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
NRK Level: 7
ORC Level: 7
Duration of training: 2 years
Volume of credits: 120

Almaty 2023

NJSC "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I. SATPAYEV"

Educational program 7M07227 - «Mine surveying» was approved at a meeting of the Academic Council of KazNRTU named after K.I.Satpayev.
Protocol № 11 of 28.03.2023
Considered and recommended for approval at a meeting of the Educational and Methodological Council of KazNRTU named after K.I.Satpayev.
Protocol № 11 of 28.03.2023

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
Chairman of the Academic Committee:				
Kochetova M.A.		director	«Leica Geosystems Kazakhstan»	
Academic staff:				
Orynbassarova E.O.	PhD	head of department	SU	
Kassymkanova Kh.M.	d.t.s	professor	SU	
Nukarbekova Zh.M.	m.s.c.	senior lecturer	SU	
Employer:				
Narbaev M.M.		director	TOO «ALIGeo»	
student:				
Abdybek A.M.		2nd year master's student		

F KazNRTU 703-05 Educational program

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List of abbreviations and designations

Table 1 – Abbreviations used

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	Field of education	7M07 Engineering, Manufacturing and Civil engineering
2	Direction of personnel training	7M072 Manufacturing and processing
3	Group of educational programs	M120 Mine surveying
4	Educational program	7M07227 Mine surveying
5	Brief description of the 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	EP purpose	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	EP type	New EP
8	Level on NQF	7
9	Level on SQF	7
10	EP distinctive features	No
11	List of competencies of the educational program:	12
12	The formed educational outcomes	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 processing methods, the ability to show creative initiative, prepare applications for inventions and industrial designs in the development of mineral resources 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 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 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
13	Form of training	Daytime
14	Duration of training	2 years
15	Volume of the credits	120
16	Languages of instruction	Russian, Kazakh, English
17	The awarded academic degree	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
Cycle of basic disciplines University component											
1.	Management Psychology	The purpose of the discipline is to familiarize students with modern ideas about the role and multidimensional content of the psychological component of managerial activity; to increase the psychological culture of the future master for the successful implementation of professional activities and self-improvement. Studies the main stages, trends and trends in the development of Kazakh and foreign management psychology, the composition and structure of management activities. Special attention is paid to the psychological component of the managerial function, the individual characteristics of the manager, the ethical and cultural components of the manager, the basics of interaction.	3				**v**				
2.	History and philosophy of science	The subject of philosophy of science, dynamics of science, specifics of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of	3				**v**				

		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.	Higher school pedagogy	The course is intended for undergraduates of the scientific and pedagogical magistracy of all specialties. As part of the course, undergraduates will master the methodological and theoretical foundations of higher school pedagogy, learn how to use modern pedagogical technologies, plan and organize learning and education processes, master the communicative technologies of subject-subject interaction between a teacher and a graduate student in the educational process of a university. Also, undergraduates study human resource management in educational organizations (using the example of a higher school).	3.				**v**				

4.	Foreign language (professional)	The course is designed for undergraduates of technical specialties to improve and develop foreign language communication skills in professional and academic fields. The course introduces students to the general principles of professional and academic intercultural oral and written communication using modern pedagogical technologies.	5								
Cycle of basic disciplines Elective component											
5.	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**					
6.	Monitoring of rock movement during underground mining	The discipline includes: basic concepts and definitions of the process of movement of rocks and the earth's surface in ore deposits, observation of	5				**v**	**v**			

		the movement of the rock mass, for moonlighting structures, mining workings, special underground observation stations, general guidelines for the study of fracturing and determination of the strength properties of rocks, methods of monitoring during underground mining.									
7.	Geodesic methods for studying modern movements of deformation of the Earth's surface	As part of the course, the master's student will master 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 and taking into account specific needs to solve the problems of processing and analyzing spatial data.	5								
8.	Mathematical modeling of field indicators	The goal is to form the ability to apply mathematical modeling methods in describing qualitative and quantitative indicators of the deposit. 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; fundamentals of mathematical thinking, the use of mathematical language.	5				**v**	**v**			
9.	Geometrization of structural and	The discipline studies the regularities of the placement of structural and	5			**v**		**v**			

	qualitative indicators of the deposit	qualitative indicators based on the geometrization of the subsoil and the variability of mineralization; calculate and take into account the movement of mineral reserves, losses and dilution; economically assess the completeness of the extraction of minerals; make surveying mining and graphic documentation for solving mining problems									
10.	Mining audit	The purpose of the discipline is to form the ability to: analyze the reliability of the technical reporting of a mining enterprise and the compliance of its activities with existing regulatory legal acts and technical requirements; develop recommendations for the elimination of violations uncovered as a result of this audit. The course is aimed at studying the systems of quantitative and qualitative indicators characterizing the activities of a mining enterprise, for which their technical reporting and actual condition are subject to mining audit.	5		**v**	**v**					
Cycle of profile disciplines University component											
11.	Geospatial data visualization	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 and includes the following sections:	5					**v**			

