SATBAYEV UNIVERSITY

Mining and Metallurgical Institute named after O.A. Baikonurov
Department of Metallurgy and Mineral Processing

EDUCATIONAL PROGRAM

7M07226 – Mineral processing

Code and classification of the field of education:	7M07 – Engineering, manufacturing and construction industries
Code and classification of training areas:	7M072 – Manufacturing and processing industries
Group of educational programs:	M118 – Mineral processing
The level of the NRK:	Level 7 – Postgraduate education. Master's degree (based on the mastered bachelor's degree program), practical experience.
ORC Level:	Level 7 – Conceptual professional and/or scientific knowledge (including innovative) and experience in a particular field and/or at the junction of fields. Evaluation and selection of professional information. Creation of new applied knowledge in a certain field. Identification of sources and search for information necessary for the development of activities
Duration of training:	2 years
Volume of loans:	120

Almaty, 2022

The educational program "7M07226 – Mineral enrichment" was approved at a meeting of the Academic Council of KazNTU named after K.I. Satpayev.

Protocol no. 13 from "28" 04 2022 y.

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

Protocol no. 7 from "26" 04 2022 y.

The educational program "7M07226 – Mineral enrichment" was developed by the academic committee in the direction of "Manufacturing and processing industries"

Full name	Academic degree/ academic title	Post	Place of work	Signature
Chairman of the Academic Committee:				
Barmenshinova M.B.	Candidate of Technical Sciences	Head of the Department of Metallurgy and mineral processing	KazNTU named after K.I. Satpayev	
Teaching staff:				
Dyussenova S.D.	PhD doctor	Assistant Professor	KazNTU named after K.I. Satpayev	
Employers:				
Jetybaeva U.K.	-	Chief metallurgist	LLP «KAZ Minerals»	
Arinov A.K.	-	General manager	Goldstone Minerals LLP	
Students				
Turymbai N.D.	-	4th year student	KazNTU named after K.I. Satpayev	

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List of abbreviations and designations

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

SES – The State compulsory standard of education of the Republic of Kazakhstan;

MES RK – Ministry of Education and Science of the Republic of Kazakhstan;

OP – educational program;

SRO – independent work of a student (student, undergraduate, doctoral student);

SROP – independent work of the student with the teacher (independent work of the student (master's student, doctoral student) with the teacher);

RUP – working curriculum;

CAD – 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 the educational program

Introduction to the educational program. The development of an innovative economy initially forms the so–called double helices of interaction - between universities (science) and business, business and government, etc., which then form a "triple spiral". Within the framework of the triple helix model, interdisciplinary knowledge is generated, developed by interdisciplinary teams united for a short time to work on a specific problem of the real world. In the triple helix model, universities, along with educational and research functions, additionally increase entrepreneurial functions by actively participating in the cultivation of startups together with industry, stimulated by the state.

The concept of this scientific and educational program is based on *the triple helix model*, which involves the creation of innovative solutions based on interdisciplinary research and educational programs (Figure 1).

Figure 1 - The concept of scientific and educational programs

The previously established structure of education, based on deep training of specialists in narrowly focused specialization, has led to the emergence of interdisciplinary barriers and hindering the development of new "growth points" that are located at the junctions of disciplines.

Modern needs require graduates not only to have in-depth knowledge in their chosen field of science, but also to understand the mechanisms and tools for implementing their ideas in practice.

The program corresponds to the unified state policy of long-term socio-economic development of the country, training of highly qualified personnel based on the achievements of science and technology, effective use of domestic scientific, technological and human resources potential of the republic.

The program is comprehensive and knowledge-intensive. The efficiency of using its results is of strategic importance for the republic.

The program is aimed at training specialists in key areas of the mining and processing industry, adapted to activities in high-tech sectors of the economy of the Republic of Kazakhstan on the basis of the development of priority areas of

science and technology, the development of high-tech industries, competitive technologies in the processing of man-made raw materials and waste.

The developed Program is the basis of a coherent and flexible system of training advanced scientific and innovative personnel, combining deep fundamental knowledge with a broad scientific outlook and the ability to independently conduct research with a comprehensive understanding of the main problems in the mining and processing industry.

The duration of the master's degree is determined by the amount of academic credits mastered. Upon mastering the established amount of academic credits and achieving the expected learning outcomes for obtaining a master's degree, the Master's degree program is considered fully mastered. The scientific and pedagogical Master's degree program provides 120 academic credits for the entire period of study, including all types of educational and scientific activities of a graduate student.

Planning of the content of education, the way of organizing and conducting the educational process is carried out by the university and the scientific organization independently on the basis of credit technology of training.

The Master's degree in scientific and pedagogical direction implements educational programs of postgraduate education for the training of scientific and scientific-pedagogical personnel for universities and scientific organizations with in-depth scientific-pedagogical and research training.

The content of the Master's degree program consists of:

1) theoretical training, including the study of cycles of basic and core disciplines;

2) practical training of undergraduates: various types of practices, scientific or professional internships;

3) research work, including the implementation of a master's thesis for a scientific and pedagogical master's degree

4) final certification.

The educational program includes the following stages of preparation of undergraduates: English (professional), management psychology, history and philosophy of science, higher school pedagogy, ore preparation and pre-concentration, geotechnological methods of complex processing of poor mineral raw materials, theory and practice of processing of gold-bearing raw materials, special chapters of the theory of flotation processes, hardware and technological features of the process of ore preparation, waste-free technologies enrichment production, modern technologies for the enrichment and processing of mineral raw materials and man-made waste, theory and practice of processing uranium-containing ores and concentrates, theory of separation of minerals in the enrichment processes, promising areas of mineral enrichment, wastewater treatment processes of processing plants, thickening and dehydration of mineral raw materials, filtration and drying of processed and enriched products, project management, labor protection and environment in the processes of mineral processing, modern methods of designing mineral processing facilities, chemistry of surface phenomena of the flotation process, theory and practice of polymetallic

ore processing, theory and practice of processing rare metal ores, theory and practice of processing non-ferrous metal ores.

