



**Mining and Metallurgical Institute named after O.A. Baikonurov**

**Mining Department**

**EDUCATIONAL PROGRAM**

**7M07230 – “Mining Resource-saving Digital Engineering”**

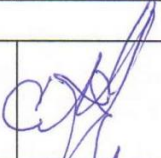
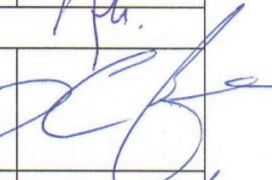
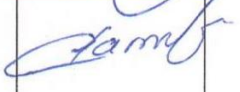

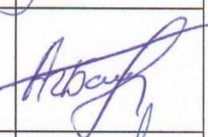

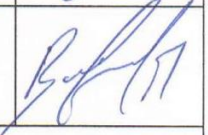
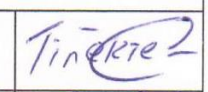
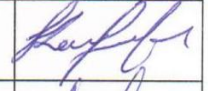
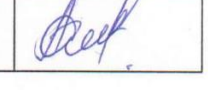
Code and classification of the field of education:	7M07 – Engineering, Manufacturing and Construction industries
Code and classification of training directions:	7M072 – Manufacturing and Processing industries
Group of educational programs:	M116 – Mining
Level based on NQF:	7
Level based on IQF:	7
Study period:	1 year
Amount of credits:	60

**Almaty 2025**

Educational program 7M07230 – “Mining Resource-saving Digital Engineering” was approved at the meeting of K.I. Satbayev KazNRTU Academic Council. Minutes №10 dated «03» March 2025.

Educational program was reviewed and recommended for approval at the meeting of K.I. Satbayev KazNRTU Educational and Methodological Council. Minutes № 3 dated «22» December 2024.

Educational program 7M07230 – “Mining Resource-saving Digital Engineering” was developed by Academic committee based on direction 7M072-«Manufacturing and processing industries »

Full name	Academic degree/academic title	Post	Place of work	Signature
<b>Chairman of the Academic Committee:</b>				
Moldabayev Serik	Doctor of Technical Sciences, Professor	Head of the Department	KazNRTU named after K.I. Satpayev	
<b>Teaching staff:</b>				
Yusupov Kh.	Doctor of Technical Sciences, Professor	Professor	KazNRTU named after K.I. Satpayev	
Sandibekov Manarbek	Candidate of Technical Sciences, Associate Professor	Professor	KazNRTU named after K.I. Satpayev	
<b>Employers:</b>				
Uteshov Y.	PhD doctor	Director	IGD named after D.A. Kunaeva	
Amankulov Maksat	Master of Engineering sciences	Executive Director	Antal LLP	
Orynbayev Baurzhan	PhD doctor	Head of the BVR Parameters Department	NPP Interrin LLP	
Gryaznov V.	Master of Engineering sciences	Head of the Mining Department	Antal LLP	
<b>Students:</b>				
Tilektes Ayaulym		3 <sup>rd</sup> year student		
Karsibekov Magzhan		2 <sup>nd</sup> year Master 's student		
Assylkhanova Gulnur	Master of Engineering sciences	3 <sup>rd</sup> year doctoral student		

## **Table of contents**

### List of abbreviations and designations

1. Description of educational program
2. Purpose and objectives of educational program
3. Requirements for the evaluation of educational program learning outcomes
4. Passport of educational program
  - 4.1. General information
  - 4.2 Matrix of correlation of learning outcomes in the educational program as a whole with the competencies being formed
5. Curriculum of educational program

## **List of abbreviations and designations**

**NAO "Kazakh National Research Technical University named after K.I. Satpayev"** – NAO KazNRTU named after K.I. Satpayev;

**GOSO** – The State mandatory standard of education of the Republic of Kazakhstan;

**MNVO RK** – Ministry of Science and Higher Education of the Republic of Kazakhstan;

**OP** – educational program;

**SRO** – independent work of a student (student, master's student, doctoral student);

**SROP** – independent work of a student with a teacher (independent work of a student (undergraduate, doctoral student) with a teacher);

**RUP** – a working curriculum;

**QED** – catalog of elective disciplines;

**VK** – university component;

**KV** – component of choice;

**NRK** – National Qualifications framework;

**ORC** – Industry qualifications framework;

**RO** – learning outcomes;

**CC** – key competencies.

## 1. Description of educational program

It is intended for the implementation of specialized bachelor's degree training in the educational program 7M07230 - "Mining resource-saving digital Engineering" at Satbayev University and was developed within the framework of the direction 7M072-"Manufacturing and processing industries".