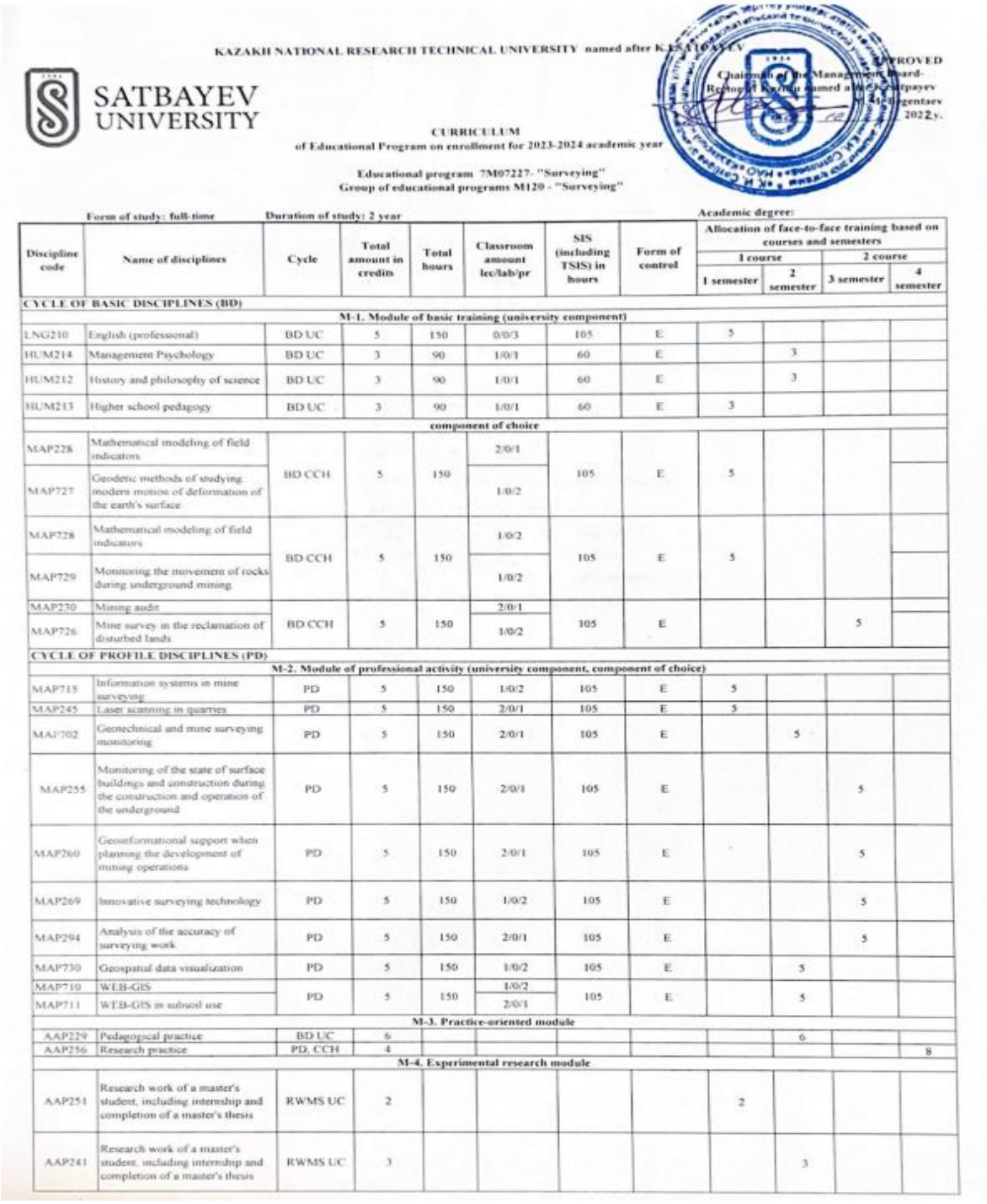
		geovisualization in the context of: points of view of related disciplines; geo-imaging; methods of visualization and representation of PD; interactive approaches to delineating the isosurface for geovisualization; multivariate mapping and classification; interpretation of spatial analysis results; Simulation of virtual environments ("True 3D", empirical research, VR/AR).									
12.	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**					
13.	Laser scanning at quarries	The discipline studies the main methods of laser scanning: aerial laser scanning, ground laser scanning, mobile laser scanning and their application in mining, with a focus on open deposits. The discipline considers the possibilities of using a laser scanner during engineering surveys, 3D modeling of quarries and estimating the volume of displaced rock, high-precision surveying of structures, workshops of mining and processing plants, adjacent territories for design and reconstruction,	5						**v**		**v**