The ability to choose disciplines from the catalog of elective disciplines of Satbayev University.

Types of professional activity

Graduates of the educational program of the *scientific and pedagogical* magistracy "Mineral enrichment" can perform the following types of professional activities: design, production and technological, organizational and managerial, research and pedagogical.

A distinctive feature of the master's degree program is that the educational program provides knowledge, skills and abilities for the production and sale of processing processing products; for the development of regulatory and technical documentation of the mining and processing sector; for the improvement and preparation of mining and processing facilities. Graduates gain knowledge in the field of development and implementation of enrichment technologies, graduates have high leadership and organizational qualities; they are capable of creating small knowledge-intensive mining and processing businesses.

The mission of the Master's degree program "Mineral enrichment" on the basis of the specialty 6M073700 – "Mineral enrichment" is the formation of students' socio-personal qualities and professional competencies that allow graduates to successfully solve production and technological, organizational and managerial, project tasks in the field of mineral enrichment, and contribute to their sustainable demand in the labor market, as well as compliance with international education standards; providing enterprises with highly qualified specialists in the field of mineral processing, specializing in the implementation of promising fundamental, innovative, digital and applied research and development and implementation of modern technological processes that ensure high quality products with minimal costs.

Objects of professional activity.

The objects of professional activity of graduates are processing plants, enterprises of chemical, mining, chemical and machine-building industries, branch research and design institutes, factory laboratories, higher and secondary vocational educational institutions, state management bodies and organizations of various organizational and legal forms.

Types and subjects of professional activity.

The subjects of professional activity are technological processes of the mining and processing industry, processing of raw materials, equipment of mining and processing production, automatic control systems of processing production and quality control of final products.

2. The purpose and objectives of the educational program

The purpose of EP "7M07226 – Mineral enrichment" is:

– formation of personnel for the mining and processing industry, covering modern energy-saving technologies, project activities, innovative solutions, entrepreneurship in the high-tech field of mineral and man-made raw materials enrichment.

The objectives of the EP "7M07226 – Mineral enrichment" are: – the competence of graduates in design and technological work in the implementation of projects to improve and optimize enrichment processes, increase their productivity and improve the quality of products.

– competence of graduates in the implementation of the development and implementation of technological processes for processing mineral, natural and man-made raw materials;

– competence of graduates in the assessment of innovation and technological risks in the introduction of new technologies;

– competence of graduates in the system of digitalization of mineral processing industries. Acquisition of competencies in production management at all stages of the life cycle of manufactured products;

– competence in the marketing of high-tech technologies.

3. Requirements for applicants

The previous level of education of applicants is higher professional education (bachelor's degree). The applicant must have a diploma of the established sample and confirm the level of knowledge of the English language with a certificate or diplomas of the established sample.

The procedure for admission of citizens to the magistracy is established in accordance with the "Standard rules for admission to training in educational organizations implementing educational programs of postgraduate education".

The formation of a contingent of undergraduates is carried out by placing a state educational order for the training of scientific and pedagogical personnel, as well as paying for training at the expense of citizens' own funds and other sources. The State provides citizens of the Republic of Kazakhstan with the right to receive free postgraduate education on a competitive basis in accordance with the state educational order, if they receive education of this level for the first time.

At the "entrance", a master's student must have all the prerequisites necessary to master the relevant master's degree program. The list of necessary prerequisites is determined by the higher educational institution independently.

In the absence of the necessary prerequisites, the undergraduate is allowed to master them on a paid basis.

4. Requirements for completing studies and obtaining a diploma

Degree/qualifications awarded: The graduate of this educational program is awarded the academic degree "Master of Technical Sciences" in the direction of "Mineral enrichment".

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

- the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities;
- the ability to formulate research goals independently, 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 orientation (profile) of the master's degree program;
- the ability to professionally choose 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, tolerantly perceiving social, ethnic, confessional and cultural differences;
- readiness to communicate orally and in writing in a foreign language to solve the tasks of professional activity.

A graduate who has mastered the master's degree program must have professional competencies corresponding to the types of professional activities that the master's degree program is focused on:

research activities:

- the ability to form diagnostic solutions to professional problems by integrating the fundamental sections of sciences and specialized knowledge acquired during the development of the master's degree program;
- the ability to independently conduct scientific experiments and research in the professional field, generalize and analyze experimental information, draw conclusions, formulate conclusions and recommendations;
- the ability to create and explore models of the studied objects based on the use of in-depth theoretical and practical knowledge in the field of mineral processing;

scientific and production activities:

- the ability to independently carry out production and scientific-production, laboratory and interpretive work in solving practical problems;
- the ability to professionally operate modern 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 research and scientific-production works;

- readiness to design complex research and scientific-production works in solving professional tasks;

organizational and managerial activities:

- readiness to use practical skills of organization and management of research and scientific-production works in solving professional tasks;

- readiness for the practical use of regulatory documents in the planning and organization of scientific and production work;

scientific and pedagogical activity:

- ability to conduct seminars, laboratory and practical classes;

- the ability to participate in the management of scientific and educational work of students in the field of enrichment.

When developing a master's degree program, all general cultural and general professional competencies, as well as professional competencies related to those types of professional activities that the master's program is focused on, are included in the set of required results of mastering the master's program.

