



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

**EDUCATIONAL PROGRAM  
7M07227 - «Mine surveying»**

Code and classification of the field of education: 7M07 Engineering, Manufacturing and Civil engineering

Code and classification of training areas: 7M072 Manufacturing and processing

Group of educational programs: M120 Mine surveying

Level based on NQF: 7

Level based on IQF: 7

Study period: 2 years

Amount of credits: 120

**Almaty 2024**

Educational program 7M07227 - «Mine surveying» was approved at a meeting of the Academic Council of KazNRTU named after K.I.Satpayev.

Protocol № 6 of 19.04.2024

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

Protocol № 12 of 22.04.2024

Educational program 7M07227 - «Mine surveying» developed by the academic committee in the direction of «Mine surveying»

Full name	Academic degree/ academic title	Position	Place of work	Signature
<b>Academic staff:</b>				
Orynbasarova E.O.	PhD	head of department	SU	
Kassymkanova Kh.M.	d.t.s	professor	SU	
<b>Employer:</b>				
Aymenov A.T.		Chief Engineer	Republican Cartographic Factory	
<b>student:</b>				
Yusupov S.B.		2 <sup>nd</sup> year master's student		

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## List of abbreviations and designations

Reduction	Full name
ECTS	European Credit Transfer and Accumulation System
NJSC SU	NJSC Satbayev university
MES RK	Ministry of Education and Science of the Republic of Kazakhstan
TS	Teaching staff
EP	Educational program
RO	Registrar's Office
WC of the EP	Working curriculum of the EP

### 1. Description of the educational program

It is intended for the implementation of scientific and pedagogical training of masters in the educational program "Surveying" at Satbayev University.

### 2. The purpose and objectives of the educational program

**Goal EP:** training of highly qualified scientific, technical and engineering personnel in the field of surveying, geospatial digital technologies with a focus on the development of Master's competencies.

**Tasks EP:**

Task 1: The readiness of specialists for research and project work in the field of geodesy, cartography, geoinformatics, surveying and geospatial technologies, including in related fields related to the selection of necessary research methods, modification of existing and development of new methods based on a specific study.

Task 2: The readiness of specialists for production and technological activities that ensure the introduction of new digital developments at the local level.

Task 3: The readiness of specialists to search for and obtain new information necessary to solve professional tasks in the field of knowledge integration in relation to their field of activity, to actively participate in the activities of an enterprise or organization.

Task 4: The readiness of specialists for scientific, informational, ideological and problematic communications in the professional environment and in the audience of non-specialists with a clear and deep justification of their position, to engage in organizational, managerial and service activities, to be aware of the responsibility for making their professional decisions.

Task 5: The readiness of specialists for self-study and continuous professional development during the entire period of scientific or professional activity.

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

Learning outcomes include knowledge, skills and competencies and are

defined both for the educational program as a whole and for its individual modules, disciplines or tasks.

The main task at this stage is to select assessment methods and tools for all types of control, with the help of which it is possible to most effectively assess the achievement of planned learning outcomes at the discipline level.

#### 4. Passport of the educational program

##### 4.1. General information

№	Field name	Note
1	Code and classification of the field of education	7M07 Engineering, Manufacturing and Civil engineering
2	Code and classification of training directions	7M072 Manufacturing and processing
3	Educational program group	M120 Mine surveying
4	Educational program name	7M07227 Mine surveying
5	Short description of educational program	Designed for the implementation of scientific and pedagogical training of masters in the educational program "Surveying" at Satbayev University and developed within the framework of the direction "Geospatial digital Engineering"
6	Purpose of EP	Training of highly qualified scientific, technical and engineering personnel in the field of surveying, geospatial digital technologies with a focus on the development of Master's competencies
7	Type of EP	New EP
8	The level based on NQF	7
9	The level based on IQF	7
10	Distinctive features of EP	No
11	List of competencies of educational program	12
12	Learning outcomes of educational program	1. Be able to develop plans and programs for the organization of innovative activities in the mining sector and understand the economic efficiency using professional automated complexes in solving surveying tasks 2. Apply the skills of management systems, means of increasing production efficiency and adapting modern information technologies for surveying. 3. To carry out planning for the development of mining operations and surveying control of the condition of mine workings, buildings, structures and the earth's surface at all stages of development and protection of the subsoil with industrial and environmental safety 4. To carry out research and pedagogical work, to raise the intellectual and general cultural level, to improve the moral and physical development of one's personality in the competence of professional activity 5. Be able to analyze and apply modern computer technologies, including web-based GIS systems, to create database management systems, analyze mathematical