		operational assessment in case of emergency, etc..									
14.	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 the tasks of management, planning of mining operations and in the construction of a digital model of mines.	5			v	v	v			
15.	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	
16.	Analysis of the accuracy of surveying work	The discipline studies the issues of assessing the accuracy of underground planned and high-altitude surveying networks, which are the geometric basis of surveying surveys; the accuracy of angular and linear measurements in mine workings; the laws of error accumulation in polygonometric and leveling courses, methods for assessing the accuracy of orientation of underground networks; methods for	5			v		v			

		equalizing underground networks.									
17.	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 GNSS in surveying, UAVs and underground and aboveground scanning systems.	5			v				v	
18.	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					
Cycle of profile disciplines Component of choice											
19.	WEB-GIS in subsurface use	This discipline is an alternative to the discipline of Web GIS and provides theoretical and practical knowledge	5	v				v			

		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.									
20.	WEB GIS	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 services, geoportals, meshes, mobile GIS, the creation of interactive online maps to solve problems in the field of geodesy, cartography, surveying.	5					**v**			

5. Curriculum of the educational program



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

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of Kazakh named after K.I. Satpayev
M.K. Surkhanbayev
2022 y.

CURRICULUM
of Educational Program on enrollment for 2023-2024 academic year

Educational program 7M07227- "Surveying"
Group of educational programs M120 - "Surveying"

Form of study: full-time | Duration of study: 2 year | Academic degree:

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			
								1 course		2 course	
								1 semester	2 semester	3 semester	4 semester
CYCLE OF BASIC DISCIPLINES (BD)											
M-1. Module of basic training (university component)											
LNG210	English (professional)	BD UC	5	150	0/0/3	105	E	5			
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			
component of choice											
MAP228	Mathematical modeling of field indicators	BD CCH	5	150	2/0/1	105	E	5			
MAP727	Geodetic methods of studying modern motion of deformation of the earth's surface				1/0/2						
MAP728	Mathematical modeling of field indicators	BD CCH	5	150	1/0/2	105	E	5			
MAP729	Monitoring the movement of rocks during underground mining				1/0/2						
MAP230	Mining audit	BD CCH	5	150	2/0/1	105	E			5	
MAP726	Mine survey in the reclamation of disturbed lands				1/0/2						
CYCLE OF PROFILE DISCIPLINES (PD)											
M-2. Module of professional activity (university component, component of choice)											
MAP715	Information systems in mine surveying	PD	5	150	1/0/2	105	E	5			
MAP245	Laser scanning in quarries	PD	5	150	2/0/1	105	E	5			
MAP702	Geotechnical and mine surveying monitoring	PD	5	150	2/0/1	105	E		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	E			5	
MAP260	Geoinformational support when planning the development of mining operations	PD	5	150	2/0/1	105	E			5	
MAP269	Innovative surveying technology	PD	5	150	1/0/2	105	E			5	
MAP294	Analysis of the accuracy of surveying work	PD	5	150	2/0/1	105	E			5	
MAP730	Geospatial data visualization	PD	5	150	1/0/2	105	E		5		
MAP710	WEB-GIS	PD	5	150	1/0/2	105	E		5		
MAP711	WEB-GIS in subsoil use				2/0/1						
M-3. Practice-oriented module											
AAP229	Pedagogical practice	BD UC	6						6		
AAP256	Research practice	PD, CCH	4								8
M-4. Experimental research module											
AAP251	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	2					2			
AAP241	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	3						3		

AAP254	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	5							5	
AAP255	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	14								14
M-5. Module of final attestation											
ECA212	Preparation and defense of a master's thesis	FA	8								8
Total based on UNIVERSITY:								30	30	30	30
								60		**60**	

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

Decision of the Academic Council of Kaznu named after K.Satpayev. Protocol № 3 27.10.2022 y.

Decision of the Educational and Methodological Council of Kaznu named after K.Satpayev. Protocol № 2 21. 10. 2022 y.

Decision of the Academic Council of the Institute_____. Protocol № 2 от "17" 10 2022 y.

Vice-Rector for Academic Affairs **B.A.Zhautikov**

Director Mining and Metallurgical Institute named after O.Baikonurov **K.B. Rysbekov**

Head of the Department " Mine surveying and geodesy" **E. O. Orynbassarova**

Specialty Council representative from employers **A.T.Aimenov**