5. Requirements for the evaluation of the learning outcomes of the educational program

5.1 Requirements for the key competencies of graduates of the scientific and pedagogical Master's degree

A graduate of the scientific and pedagogical magistracy, must:

have an idea:

- on the role of science and education in public life;
- about current trends in the development of scientific knowledge;
- on current methodological and philosophical problems of natural sciences;
- about the professional competence of a high school teacher;
- contradictions and socio-economic consequences of globalization processes;
- about the latest discoveries in the chosen field of activity, the prospects of their use for the construction of technical systems and devices;
- mathematical and physical modeling of systems in the field of technology and equipment development;
- about design, research, inventive, innovative activities in the field of mineral processing;
- about the possibilities of advanced scientific methods and technical means, to use them at the level necessary for the study of mining and processing processes and equipment.

to know:

- methodology of scientific knowledge;
- principles and structure of the organization of scientific activity;
- psychology of cognitive activity of students in the learning process;
- psychological methods and means of improving the effectiveness and quality of training;
- international and domestic standards, resolutions, orders, orders of higher and other domestic organizations, methodological normative and guidance materials related to the work performed;
- current state and prospects of technical and technological development of enrichment processes, features of the activities of institutions, organizations, enterprises and related industries;
- goals and objectives facing a specialist in the field of mineral processing for the development and implementation of the latest high-tech production technologies;
- methods of research of processing and processes, equipment operation;
- basic requirements for technical documentation of materials and products;
- rules and norms of labor protection, issues of environmental safety of technological processes;
- methods of expert assessment in the field of life safety and environmental protection;

- standards in the field of quality management;
- achievements of science and technology, advanced domestic and foreign experience in the field of mineral processing;
- at least one foreign language at a professional level that allows conducting scientific research and practical activities;
- the methodology of conducting all types of training sessions and independent work of students.

be able to:

- to develop technological processes for obtaining conditioned concentrates from ore, as well as metals from concentrates, processing of metals and alloys, schemes of processing processes, to justify regime parameters and indicators;
- to draw up a business plan for a technological project;
- develop energy- and resource-saving technologies in the field of mineral processing;
- develop environmental protection measures for enrichment production;
- carry out planning of experimental studies, choose research methods;
- to develop the scheme and design of the experimental installation, to carry out installation and debugging;
- process data using planning techniques, regression and correlation analysis, digitalization methods;
- to carry out measures for the organization of production in accordance with regulatory documents;
- to use the acquired knowledge for the original development and application of ideas in the context of scientific research;
- critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena;
- integrate knowledge gained in different disciplines to solve research problems in new unfamiliar conditions;
- by integrating knowledge to make judgments and make decisions based on incomplete or limited information;
- apply the knowledge of pedagogy and psychology of higher education in their teaching activities;
- apply interactive teaching methods;
- to carry out information-analytical and information-bibliographic work with the involvement of modern information technologies;
- to think creatively and creatively approach the solution of new problems and situations;
- be fluent in a foreign language at a professional level, which allows conducting scientific research and teaching special disciplines in universities;
- to summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc.;

have skills:

- research activities, solutions of standard scientific tasks;
- implementation of educational and pedagogical activities on credit technology of training;

- methods of teaching professional disciplines;
- the use of modern information technologies in the educational process;
- professional communication and intercultural communication;
- oratory, correct and logical formalization of their thoughts in oral and written form;
- expanding and deepening the knowledge necessary for daily professional activities and continuing education in doctoral studies.

be competent:

- in the field of research methodology;
- in the field of scientific and scientific-pedagogical activity in higher educational institutions;
- in matters of modern educational technologies;
- in the implementation of scientific projects and research in the professional field;
- in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.

B – Basic knowledge, skills and abilities

B1 - Know the history and philosophy of science, pedagogy and psychology;

B 2 - The ability to independently apply methods and means of cognition, learning and self-control to acquire new knowledge and skills, including in new areas directly unrelated to the field of activity.

B 3 - To speak the state, Russian and one of the most common foreign languages in the industry at the level that provides human communication.

B4 - Be able to use fundamental general engineering knowledge, the ability to practically use the basics and methods of mathematics, physics and chemistry in their professional activities.

B5 - Proficiency in professional terminology and the ability to work with educational and scientific materials in the specialty in the original in a foreign language. The ability to logically correctly, argumentatively and clearly build oral and written speech.

B6 - General engineering skills.

B7 - Possession of fundamental knowledge on the theory of mineral enrichment;

B8 - Basic knowledge of waste management, metal recycling.

B9 - Possession of modern and promising technologies of enrichment production.

B10 - To know and own the main business processes in an industrial enterprise.

B11 - The ability to conduct pedagogical work using modern techniques and technologies.

P – Professional competencies:

P1 - a wide range of theoretical and practical knowledge in the professional field;

P2 - is able to analyze technological lines of mineral processing.

P3 - ready to install, adjust and operate production systems for mineral processing;

P4 - ready to participate in the development and design of new technologies and production lines for mineral processing, production of finished metal-containing products.

P5 - Have the skills of drawing up an equipment and technological scheme

P6 - Possess the skills to carry out technological, thermal and energy calculations

P7 - Be able to calculate aero- and hydrodynamics according to the circuit diagram of the apparatus

P8 - Be able to calculate and select the main and auxiliary equipment

P9 - Be able to develop and select drawings of equipment, buildings and structures

P10 - Be able to develop technological processes for the production and processing of metals and alloys

P11 - Be able to develop a scheme of enrichment processes, justify regime parameters and indicators

P12 - Be able to draw up a business plan for a technological project

P13 - Be able to develop energy- and resource-saving technologies in the field of mineral processing

P14 - Be able to develop environmental protection measures for enrichment production

P15 - Be able to conduct a literary search, compile reports, reviews, conclusions, etc., choose research methods, plan and conduct necessary experiments, analyze and summarize research results, issue patents

P16 - Mastering the technology of processing slags and industrial products of non-ferrous and ferrous metallurgy for additional extraction of valuable components and solving environmental problems of the industrial region

P17 -The ability to use the knowledge, skills, and skills acquired in the course of training to develop a methodology for conducting research related to the professional field and to organize experiments with the analysis of their results

P18 - To identify issues related to the modernization and introduction of new technologies and equipment for the intensification of enrichment processes in order to increase the extraction of valuable components contained therein

P19 - Possess practical skills in the field of independent organization and management of research works on the topic

P20 - The ability to apply the knowledge, skills, and skills acquired in the process of studying under the Master's degree program.

