	15/0/30	105	E							5		
MAP580	Web-GIS basics	1	BD, CCH	5	150	15/0/30	105	E							5		
MAP466	Web-cartography	1	BD, CCH	5	150	15/0/30	105	E							5		
MNG562	Legal regulation of intellectual property	1	BD, CCH	5	150	30/0/15	105	E							5		
CHE950	ESG principles in inclusive culture	1	BD, CCH	5	150	30/0/15	105	E							5		
MAP102	Automation of topographic and geodetic production	2	BD, CCH	5	150	30/15/0	105	E							5		MAP112
MAP165	Automation of mine surveying works	2	BD, CCH	5	150	30/15/0	105	E							5		
CYCLE OF PROFILE DISCIPLINES (PD)																	
M-8. Module of professional activity																	
MAP595	Bases of mining (Introduction to specialty)		PD, UC	5	150	15/0/30	105	E		5							
AAP408	Industrial practice I		PD, UC	3				R				3					
MET641	Processing and enrichment of minerals		PD, UC	4	120	30/15/0	75	E					4				
AAP163	Industrial internship II		PD, UC	4				R						4			
MAP528	GIS cartography in mining		PD, UC	5	150	15/0/30	105	E						5			
MAP525	Mine Survey of underground development systems	1	PD, CCH	5	150	15/0/30	105	E						5			
MAP432	Mine surveying at underground mining	1	PD, CCH	5	150	15/30/0	105	E						5			
MIN533	Aerology of concessions		PD, UC	6	180	30/0/30	120	E							6		
MAP593	Technology of Terrestrial and Airborne Laser Scanning	1	PD, CCH	5	150	15/0/30	105	E							5		
MAP581	Photogrammetric analysis and 3D modeling	1	PD, CCH	5	150	15/0/30	105	E							5		
MAP425	Remote sensing of the earth	1	PD, CCH	5	150	15/0/30	105	E							5		MAP172
MAP579	Geometry of subsoil		PD, UC	6	180	30/0/30	120	E								6	

MAP527	Mine survey software		PD, UC	5	150	15/0/30	105	E								5	
MAP428	Geomechanics		PD, UC	6	180	15/30/0	135	E								6	
MAP433	Mine surveying for the construction of mines	1	PD, CCH	5	150	15/30/0	105	E								5	
MAP526	Mine surveying of the construction of tunnels	1	PD, CCH	5	150	15/0/30	105	E								5	
M-9. Module of final attestation																	
ECA103	Final examination		FA	8												8	
Additional type of training (ATT)																	
AAP500	Military training																
Total based on UNIVERSITY:									30	30	30	30	30	30	30	30	
									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	0	5	56
BD	Cycle of basic disciplines	0	80	37	117
PD	Cycle of profile disciplines	0	44	15	59
Total for theoretical training:		**51**	**124**	**57**	**232**
FA	Final attestation				8
TOTAL:					**240**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 5 dated 12.03.2025

Decision of the Academic Council of the Institute. Minutes № 5 dated 23.01.2025

Signed:

Governing Board member - Vice-Rector for Academic Affairs — Uskenbayeva R. K.

Approved:

Vice Provost on academic development — Kalpeyeva Z. B.

Head of Department - Department of Educational Program Management and Academic-Methodological Work — Zhumagaliyeva A. S.

Director - Mining and Metallurgical Institute named after O.A. Baikonurov — Ryshekov K. .

Department Chair - Surveying and geodesy — Meirambek G. .

Representative of the Academic Committee from Employers ___Acknowledged___ — Kudaibergenova A.