		<p>processing methods, the ability to show creative initiative, prepare applications for inventions and industrial designs in the development of mineral resources</p> <p>6. Understand the trends in the development of technologies for digitalization of geospatial data, the readiness to transform processes in the conditions of dynamic changes in processes in the production market, apply modern technologies for visualization and optimization of production processes in the field of surveying</p> <p>7. Apply the skills to express your thoughts freely and clearly in English and use it as a means of business communication at a professional level</p> <p>8. Possess theoretical and practical skills, perform professional functions in the tasks of rational production of geodetic and surveying measurements, including substantiation of the type and type of geodetic instruments and equipment</p>
13	Education form	Full-time
14	Period of training	2 years
15	Amount of credits	120
16	Languages of instruction	Russian, Kazakh, English
17	Academic degree awarded	Master
18	Developer(s) and authors	Department of MSaG

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

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)							
				LR1	LR2	LR3	LR4	LR5	LR6	LR7	LR8
<b>Cycle of basic disciplines University component</b>											
1.	English (professional)	The course is aimed at studying the main problems of scientific knowledge in the context of its historical development and philosophical understanding, the evolution of scientific theories, principles and methods of scientific research in the historical construction of scientific paintings of the world. The discipline will help to master the skills of developing critical and constructive scientific thinking based on research on the history and philosophy of science. At the end of the course, undergraduates will learn to analyze the ideological and methodological problems of science and engineering and technical activities in building Kazakhstan's science and the prospects for its development.	3							v	
2.	Management Psychology	The course is aimed at mastering the tools for effective employee management, based on knowledge of the psychological mechanisms of the manager's activity. Discipline will help	3				v				

		you master the skills of making decisions, creating a favorable psychological climate, motivating employees, setting goals, building a team and communicating with employees. At the end of the course, undergraduates will learn how to resolve managerial conflicts, create their own image, analyze situations in the field of managerial activity, as well as negotiate, be stress-resistant and effective leaders.									
3.	History and philosophy of science	to explore the history and philosophy of science as a system of concepts of global and Kazakh science. Content: the subject of philosophy of science, dynamics of science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, engineering and technology, specifics of engineering sciences, ethics of science, social and moral responsibility of a scientist and engineer.	3				v				



4.	Higher school pedagogy	The course is aimed at mastering the methodological and theoretical foundations of higher education pedagogy. The discipline will help to master the skills of modern pedagogical technologies, technologies of pedagogical design, organization and control in higher education, skills of communicative competence. At the end of the course, undergraduates learn how to organize and conduct various forms of organizing training, apply active teaching methods, and select the content of training sessions. Organize the educational process on the basis of credit technology of education.	3			v					
<b>Cycle of basic disciplines</b> <b>Elective component</b>											
1.	Surveying during reclamation of disturbed lands	The discipline studies the concept of disturbed lands during the development of open-pit deposits; the extent of disturbed lands and changes in soil conditions during open-pit mining; landscape disturbance, transformation of soil cover and its development in open-pit mining; technical and biological stages of reclamation of disturbed lands.	5			v					

2.	Monitoring the movement of rocks during underground mining	Mastering the theoretical foundations and practical methods of studying the process of movement of rocks and the earth's surface in ore deposits, organizing and conducting observations of the movement of a rock mass, studying fracturing and determining the strength properties of rocks, methods of monitoring during underground mining.	5				✓	✓			
3.	Geodesic methods for studying modern movements of deformation of the Earth's surface	mastering the theoretical and practical aspects of geodetic measurements in the tasks of studying the movement of the Earth's surface (including ground-based instrumental and satellite methods), effectively solving the problems of processing and analyzing spatial data.	5								
4.	Mathematical modeling of field indicators	The discipline studies the basic methods of mathematical modeling and their application in applied mining and geological sciences, the theory of mathematical modeling, which allows you to build models of field indicators and judge their adequacy; scientific approaches to modeling field indicators; the basics of mathematical thinking, the use of mathematical language.	5				✓	✓			
5.	Geometrization of structural and qualitative indicators of the deposit	the study of the theoretical foundations and practical skills for solving problems and their graphical representation in various forms with the mandatory inclusion of patterns of placement of structural and qualitative indicators based on the geometrization of the subsoil and take into account the	5			✓		✓			