O - Universal, social and ethical competencies

O 1 - is able to use English fluently as a means of business communication, a source of new knowledge in the field of automation or robotization of production processes. I am ready to use English in my professional activity in the field of enrichment;

O2 - is able to speak Kazakh (Russian) fluently as a means of business communication, a source of new knowledge in the field of automation or

robotization of production processes. I am ready to use the Kazakh (Russian) language in my professional activity in the field of enrichment;

O3 - to know and apply the basics of applied ethics and ethics of business communication in work and life;

O4 - know and apply the basic concepts of professional ethics;

O5 - to know and solve the problems of human influence on the environment.

C – Special and managerial competencies

From 1 - independent management and control of the processes of labor and educational activities within the framework of the strategy, policy and goals of the organization, discussion of problems, reasoning conclusions and competent information management;

C2 - to be a specialist in conducting experimental studies of ore processing facilities;

C3 - to be a researcher, a specialist in scientific research of ore processing facilities and objects of finished metal-containing products;

C4 - to be an engineer for the development and design of processing plants, factories, production lines.

5.2 Requirements for the Master's research work

Requirements for the research work of a master's student in the scientific and pedagogical magistracy:

1) corresponds to the profile of the master's degree program, according to which the master's thesis is being performed and defended;

2) relevant and contains scientific novelty and practical significance;

3) based on modern theoretical, methodological and technological achievements of science and practice;

4) performed using modern methods of scientific research;

5) contains research (methodological, practical) sections on the main protected provisions;

6) based on the best international experience in the relevant field of knowledge.

5.3 Requirements for the organization of practices

The educational program of the scientific and pedagogical Master's degree includes two types of practices that are conducted in parallel with theoretical training or in a separate period:

1) pedagogical in the DB cycle - at the university;

2) research in the PD cycle - at the place of completion of the dissertation.

Pedagogical practice is conducted in order to form practical skills of teaching and learning methods. At the same time, undergraduates are involved in conducting undergraduate classes at the discretion of the university.

The research practice of the undergraduate is conducted in order to familiarize himself with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.

6. Passport of the educational program

6.1. General information

№	Field name	Note
1	Code and classification of the field of education	7M07 - Engineering, manufacturing and construction industries
2	Code and classification of training areas	7M072 - Manufacturing and processing industries
3	Group of educational programs	M118 – Mineral processing
4	Name of the educational program	Mineral enrichment
5	Brief description of the educational program	The educational program "Mineral enrichment" includes fundamental, natural science, general engineering and professional training of masters in the field of mineral enrichment in accordance with the development of science and technology, as well as the changing needs of the mining and processing industry.
6	Purpose of the EP	formation of personnel for the mining and processing industry, covering modern energy-saving technologies, project activities, innovative solutions, entrepreneurship in the high-tech field of mineral and man-made raw materials enrichment
7	Type of EP	New
8	The level of the NRK	Level 7 – Postgraduate education. Master's degree (based on the mastered bachelor's degree program), practical experience.
9	ORC Level	Level 7 – Conceptual professional and/or scientific knowledge (including innovative) and experience in a particular field and/or at the junction of fields. Evaluation and selection of professional information. Creation of new applied knowledge in a certain field. Identification of sources and search for information necessary for the development of activities
10	Distinctive features of the EP	No
11	List of competencies of the educational program:	See 4.2 Matrix of correlation of learning outcomes in the educational program as a whole with the competencies being formed
12	Learning outcomes of the educational program:	
13	Form of training	Full - time full
14	Duration of training	2 years
15	Volume of loans	120
16	Languages of instruction	Kazakh/Russian

17	Academic degree awarded	Master of Technical Sciences
18	Developer(s) and authors:	Барменшинова М.Б.

6.2. Matrix of correlation of learning outcomes in the educational program as a whole with the competencies being formed

Key competencies /Learning outcomes	LO1	LO2	LO3	LO4
KC1 Professional competencies			V	V
KC2 Research competencies			V	V
KC3 Research competencies		V	V	
KC4 Communication competencies			V	V
KC5 Universal competencies	V	V		
KC6 Management competencies			V	V
KC7 Cognitive competencies	V	V		
KC8 Creative competencies		V	V	
KC9 Information and communication competencies	V	V		

6.3. 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	Кол-во кредитов	Generated learning outcomes (codes)			
				LO1	LO2	LO3	LO4
Cycle of basic disciplines University component							
1	English (professional)	The course is designed for undergraduates of technical specialties to improve and develop foreign language communication skills in the professional and academic field. The course introduces students to the general principles of professional and academic intercultural oral and written communication using modern pedagogical technologies (round table, debates, discussions, analysis of professionally-oriented cases, design). The course ends with a final exam. Undergraduates also need to study independently (MIS).	5	V	V		
2	Management Psychology	The course is aimed at teaching undergraduates the basics of management psychology. It will consider the specifics of management psychology, psychological patterns of managerial activity, personality and its potential in the management system; motivation and effectiveness in the organization, leadership and leadership in modern management of organizations, social group as an object of management, psychological foundations of managerial decision-making, business communication and managerial conflicts, psychology of responsibility, image creation, how an integral part of the culture of communication, the psychology of advertising.	3	V	V		
3	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 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	V		
4	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	V		
Cycle of basic disciplines Component of choice							
5	Ore preparation and pre-concentration	In this discipline, the following are studied: Technological processes of preparation and	5		V	V	