This document meets the requirements of the following legislative acts of the Republic of Kazakhstan and regulatory documents of the Ministry of Education and Science of the Republic of Kazakhstan:

- The Law of the Republic of Kazakhstan "On Education" with amendments and additions in the framework of legislative amendments to enhance the independence and autonomy of universities dated 04.07.18 №171-VI;

- The Law of the Republic of Kazakhstan "On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan on the expansion of academic and managerial independence of higher education institutions" dated 07/04/18, No. 171-VI;

- Order of the Minister of Education and Science of the Republic of Kazakhstan dated 10/30/18, No. 595 "On approval of Standard Rules for the activities of educational organizations of appropriate types";

- The State mandatory standard of higher education (Appendix 7 to the Order of the Minister of Education and Science of the Republic of Kazakhstan dated 31.10.18 №604;

- Resolution of the Government of the Republic of Kazakhstan dated December 27, 2019 No. 988 "On approval of the State Program for the Development of Education and Science of the Republic of Kazakhstan for 2020-2025";

- Resolution of the Government of the Republic of Kazakhstan dated 31.12.2019 No. 1050 "On approval of the State Program of Industrial and Innovative Development of the Republic of Kazakhstan for 2020-2025";

- "National Qualifications Framework", approved by the protocol dated 16.06.2016. By the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations;

- Industry Qualifications Framework "Mining and Metallurgical Complex" dated 30.07.2019 No. 1;

The educational program 7M07203 - "Mining Engineering" takes into account the field of professional activity of graduates who have completed the bachelor's degree program and includes:

- the bowels of the Earth, including production facilities, equipment and technical systems for their development;

- measures to ensure the safe operation of mining machinery and equipment and reduce their anthropogenic impact on the environment.

*Types and objectives of the graduate's professional activity*

*The list of types of professional activity and their corresponding professional tasks:*

*Organizational and managerial:*

- organization, planning and management of mining and construction works;
- carrying out organizational and planning calculations for the creation (reorganization) of production sites;
- development of operational work plans for production units;

*Production and technological:*

- organization of the production process during the construction, operation and reconstruction of mining enterprises, various facilities on the surface and underground;
- ensuring the performance of mining and construction works in accordance with projects, technical requirements and safety regulations;
- selection of equipment and materials to support production processes;

*The subjects of the bachelor's professional activity* are the improvement of mining technology, the development and creation of new mining equipment and technology, taking into account the needs of the mining and nuclear industry of the Republic of Kazakhstan.

The specific types of professional activities for which the bachelor is mainly preparing are determined by the higher education institution together with students, scientific and pedagogical staff of the higher educational institution and employers' associations.

## **2. Purpose and objectives of educational program**

**The purpose of EP 7M07230** – "Mining resource-saving digital engineering" are: Training of highly qualified specialists in the field of development of solid minerals, meeting the requirements of modern high-tech resource-saving production, capable of carrying out production and design of mining operations at a high technical level using digital information systems and endowed with the skills of transition to a green economy. The set of disciplines corresponds to the goals of sustainable development: quality education; decent work and economic growth; industrialization, innovation and infrastructure.

**Graduates of EP will be able to:** acquire skills in implementing resource-saving, environmentally friendly mining technologies; apply licensed software products to create working drawings with optimal mining conditions; perform theoretical and experimental laboratory studies with the processing of the results obtained using modern information technologies.