		movement of mineral reserves, their loss and dilution; economically assess the completeness of mineral extraction; prepare surveying documentation for solving mining problems.									
6.	Mining audit	the study of methods for analyzing the reliability of the technical reporting of a mining enterprise and the compliance of its activities with existing regulatory legal acts and technical requirements; the methodology in the development of recommendations for the elimination of violations revealed as a result of the analysis is considered.	5		v	v					
7.	Remote sensing of the Earth and natural resources	formation of remote sensing data processing skills using modern software, classification and interpretation of the results obtained, correct design of the results and preparation of accounting documentation.	4								
8.	Sustainable development strategies	Graduate students will study the concepts and principles of sustainable development, the development and implementation of sustainable development strategies, the evaluation of their effectiveness, and international standards and best practices. Cases and examples of successful sustainable development strategies are included.	5								
9.	Creativity, Innovation, Leadership, and Entrepreneurship	Mastering methodologies for encouraging creativity and innovation in resource management practices. Using leadership theory and strategy to gain	5								

		effective decision-making and management skills. The principles of entrepreneurship are considered, using the opportunities in the mineral resources sector to increase the economic effect.									
10.	Intellectual property and research	The purpose of this course is to provide undergraduates with the knowledge and skills necessary to understand, protect and manage intellectual property (IP) in the context of scientific research and innovation. The course is aimed at training specialists who can effectively work with IP, protect the results of scientific research and apply them in practice.	5								
11.	Gamification in Eco-Mining	the study of the principles of gamification in the practice of ensuring environmental mining using elements of game design in non-gaming contexts. Innovative solutions are being considered to increase engagement, motivation and productivity in the mining industry. The possibilities of using gamification are being applied to promote sustainable safe mining practices and optimize mining processes.	5								
12.	Mine survey in the reclamation of disturbed lands	as a result of studying the theoretical and practical foundations of restoration processes in land reclamation, environmental and economic aspects of protection and reclamation of disturbed territories. Development of skills in	5								

		analyzing objects requiring reclamation and making effective decisions on their restoration.									
13.	Sustainable Business and Project Management	The discipline "Sustainable Business and Project Management" for undergraduates is aimed at teaching the principles and methods of creating and managing sustainable business projects, including the development of sustainable development strategies and the use of project management tools in conditions of variability and uncertainty. Master's students master project management methodologies, develop skills in analysis and risk assessment, and also prepare to solve case studies and participate in practical projects related to sustainable business. As a result of the training, they acquire the ability to develop sustainable business development strategies, plan, monitor and complete projects, as well as analytical and practical skills to effectively manage sustainable business projects.	5								
<b>Cycle of profile disciplines University component</b>											
1.	Visualization of geospatial data	The discipline aims to master the methods and concept of visual representation of spatial data (PD) obtained as a result of geodetic and surveying measurements for making managerial and engineering decisions	5					v			

		and includes the following sections: geovisualization in the context of: points of view of related disciplines; geo-imaging; methods of visualization and representation of PD; interactive approaches to delineating the isosurface for geovisualization; multivariate mapping and classification; interpretation of spatial analysis results; Simulation of virtual environments ("True 3D", empirical research, VR/AR).									
2.	Geotechnical and surveying monitoring	The aim of the course is for undergraduates to acquire deep theoretical knowledge and practical skills in the study of geomechanical processes, which is understood as a set of observations, measurements, computational and graphic works aimed at obtaining information about the processes occurring in the subsurface during open-pit mining.	5			v					
2.	Laser scanning at quarries	The study of the use of a high-precision scanner device to reliably obtain data on the volume of mining and create 3D models of the object.	5						v		v
4.	Geoinformation support in planning the development of mining operations	The purpose of mastering the discipline "Geoinformation support in planning the development of mining operations" is the formation of professional competencies that determine the readiness and ability of the master to use methods and technologies of geoinformation and spatial analysis in	5			v	v	v			

		the tasks of management, planning of mining operations and in the construction of a digital model of mines.									
5.	Information systems in surveying	As part of the course, the master's student will master the practical and scientific use of methods and methods of automatic information processing, the use of applied programs in surveying and database management systems used in production when solving complex mathematical problems, when processing geodetic and surveying measurements in quarries and mines.	5	v			v			v	
3.	Analysis of the accuracy of surveying work	the study of the issues of assessing the accuracy of underground planned and high-altitude surveying networks, which are the basis of surveying surveys; the accuracy of angular and linear measurements in mine workings; the laws of error accumulation in polygonometric and leveling courses, the development of methods for assessing the accuracy of orientation and methods of equalizing underground networks.	5			v		v			
7.	Innovative technologies in surveying	Preparation of undergraduates for the production of surveying work, determining the state of the Earth's surface and subsurface, displaying information in accordance with modern regulatory requirements; apply modern software and technologies for processing underground and aboveground field measurements; apply	5			v				v	