		enrichment of ores; design of the equipment used; methods of calculation and selection of main and auxiliary equipment; operation of crushing and crushing and processing equipment.					
6	Geotechnological methods of complex processing of poor mineral raw materials	The discipline studies methods of geotechnological mining, as well as characteristics of the properties of rocks and minerals, in order to determine the possibility of transferring the extracted minerals to a mobile state. The issues of physico-chemical bases of technological processes are considered. The schemes of geotechnological processing of uranium, gold, manganese, iron ores and non-metallic minerals are studied, and the processes of processing geotechnical products are also considered. The economic, environmental and social aspects of geotechnological methods of mineral enrichment are considered.	5		V	V	
7	Theory and practice of processing gold-containing raw materials	In this discipline are studied: The material composition of gold ores. The technology of processing gold ores using processing and metallurgical operations. Refining. Associated extraction of gold in the processing of copper and zinc concentrates. Technologies for processing secondary raw materials containing precious metals. Environmental aspects in the processing of gold-containing raw materials.	5			V	V
8	Special chapters of the theory of flotation processes	This course outlines the theoretical foundations of the flotation process. The basic concepts of the flotation method of mineral raw material enrichment, the variety and complexity of physico-chemical processes occurring in the flotation pulp are given. The current state of the most pressing issues of flotation theory is described: preparation of minerals for flotation, interphase interactions, mechanism of action of flotation reagents, kinetics of flotation, etc. Attention is paid to new directions in the field of flotation: foam separation, ion and column flotation, electroflotation and the use of electrochemical technology. The possibility of solving the flotation problem based on the application of capillary physics equations is shown.	5			V	V
9	Hardware and technological features of the ore preparation process	In this discipline, the following are studied in detail: technological processes of ore preparation and enrichment; designs of the equipment used; methods of calculation and selection of main and auxiliary equipment; operation of crushing and grinding and processing equipment.	5		V	V	
10	Waste-free technologies of enrichment production	In this discipline, such production methods will be studied that ensure the fullest possible use of the processed raw materials and the waste generated at the same time. The principles of waste-free technologies, requirements for waste-free production, the main directions of waste-free and low-waste technologies, waste processing and use will be studied. Information is given on the processing of multi-tonnage dump waste from mining and processing plants with the release of ready-made building materials.	5		V	V	
Cycle of profile disciplines University component							
11	Modern technologies for the enrichment and processing of mineral raw materials and man-made waste	Modern technologies for the enrichment and processing of mineral raw materials and man-made waste containing various valuable metals. Basic knowledge and skills in the field of processing of mineral and man-made raw materials, characteristic features of	5		V	V	V

		modern technologies of metal enrichment, sources and main processes of processing of mineral and man-made raw materials; as well as methods for increasing the extraction of metals and reducing the cost of reagents, electricity and various materials. After completing the course, the student must demonstrate the ability to navigate through the variety of enrichment methods used for processing mineral and man-made raw materials, as well as calculate costs when using modern technologies. At the end of the course, a master's student should know: basic technologies for processing and extracting metals from ores and concentrates, as well as man-made mineral formations; methods of engineering calculations.					
12	Theory and practice of processing uranium-containing ores and concentrates	In this discipline are studied: The material composition of uranium ores. The technology of processing uranium ores. The main stages of uranium production. Ore enrichment. Extraction of uranium from ores and concentrates by leaching. Processing of productive solutions. Sorption technology for processing productive solutions. Methods of concentration and separation of uranium from commercial desorbates. Environmental aspects of processing uranium ores and concentrates.	5		V	V	V
13	Theory of mineral separation in enrichment processes	The theoretical foundations, types and indicators of processing processes, patterns of separation of mineral particles in the working areas of processing machines and technological schemes, methods of modeling separation processes are considered. The issues of separation of minerals in the processes of ore enrichment are studied based on differences in the properties of the separated minerals. In this case, the difference in the physicochemical properties of the surface of minerals is used, namely, the difference in their specific free surface energies, separating media and their properties: density (specific gravity), viscosity, etc.	5		V	V	V
14	Promising directions of mineral raw material enrichment	The main trends in the development of ore preparation processes of raw materials, flotation, gravity, magnetic and electric enrichment processes and the devices used, as well as the main trends in the development and improvement of processes that are used in the dehydration of mineral processing products. Basic knowledge and skills in the field of mineral processing will be presented. After completing the course, the master's student must demonstrate the ability to navigate the entire variety of enrichment methods used for processing mineral raw materials; analyze the information obtained during the research. A master's student should be able to: navigate the variety of processes and devices used in enrichment; use modern techniques; use technical literature.	5			V	V
15	Wastewater treatment processes of processing plants	The composition of wastewater from processing plants. Polluted and conditionally clean wastewater from processing plants. The composition of wastewater from gravity, gold recovery and flotation processing plants. The main pollutants are coarse impurities, acids and alkalis, metal ions, organic reagents, cyanides, rhodonides, phenols and cresols, petroleum products, other flotation reagents. MPC of wastewater. Methods of wastewater treatment up to the maximum permissible MPC. Mechanical wastewater treatment.	5			V	V
Cycle of profile disciplinesКомпонент по выбору							