**The tasks of EP 7M07230** – "Mining resource-saving digital engineering" are:

- study of a cycle of general education disciplines to provide social and humanitarian education based on the laws of socio-economic development of society, history, modern information technologies, the state language, foreign and Russian languages;
- the cycle of core disciplines focuses on the study of key theoretical aspects of engineering and technology to ensure the safe and effective implementation of various technologies for the extraction, processing of solid minerals and the rational use of natural resources;

- study of disciplines on the development of uranium deposits, extraction of natural resources by open and underground methods based on advanced technologies, planning the construction of industrial facilities at mining enterprises and urban underground structures for various purposes;
- study of disciplines that form knowledge, skills and abilities in planning and organizing research and mining design;
- familiarization with the technologies and equipment of enterprises during the period of various types of practices;
- acquisition of skills in laboratory research, technological calculations, equipment selection and design using modern computer technologies and programs.
- combining the efforts of the University and manufacturing enterprises to conduct scientific research, train and retrain personnel in the field of studying the principles and patterns of functioning and development of cities and megacities, the features of anthropogenic impacts on urban objects, the principles of sustainable development of urbanized territories and measures of their organizational and legal support, ensuring true interdisciplinarity of education in these areas;
- formation of skills and abilities in choosing and evaluating methods of environmental protection from anthropogenic impact in urbanized areas;
- strengthening the technological component of classical natural science education, to provide knowledge on modern technologies without lowering the bar for the level of fundamental education;
- fundamentals of the development and conduct of fundamental and applied research and development in the field of geological exploration and mineral processing, mining and metallurgy using new technological achievements, new generation equipment and environmental monitoring of enterprises;
- ensuring the interaction of fundamental and applied science with the educational process at all its stages, including the use of the results of joint research in lecture courses, an experimental base for conducting educational research, laboratory and term work, industrial and postgraduate practice;
- improving the level of educational and methodological work by creating new curricula, textbooks, educational and methodological manuals, including on electronic media;
- provision of training and retraining of personnel for the domestic mining and metallurgical sector in close cooperation with state corporations and the real sector of the economy, employment of graduates in high-tech innovative companies and other research centers;
- organization of effective cooperation with foreign universities for the development of new generation educational standards, student exchange, training and retraining of mining and metallurgical industry specialists in specialized bachelor's degree programs;
- implementation of international cooperation in the field of development of new technologies in the mining and metallurgical industry through the implementation of joint contracts, participation in international conferences,

organization of international exchange of staff, students and young scientists with relevant universities and laboratories of the world, international scientific and educational organizations;

- formation of theoretical and practical knowledge in technologies for processing man-made and secondary raw materials, knowledge in technologies for the production of ferrous and non-ferrous metals, as well as their alloys and various metal-containing products from man-made materials and secondary resources.

- formation of theoretical and practical knowledge in the field of processing critical raw materials and metals, innovative "green" technologies of the metallurgical sector, waste disposal of metallurgical production and environmental restoration.

### **3. Requirements for evaluating the educational program learning outcomes**

The graduate of this educational program is awarded the academic degree "Master of Technical Sciences" in the direction 7M07230 - Manufacturing and processing industries (Mining resource-saving digital engineering).

A graduate who has completed Master's degree programs must have the following general professional competencies:

- the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, to develop their innovative abilities;

- the ability to independently formulate research goals, establish the sequence of solving professional tasks;

- the ability to apply in practice the knowledge of fundamental and applied sections of disciplines that determine the focus (profile) of the master's degree program;

- the ability to professionally select and creatively use modern scientific and technical equipment to solve scientific and practical problems;

- the ability to critically analyze, present, defend, discuss and disseminate the results of their professional activities;

- proficiency in the preparation and execution of scientific and technical documentation, scientific reports, reviews, reports and articles;

- willingness to lead a team in the field of their professional activities, tolerant of social, ethnic, religious and cultural differences;

- willingness to communicate orally and in writing in a foreign language to solve the tasks of professional activity.