		GNSS in surveying, UAVs and underground and aboveground scanning systems.									
8.	Monitoring of the condition of surface buildings and structures during the construction and operation of the subway	This discipline provides theoretical and practical knowledge about the methods of monitoring buildings and structures during the construction and operation of the subway to ensure safe operating conditions and to exclude the possibility of damage to the infrastructure of the city, surveying and geodetic surveys, geotechnical surveys and inspection of the technical condition of subway structures located in the zone of influence of new construction.	5			v					
4.	Mineral resources exploration and assessment	The study of the technique of exploration and evaluation of mineral resources based on the analysis of geological formations, with the identification of potential resources of mineral deposits using advanced technology of mapping and resource assessment. Special attention is paid to the integration of geospatial data, remote sensing and software for geological modeling.	5								
5.	Monitoring of the state of surface buildings and construction during	the study of theoretical and practical knowledge about the methods of monitoring buildings and structures during the construction and operation of	5								





	the construction and operation of the underground	the subway to ensure safe operating conditions and eliminate the possibility of damage to the city's infrastructure, surveying and geodetic surveys, geotechnical surveys and inspection of the technical condition of subway structures located in the zone of influence of the subway.									
6.	Rational use of mineral resources	the study of the strategy and methodology for the rational use of mineral resources, covering all stages of extraction, processing and use. Optimization techniques based on waste management practices and recycling strategies are considered to minimize environmental impacts and maximize resource efficiency, taking into account economic and environmental expediency.	5								
7.	Organization of scientific research	the organization of scientific research based on the familiarization of undergraduates with scientific knowledge, the formation of readiness and ability to conduct research activities related to the selection of necessary research methods, conducting experimental research and analyzing their results, based on modern achievements of domestic and foreign scientists and opens the way to the introduction of new developments.	5								
8.	Innovative surveying technology	the study of innovative technologies, determining the state of the earth's surface and subsurface with the display	5								

		of information in accordance with modern regulatory requirements based on the use of modern software and technology for processing underground and aboveground measurements.									
9.	WEB GIS	formation of ideas and understandings about the concepts and technical foundations of web GIS; exploring the possibilities of web GIS technologies using ESRI products (ArcGIS online, server) and open resources (QGIS, Mapserver, Geoserver); geospatial web services, geoportals, meshes, mobile GIS, creating interactive online maps for solving problems in the field of geodesy, cartography, surveying.	5								
10.	WEB-GIS in subsurface use	the discipline is an alternative to the discipline of Web GIS and provides theoretical and practical knowledge about the concept and technical foundations of web GIS, geoportals, meshes, mobile GIS. Develops skills in using web GIS technologies to create, manage, and analyze databases on deposits, subsurface use licenses, mineral reserves, infrastructures, etc. using ESRI products (ArcGIS online, server) and open resources (QGIS, Mapserver, Geoserver) as an example.	5								
11.	Resources modelling and evaluation	the study and application of modeling techniques for the assessment and management of mineral resources based on geological, geophysical and geochemical data in order to create	5								

		<p>predictive models of mineral deposits. Assessment of the quality and quantity of mineral resources, based on statistical analysis and computer simulation for decision-making related to the exploitation of resources. Consideration of the methodology of uncertainty and risk analysis in order to improve the reliability of estimates and optimize resource allocation strategies.</p>									
<p><b>Cycle of profile disciplines</b> <b>Component of choice</b></p>											
1.	WEB-GIS in subsurface use	<p>This discipline is an alternative to the discipline of Web GIS and provides theoretical and practical knowledge about the concept and technical foundations of web GIS, geoportals, meshes, mobile GIS. Develops skills in using web GIS technologies to create, manage, and analyze databases on deposits, subsurface use licenses, mineral reserves, infrastructure, etc. using ESRI products (ArcGIS online, server) and open resources (QGIS, Mapserver, Geoserver) as an example.</p>	5	v				v			
2.	WEB GIS	<p>The discipline is focused on the formation of ideas and understandings about the concepts and technical foundations of web GIS; the study of the possibilities of web GIS technologies on the example of ESRI products (ArcGIS online, server) and on the example of open resources (QGIS, Mapserver, Geoserver); geospatial web</p>	5					v			

		services, geoportals, meshes, mobile GIS, the creation of interactive online maps to solve problems in the field of geodesy, cartography, surveying.										
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### 5. Curriculum of the educational program

KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATPAYEV											
		<b>CURRICULUM</b> of Educational Program on enrollment for 2024-2025 academic year Educational program 7M07227- "Surveying" Group of educational programs M120 - "Surveying" Form of study: full-time      Duration of study: 2 year      Academic degree: Master of Technical Sciences									
										Allocation of base-to-free training based on courses and semesters	
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 base-to-free training based on courses and semesters			
								1 course		2 course	
								1 semester	2 semester	3 semester	4 semester
<b>CYCLE OF BASIC DISCIPLINES (BD)</b>											
<b>M-1. Module of basic training (university component)</b>											
LNG210	English (professional)	BD UC	5	150	0/0/3	105	E	3			
HUM214	Management Psychology	BD UC	3	90	1/0/1	60	E	3			
HUM212	History and philosophy of science	BD UC	3	90	1/0/1	60	E		3		
HUM213	Higher school pedagogy	BD UC	3	90	1/0/1	60	E		3		
<b>component of choice</b>											
MAP265	Remote sensing of the Earth and natural resources	BD CCH	4	120	1/0/2	75	Э			4	
MAP228	Geometrization of the structural and qualitative characteristics of the deposit	BD CCH			2/0/1						
MAP727	Geodetic methods of studying modern motion of deformation of the earth's surface	BD CCH	5	150	1/0/2	105	Э	5			
MNG782	Sustainable development strategies	BD CCH			2/0/1						
MAP731	Creativity, Innovation, Leadership, and Entrepreneurship	BD CCH			1/0/2						
MAP728	Mathematical modeling of field indicators	BD CCH			1/0/2						
MNG781	Intellectual property and research	BD CCH	5	150	2/0/1	105	Э	5			
MAP729	Monitoring the movement of rocks during underground mining	BD CCH			1/0/2						
MAP732	Gamification in Eco-Mining	BD CCH			1/0/2						
MAP230	Mining audit	BD CCH			2/0/1						
MAP726	Mine survey in the reclamation of disturbed lands	BD CCH	5	150	1/0/2	105	Э		5		
MNG783	Sustainable Business and Project Management	BD CCH			1/0/2						
<b>CYCLE OF PROFILE DISCIPLINES (PD)</b>											
<b>M-2. Module of professional activity (university component, component of choice)</b>											
MAP245	Laser scanning in quarries	PD	5	150	2/0/1	105	Э	5			
MAP733	Mineral resources exploration and assessment	PD	5	150	1/0/2	105	Э	5			
MAP255	Monitoring of the state of surface buildings and construction during the construction and operation of the underground	PD	5	150	2/0/1	105	Э		5		
MAP294	Analysis of the accuracy of surveying work	PD	5	150	2/0/1	105	Э			5	
MAP734	Rational use of mineral resources	PD	5	150	1/0/2	105	Э			5	
MAP730	Geospatial data visualization	PD	5	150	1/0/2	105	Э			5	
MAP238	Organization of scientific research	PD	5	150	2/0/1	105	Э		5		
MAP269	Innovative surveying technology	PD	5	120	1/0/2	75	Э		5		
MAP710	WEB-GIS	PD			1/0/2						
MAP711	WEB-GIS in subsurface use	PD	5	150	1/0/2	105	Э			5	
MAP735	Resources modelling and evaluation	PD			1/0/2						
<b>M-3. Practice-oriented module</b>											
AAP229	Pedagogical practice	BD UC	8							8	
AAP256	Research practice	PD, CCH	4								4
<b>M-4. Experimental research module</b>											
AAP272	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	4						4		
AAP268	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	4						4		
AAP254	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	2							2	
AAP255	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	14								14
<b>M-5. Module of final attestation</b>											

ECA212	Preparation and defense of a master's thesis	FA	8								8	
Total based on UNIVERSITY:									30	30	34	26
									60		60	

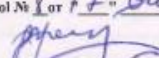
Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
			university component (UC)	component of charter (CCH)	Total
BD	Cycle of basic disciplines		20	15	35
PD	Cycle of profile disciplines				53
	<i>Total for theoretical training:</i>	0	20	15	88
	RWMS				24
FA	Final attestation	8			8
	<b>TOTAL:</b>	8	20	15	120

Decision of the Academic Council of KazNRTU named after K.Satpayev. Protocol № 12 or "22" 04 2024 y.

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Protocol № 6 or "19" 04 2024 y.

Decision of the Academic Council of the Institute MHI. Protocol № 1 or 17 "04" 2024 y.

Vice-Rector for Academic Affairs

 R.K. Uskenbayeva

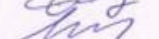
Director Mining and Metallurgical Institute named after O. Balkonurayev

 K.B. Rysbekov

Head of the Department " Mine surveying and geodesy"

 E. O. Orynbassarova

Specialty Council representative from employers

 A.T. Aimenov