16	Thickening and dehydration of mineral raw materials	The discipline contains the basics of the theory and mechanisms of the processes of dehydration of enrichment products and hydrometallurgy, dehydration processes in the presence of flocculants; introduces in detail the equipment and equipment used for these processes, the methodology of technological calculations of these processes.	5		V	V	
17	Filtration and drying of processed and enriched products	The discipline contains the basics of the theory and mechanisms of the processes of dehydration of enrichment products and hydrometallurgy, dehydration processes in the presence of flocculants; introduces in detail the equipment and equipment used for these processes, the methodology of technological calculations of these processes.	5		V	V	V
18	Project management	After successful completion of the discipline, undergraduates will gain knowledge about the key components of project management, with an emphasis on modern behavioral models of project-oriented business development management. The course program is based on the international standards PMI PMBOK, IPMA ICB and national standards of the Republic of Kazakhstan in the field of project management recognized by the business community. The features of organizational management of business development through projects in the relationship of strategic, project and operational management are studied. The system of practices, methods and procedures used in the innovative activity of organizations is considered, taking into account the psychological aspects of team building, communication and interaction with stakeholders.	5	V	V		
19	Labor and environmental protection in mineral processing processes	Sources of environmental pollution. Wastewater and recycled water treatment. Dust suppression and dust collection. Waste storage. Safety and industrial sanitation. Safety measures during maintenance of machines and mechanisms. Industrial injuries. Accident response plan.	5		V	V	V
20	Modern methods of designing mineral processing facilities	The discipline studies general information about the design and design of mining and metallurgical enterprises, initial data for design, selection and justification of qualitative indicators of enrichment and productivity of factories and individual workshops. Selection and calculation of technological and water-sludge enrichment schemes, selection and calculation of main and auxiliary equipment. Organization of design of buildings and structures, general principles of equipment layout. Repair, storage and tail facilities, master plan. CAD elements in the design of processing plants.	5			V	V
21	Chemistry of surface phenomena of the flotation process	The universality of the flotation process is ensured by the fact that if the "natural" difference in the surface energy values of the separated minerals is small and insufficient for effective flotation separation, then it can be increased with the help of special reagents called flotation, the selective fixation of which on the surface of certain minerals changes their surface energy in a given direction. The parameters and properties of the phases of the flotation system and the main processes occurring during the interaction of phases in the volume of the liquid phase and on the mineral surface are described: hydration, dissolution and hydrolysis. The basic physico-chemical and flotation properties of collecting reagents and foaming agents, as well as the mechanism of their interaction with the mineral surface, are considered	5		V	V	V
22	Theory and practice of polymetallic ore	Polymetallic ores, in which valuable components are minerals of lead, zinc, copper,	5		V		V

	processing	precious metals, in some cases tin minerals are a very complex object for mechanical enrichment. The associated extraction of precious metals significantly affects the profitability of processing of this mineral raw material. The optimal method of processing polymetallic ores is flotation enrichment.					
23	Theory and practice of processing rare metal ores	Types and deposits of rare ores. Their technical characteristics and classification by chemical and mineralogical composition. Preliminary enrichment of ores and placers of rare metals. Ore preparation operations in the processing of ores and placers of rare metals. Technology of enrichment and integrated use of the main types of ores and placers (tungsten and tungsten-molybdenum, tin and tin-polymetallic ores, titanium-zirconium ores and placers, tantalum-niobium ores and placers, etc.)	5		V		V
24	Theory and practice of processing non-ferrous metal ores	Types and deposits of non-ferrous metal ores. Their technical characteristics and classification by chemical and mineralogical composition. Preliminary enrichment of ores. Ore preparation operations during ore processing. Technology of enrichment and integrated use of the main types of ores.	5			V	V

6.4. Information about modules/disciplines

№	Name of the discipline	Brief description of the discipline (30-50 words)	Number of credits	Formed competencies (codes)
Cycle of basic disciplines University component				
1	English (professional)	The course is designed for undergraduates of technical specialties to improve and develop foreign language communication skills in the professional and academic field. The course introduces students to the general principles of professional and academic intercultural oral and written communication using modern pedagogical technologies (round table, debates, discussions, analysis of professionally-oriented cases, design). The course ends with a final exam. Undergraduates also need to study independently (MIS).	5	KC3, KC5, KC7, KC8, KC9
2	Management Psychology	The course is aimed at teaching undergraduates the basics of management psychology. It will consider the specifics of management psychology, psychological patterns of managerial activity, personality and its potential in the management system; motivation and effectiveness in the organization, leadership and leadership in modern management of organizations, social group as an object of management, psychological foundations of managerial decision-making, business communication and managerial conflicts, psychology of responsibility, image creation, how an integral part of the culture of communication, the psychology of advertising.	3	KC3, KC5, KC7, KC8, KC9
3	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 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	KC3, KC5, KC7, KC8, KC9
4	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	3	KC3, KC5, KC7, KC8, KC9

		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).		
Basic disciplines Component of choice				
5	Ore preparation and pre-concentration	In this discipline, the following are studied: Technological processes of preparation and enrichment of ores; design of the equipment used; methods of calculation and selection of main and auxiliary equipment; operation of crushing and crushing and processing equipment.	5	KC1, KC2, KC3, KC6
6	Geotechnological methods of complex processing of poor mineral raw materials	The discipline studies methods of geotechnological mining, as well as characteristics of the properties of rocks and minerals, in order to determine the possibility of transferring the extracted minerals to a mobile state. The issues of physico-chemical bases of technological processes are considered. The schemes of geotechnological processing of uranium, gold, manganese, iron ores and non-metallic minerals are studied, and the processes of processing geotechnical products are also considered. The economic, environmental and social aspects of geotechnological methods of mineral enrichment are considered.	5	KC1, KC2, KC3, KC6
7	Theory and practice of processing gold-containing raw materials	In this discipline are studied: The material composition of gold ores. The technology of processing gold ores using processing and metallurgical operations. Refining. Associated extraction of gold in the processing of copper and zinc concentrates. Technologies for processing secondary raw materials containing precious metals. Environmental aspects in the processing of gold-containing raw materials.	5	KC1, KC2, KC3, KC8
8	Special chapters of the theory of flotation processes	This course outlines the theoretical foundations of the flotation process. The basic concepts of the flotation method of mineral raw material enrichment, the variety and complexity of physico-chemical processes occurring in the flotation pulp are given. The current state of the most pressing issues of flotation theory is described: preparation of minerals for flotation, interphase interactions, mechanism of action of flotation reagents, kinetics of flotation, etc. Attention is paid to new directions in the field of flotation: foam separation, ion and column flotation, electroflotation and the use of electrochemical technology. The possibility of solving the flotation problem based on the application of capillary physics equations is shown.	5	KC1, KC2, KC3, KC8
9	Hardware and technological features of	In this discipline, the following are studied in detail: technological processes	5	KC1, KC2, KC3, KC6