A graduate who has completed a master's degree program must possess professional competencies corresponding to the types of professional activities that the Master's degree program is focused on:

*scientific and production activities:*

- the ability to independently carry out production and scientific field, laboratory and interpretive work in solving practical problems;



- the ability to professionally operate modern field and laboratory equipment and devices in the field of the master's degree program;
- the ability to use modern methods of processing and interpreting complex information to solve production problems;
- *project activities*:
- the ability to independently draw up and submit projects of scientific research and scientific production works;
- willingness to design complex scientific research and scientific production works in solving professional tasks;
- *organizational and managerial activities*:
- willingness to use practical skills in organizing and managing research and scientific production work in solving professional tasks;
- readiness for the practical use of regulatory documents in the planning and organization of scientific and production work;

## **4. Passport of educational program**

### **4.1. General information**

<b>№</b>	<b>Field name</b>	<b>Comments</b>
1	Code and classification of the field of education	7M07 – Engineering, Manufacturing and Construction industries
2	Code and classification of training directions	7M072 – Manufacturing and Processing industries
3	Educational program group	M116 – Mining and Mining
4	Educational program name	7M07230-Mining resource-saving digital engineering
5	Short description of educational program	Mining operations in open-pit, underground and geotechnological mining, construction of mines and underground structures. The main technological processes are preparation of rocks for excavation, excavation and loading operations, transportation, unloading and dumping operations, primary processing of extracted minerals.
6	Purpose of EP	The purpose of the educational program is to train highly qualified specialists in the field of solid mineral mining, meeting the requirements of modern high-tech resource-saving production, capable of high-tech production and design of mining operations using digital information systems and equipped with the skills to transition to a green economy.
7	Type of EP	New
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	Skills in implementing resource-saving, environmentally friendly mining technologies. Be able to use licensed software products to create working drawings with optimal mining conditions. To carry out theoretical and experimental laboratory studies with the processing of the obtained results using modern information

		technologies.
12	Learning outcomes of educational program	<p>1. Provide technical supervision of mining and blasting operations, as well as work to ensure the functioning of equipment and technical systems of mining production using geoinformation systems and resource conservation.</p> <p>2. Prepare and propose measures to improve the environmental safety of mining production, taking into account the transition to clean technologies of the future.</p> <p>3. Make calculations of technological processes, the productivity of technical means of complex mechanization of work, the throughput of transport systems of mining enterprises, create schedules for the organization of work and calendar plans for production development using digital information systems.</p> <p>4. Develop and implement measures to improve and increase the technical level of mining, to ensure the competitiveness of the organization in modern economic conditions.</p> <p>5. Develop and implement measures to improve and increase the technical level of mining, to ensure the competitiveness of the organization in modern economic conditions.</p> <p>6. Baskaru matinderin azirleu; pikirtalastarda, kezdesulerde zhane kelissozderde arturli iskerlik zhagdaylardy usun; basis.</p> <p>7. Choose the use of modern information technologies, automated production management systems to create SMART mines.</p>
13	Education form	Full-time full-time
14	Period of training	1 year
15	Amount of credits	60
16	Languages of instruction	Kazakh, Russian, English
17	Academic degree awarded	Master of Engineering and Technology in the educational program 7M07230- "Mountain resource-saving digital engineering"
18	Developer and authors	Moldabayev S.K.

## 4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)							
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	
<b>Cycle of basic disciplines</b>											
<b>M-1. Cycle of basic disciplines. University component</b>											
1	Foreign language	The purpose of the discipline is to acquire and improve competencies in accordance with trade standards of foreign education, capable of competing in the labor market, because through a foreign language, the future master gains access to academic knowledge, new technologies and modern information, allowing the use of a foreign language as a means of communication in the intercultural, professional and scientific activities of the future master.	2			X					
2	Management	Purpose: To form a scientific understanding of management as a type of professional activity. Contents: Mastering the general theoretical principles of managing socio-economic systems; acquiring skills and abilities in practical problem-solving of managerial issues; studying global management practices and the specificities of Kazakhstani management; training in solving practical issues related to managing various aspects of organizational activities.	2	X					X		
3	Psychology of management	Objective: To acquire skills in making strategic and managerial decisions, taking into account the psychological characteristics of the individual and the team. Content: the modern role and content of psychological aspects in management activities, methods for improving psychological literacy, the composition and structure of management activities, both at the local and foreign levels, the psychological feature of modern managers.	2						X	X	
<b>Component of choice</b>											
<b>The module of digitalization in mining</b>											
4	Geomechanical research in open-pit mining	The course is aimed at instilling the skills of numerical 2D and 3D modeling of geomechanical processes at the interface of an array of rocks and open-pit mine workings by the finite element method using RS2 and RS3 programs, verification of research results by the finite difference	4							X	