	the ore preparation process	of ore preparation and enrichment; designs of the equipment used; methods of calculation and selection of main and auxiliary equipment; operation of crushing and grinding and processing equipment.		
10	Waste-free technologies of enrichment production	In this discipline, such production methods will be studied that ensure the fullest possible use of the processed raw materials and the waste generated at the same time. The principles of waste-free technologies, requirements for waste-free production, the main directions of waste-free and low-waste technologies, waste processing and use will be studied. Information is given on the processing of multi-tonnage dump waste from mining and processing plants with the release of ready-made building materials.	5	KC1, KC2, KC3, KC6
Cycle of profile disciplines University component				
11	Modern technologies for the enrichment and processing of mineral raw materials and man-made waste	Modern technologies for the enrichment and processing of mineral raw materials and man-made waste containing various valuable metals. Basic knowledge and skills in the field of processing of mineral and man-made raw materials, characteristic features of modern technologies of metal enrichment, sources and main processes of processing of mineral and man-made raw materials; as well as methods for increasing the extraction of metals and reducing the cost of reagents, electricity and various materials. After completing the course, the student must demonstrate the ability to navigate through the variety of enrichment methods used for processing mineral and man-made raw materials, as well as calculate costs when using modern technologies. At the end of the course, a master's student should know: basic technologies for processing and extracting metals from ores and concentrates, as well as man-made mineral formations; methods of engineering calculations.	5	KC1, KC2, KC3, KC4, KC8
12	Theory and practice of processing uranium-containing ores and concentrates	In this discipline are studied: The material composition of uranium ores. The technology of processing uranium ores. The main stages of uranium production. Ore enrichment. Extraction of uranium from ores and concentrates by leaching. Processing of productive solutions. Sorption technology for processing productive solutions. Methods of concentration and separation of uranium from commercial desorbates. Environmental aspects of processing uranium ores and concentrates.	5	KC1, KC2, KC3, KC4, KC8
13	Theory of mineral separation in enrichment processes	The theoretical foundations, types and indicators of processing processes, patterns of separation of mineral particles in the working areas of processing	5	KC1, KC2, KC3, KC4, KC8

		machines and technological schemes, methods of modeling separation processes are considered. The issues of separation of minerals in the processes of ore enrichment are studied based on differences in the properties of the separated minerals. In this case, the difference in the physicochemical properties of the surface of minerals is used, namely, the difference in their specific free surface energies, separating media and their properties: density (specific gravity), viscosity, etc.		
14	Promising directions of mineral raw material enrichment	The main trends in the development of ore preparation processes of raw materials, flotation, gravity, magnetic and electric enrichment processes and the devices used, as well as the main trends in the development and improvement of processes that are used in the dehydration of mineral processing products. Basic knowledge and skills in the field of mineral processing will be presented. After completing the course, the master's student must demonstrate the ability to navigate the entire variety of enrichment methods used for processing mineral raw materials; analyze the information obtained during the research. A master's student should be able to: navigate the variety of processes and devices used in enrichment; use modern techniques; use technical literature.	5	KC1, KC2, KC3, KC8
15	Wastewater treatment processes of processing plants	The composition of wastewater from processing plants. Polluted and conditionally clean wastewater from processing plants. The composition of wastewater from gravity, gold recovery and flotation processing plants. The main pollutants are coarse impurities, acids and alkalis, metal ions, organic reagents, cyanides, rhodonides, phenols and cresols, petroleum products, other flotation reagents. MPC of wastewater. Methods of wastewater treatment up to the maximum permissible MPC. Mechanical wastewater treatment.	5	KC1, KC2, KC3, KC8
Cycle of profile disciplines Component of choice				
16	Thickening and dehydration of mineral raw materials	The discipline contains the basics of the theory and mechanisms of the processes of dehydration of enrichment products and hydrometallurgy, dehydration processes in the presence of flocculants; introduces in detail the equipment and equipment used for these processes, the methodology of technological calculations of these processes.	5	KC1, KC2, KC3, KC6
17	Filtration and drying of processed and enriched products	The discipline contains the basics of the theory and mechanisms of the processes of dehydration of enrichment products and hydrometallurgy, dehydration processes in	5	KC1, KC2, KC3, KC4, KC8

		the presence of flocculants; introduces in detail the equipment and equipment used for these processes, the methodology of technological calculations of these processes.		
18	Project management	After successful completion of the discipline, undergraduates will gain knowledge about the key components of project management, with an emphasis on modern behavioral models of project-oriented business development management. The course program is based on the international standards PMI PMBOK, IPMA ICB and national standards of the Republic of Kazakhstan in the field of project management recognized by the business community. The features of organizational management of business development through projects in the relationship of strategic, project and operational management are studied. The system of practices, methods and procedures used in the innovative activity of organizations is considered, taking into account the psychological aspects of team building, communication and interaction with stakeholders.	5	KC3, KC5, KC7, KC8, KC9
19	Labor and environmental protection in mineral processing processes	Sources of environmental pollution. Wastewater and recycled water treatment. Dust suppression and dust collection. Waste storage. Safety and industrial sanitation. Safety measures during maintenance of machines and mechanisms. Industrial injuries. Accident response plan.	5	KC1, KC2, KC3, KC4, KC8
20	Modern methods of designing mineral processing facilities	The discipline studies general information about the design and design of mining and metallurgical enterprises, initial data for design, selection and justification of qualitative indicators of enrichment and productivity of factories and individual workshops. Selection and calculation of technological and water-sludge enrichment schemes, selection and calculation of main and auxiliary equipment. Organization of design of buildings and structures, general principles of equipment layout. Repair, storage and tail facilities, master plan. CAD elements in the design of processing plants.	5	KC1, KC2, KC3, KC4, KC8
21	Chemistry of surface phenomena of the flotation process	The universality of the flotation process is ensured by the fact that if the "natural" difference in the surface energy values of the separated minerals is small and insufficient for effective flotation separation, then it can be increased with the help of special reagents called flotation, the selective fixation of which on the surface of certain minerals changes their surface energy in a given direction.	5	KC1, KC2, KC3, KC4, KC8

		The parameters and properties of the phases of the flotation system and the main processes occurring during the interaction of phases in the volume of the liquid phase and on the mineral surface are described: hydration, dissolution and hydrolysis. The basic physico-chemical and flotation properties of collecting reagents and foaming agents, as well as the mechanism of their interaction with the mineral surface, are considered		
22	Theory and practice of polymetallic ore processing	Polymetallic ores, in which valuable components are minerals of lead, zinc, copper, precious metals, in some cases tin minerals are a very complex object for mechanical enrichment. The associated extraction of precious metals significantly affects the profitability of processing of this mineral raw material. The optimal method of processing polymetallic ores is flotation enrichment.	5	KC1, KC2, KC3, KC6, KC8
23	Theory and practice of processing rare metal ores	Types and deposits of rare ores. Their technical characteristics and classification by chemical and mineralogical composition. Preliminary enrichment of ores and placers of rare metals. Ore preparation operations in the processing of ores and placers of rare metals. Technology of enrichment and integrated use of the main types of ores and placers (tungsten and tungsten-molybdenum, tin and tin-polymetallic ores, titanium-zirconium ores and placers, tantalum-niobium ores and placers, etc.)	5	KC1, KC2, KC3, KC6, KC8
24	Theory and practice of processing non-ferrous metal ores	Types and deposits of non-ferrous metal ores. Their technical characteristics and classification by chemical and mineralogical composition. Preliminary enrichment of ores. Ore preparation operations during ore processing. Technology of enrichment and integrated use of the main types of ores.	5	KC1, KC2, KC3, KC8

7. Curriculum of the educational program

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATPAYEV

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of Kazntu named after K.Satpayev
M.M. Begentaev
«28» 04 2022 y.

CURRICULUM
of Educational Program on enrollment for 2022-2023 academic year

Educational program 7M07226 - "Mineral processing"
Group of educational programs M118 - "Mineral processing"

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											
MET712	Ore preparation and pre-concentration	BD CCH	5	150	2/1/0	105	E	5			
MET255	Geotechnological methods of complex processing of mineral raw materials poor				2/0/1						
MET714	Theory and practice of processing of gold-containing raw materials	BD CCH	5	150	2/1/0	105	E	5			
MET266	Special chapters of the theory of flotation processes				2/1/0						
MET253	Hardware and technological features of process of ore dressing	BD CCH	5	150	2/1/0	105	E			5	
MET254	Non-waste technology processing industry				2/1/0						
CYCLE OF PROFILE DISCIPLINES (PD)											
M-2. Module of professional activity (university component, component of choice)											
MET708	Modern technologies of enrichment and processing of mineral raw materials and technogenic waste	PD UC	5	150	2/0/1	105	E	5			
MET753	Theory and practice of uranium ore and concentrates processing	PD UC	5	150	2/1/0	105	E	5			
MET723	The theory of the separation of minerals in beneficiation processes	PD UC	5	150	2/1/0	105	E		5		
MET284	Prospective directions of mineral processing	PD UC	5	150	2/0/1	105	E			5	
MET262	Process wastewater concentrators	PD UC	5	150	2/1/0	105				5	
MET716	Thickening and dehydration of mineral raw materials				1/1/1						
MET717	Filtration and drying of processed and enriched products	PD, CCH	5	150	1/1/1	105	E		5		
MNG705	Project Management				2/0/1						
MET729	Labor and environmental protection in mineral processing processes	PD, CCH	5		2/0/1	105	E		5		
MET755	Modern methods of design of mineral processing facilities			150	2/1/0						
MET274	Surface chemistry flotation process	PD, CCH	5		2/1/0	105	E			5	
MET267	Theory and practice of processing of polymetallic ores			150	2/1/0						
MET268	Theory and practice of processing of ores of rare metals	PD, CCH	5		2/1/0	105	E			5	
MET269	Theory and practice of processing of non-ferrous metals			150	2/1/0						
M-3. Practice-oriented module											
AAP229	Pedagogical practice	BD UC	6						6		
AAP256	Research practice	PD, UC	4								4
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											
ECA205	Preparation and defense of a master's thesis	FA	12								12
	Total based on UNIVERSITY:							30	30	30	30

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		29	20	49
	Total for theoretical training:	*0*	*49*	*35*	*84*
	RWMS				*24*
FA	Final attestation	12			12
	TOTAL:	**12**	**49**	**35**	**120**

Decision of the Academic Council of KazNRTU named after K.Satpayev. Protocol №13 от "28" 04 2022.

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Protocol №7 от "26" 04 2022

Decision of the Academic Council of MaMI named after O. Baikonurov. Protocol №5 от "20" 12 2021.

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

Director of the Mining and Metallurgical Institute named after O. A. Baikonurov — K.B. Rysbekov

Head of department "Metallurgy and mineral processing" — M.B. Barmenshinova

Representative of the employers' council of the LLP "KAZ Minerals" — U.K. Jetybaeva

8. Additional educational programs (Minor)

Name of additional educational programs (Minor) with disciplines	Total number of credits	Recommended semesters of study	Documents on the results of the development of additional educational programs (Minor)

CHANGE REGISTRATION SHEET

Sequence number of the change	Section, paragraph of the document	Type of change (replace, cancel, add)	Number and date of notification	The change has been made	
				Date	Surname and initials, signature, position