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		method using Sliede2 and Sliede3 programs and development of effective solutions to regulate the stable design of the sides of quarries.										
5	Geomechanical research in underground mining	The course is aimed at instilling the skills of numerical 2D and 3D modeling of geomechanical processes at the interface of an array of rocks and underground mine workings by the finite element method using RS2 and RS3 programs and developing effective solutions to preserve the long-term stability of various support structures.	4							X		
<p style="text-align: center;"><b>Cycle of profile disciplines</b>  <b>M-2. Specialized training module (optional component)</b>  <b>Mining Production Support Module</b></p>												
6	Design of underground mines	Purpose: imparting skills of computer-aided design of underground mines and drawing up plans for development of mining operations during their operation using complex mining and geological information complexes. Content: working with database files, creating and analyzing points, strings, wireframes, digital surface models and block models, drawing underground workings, determining the optimal direction of mining development, calculating ore reserves and waste rock volumes, useful component content.	5		X				X			
7	Methodology of designing of underground construction	Purpose: mastering a set of methods of designing underground structures on mining-technological, financial and economic part, labor protection and safety. Content: solving the problems of designing construction of underground structures on the basis of taking into account engineering-geological, mining-technological, structural features and ensuring the stability of structures during their operation; high technologies of construction with the use of shield tunneling complexes, New Austrian method of tunneling, chemical reinforcement of soils.	5		X	X			X			
8	Technology of construction of metropolitan	Purpose: to impart skills of selection and calculation of underground structures of underground facilities on the basis of studying the methods of fixing underground structures and tunneling directed construction and installation shafts. Content: planning of the construction period, technologies and organization of construction of horizontal and inclined excavations, tunnels with the help of tunnel boring shields, technological schemes of construction of subway facilities, including three-vaulted.	5		X	X			X	X		

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9	Modernization of the processes of horizontal and inclined mine workings	Purpose: realization of technological processes of construction of mines and underground structures of various purposes with the use of advanced equipment and technology with intensification of construction rates. Content: technological schemes of excavations in different mining and geological conditions; types of temporary supports and linings and the technology of their construction; advanced mining and mining construction equipment and the principle of its operation; basic and auxiliary processes in the construction of underground structures.	5		X			X		X		
<b>Mining Production Module</b>												
10	Highly rhythmic safe production of mining operations in deep quarries	Purpose: increasing the level of technological development of quarries by providing relatively independent production of stripping and mining works with the use of the technology of mining works in steeply sloping layers. Content: technology of ledge mining by transverse panels in steeply sloping layers, method of automated scheduling of mining operations when dividing stripping and mining operations between adjacent steeply sloping layers, safe extraction of near-contour and deep reserves on the basis of optimization of the final contours of the open pit and the use of special technological complexes in the zone of deposit reworking.	5		X	X	X	X		X		
11	Intensification of reclamation of lands disturbed by open mining operations	Purpose: study of methods of restoration of fertile soil layer and environmental protection measures based on the provisions on the use of limited resources with anthropogenic function of the environment, scientific aspects of mining and biological reclamation. Content: complex of technical and hydraulic engineering measures, radical reclamation on biostimulation of natural microorganisms, biological stage of reclamation on restoration of substrates after technical reclamation.	5	X	X	X		X		X		
12	Technology of laying-of the developed space	Purpose: study of the latest achievements in the field of application of development systems with backfilling of excavated space. Content: reduction of costs for preparation of backfill mixture in the process of improving their characteristics (hydraulic, pneumatic, solidification, gravity and mechanical), processes of preparation of components of the backfill mixture and methods of its transportation to ensure its placement within the boundaries of the excavated	5		X	X		X	X	X		

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		space of the excavation.										
13	Rational technologies for the development of placer deposits	The course is aimed at studying the ways to improve the efficiency of the development of placer deposits by open, underwater and underground methods. Based on the results of scientific research and the main provisions for the development of placers, examples of gold extraction at the junction of geology, geotechnology and mineral processing are presented.	5		X	X	X	X		X		
14	Resource-saving clean technologies in open-pit mining	Purpose: familiarization with best practices and international experience in the context of implementing resource-saving technologies in open-pit mining. Content: solving the transport problem of deep quarries in conjunction with reducing the separation of their sides and reducing emissions into the environment; ensuring minimum sizes of concentration horizons during the transition to combined modes of transport; maintaining high production capacity of quarries to great depths using innovative designs of steeply inclined lifts.	4		X	X	X	X				

## 5. Curriculum of educational program

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«APPROVED»  
Decision of the Academic Council  
NPJSC«KazNRTU  
named after K.Satbayev»  
dated 06.03.2025 Minutes № 10

### WORKING CURRICULUM

Academic year 2025-2026 (Autumn, Spring)  
Group of educational programs M116 - "Mining engineering"  
Educational program 7M07230 - "Mining resource-saving digital engineering"  
The awarded academic degree Master of engineering and technology  
Form and duration of study full time (professional track) - 1 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		
									1 sem	2 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)											
CYCLE OF BASIC DISCIPLINES (BD)											
M-1. Module of basic training (university component)											
LNG212	Foreign language (professional)		BD, UC	2	60	0/0/30	30	E	2		
MNG726	Management		BD, UC	2	60	15/0/15	30	E	2		
HUM211	Psychology of management		BD, UC	2	60	15/0/15	30	E	2		
MIN703	Geomechanical research on open-pit mining	1	BD, CCH	4	120	15/15/15	75	E	4		
MIN702	Geomechanical research on underground mining	1	BD, CCH	4	120	15/15/15	75	E	4		
CYCLE OF PROFILE DISCIPLINES (PD)											
M-3. Mining production support module											
MIN273	Design of underground mines	1	PD, CCH	5	150	30/0/15	105	E	5		
MIN211	Methodology of designing of underground construction	1	PD, CCH	5	150	30/0/15	105	E	5		
MIN253	Technology of construction of metropolitan	2	PD, CCH	5	150	30/0/15	105	E	5		
MIN285	Modernization of the processes of horizontal and inclined mine workings	2	PD, CCH	5	150	30/0/15	105	E	5		
M-4. Mining production module											
MIN700	Highly rhythmic safe production of mining operations in deep quarries	1	PD, CCH	5	150	30/0/15	105	E	5		
MIN701	Intensification of reclamation of lands disturbed by open mining operations	1	PD, CCH	5	150	30/0/15	105	E	5		
MIN295	Technology of laying-of the developed space	2	PD, CCH	5	150	30/0/15	105	E	5		
MIN296	Rational technologies for development of placer deposits	2	PD, CCH	5	150	30/0/15	105	E	5		
MIN713	Resource-saving clean technologies in open-pit mining		PD, UC	4	120	30/0/15	75	E		4	
M-5. Practice-oriented module											
AAP253	Internship		PD, UC	5				R		5	
M-6. Experimental-research module											
AAP257	Experimental research work of a master student, including an internship and the implementation of a master's project		ERWMS	13				R		13	
M-7. Module of final attestation											
ECA213	Design and defense of the master's project		FA	8						8	
Total based on UNIVERSITY:									30	30	
									60		

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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	0	0	0	0
BD	Cycle of basic disciplines	0	6	4	10
PD	Cycle of profile disciplines	0	9	20	29
Total for theoretical training:		0	15	24	39
RWMS	Research Work of Master's Student				0
ERWMS	Experimental Research Work of Master's Student				13
FA	Final attestation				8
TOTAL:					60

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024

Decision of the Academic Council of the Institute. Minutes № 4 dated 12.12.2024

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

Rysbekov K. .

Department Chair - Mining

Moldabayev S. .

Representative of the Academic Committee from Employers

Bauyrzhan O.

\_\_\_\_Acknowledged\_\_\_\_



