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

EDUCATIONAL PROGRAM

6B07213 – «Mineral Processing»

Code and classification of the field of education:	6B07-Engineering, manufacturing and construction industries
Code and classification of training areas:	6B072-Manufacturing and manufacturing industries
Group of educational programs:	B071-Mining and Quarrying
NRC level:	6
ORC Level:	6
Duration of training:	4 years
Loan:	240

Almaty 2025

The educational program «6B07213 - Mineral Processing» was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Protocol № 4 dated « 12 » 12 2024 y.

was reviewed and recommended for approval at the meeting of K.I. Satbayev KazNRTU Educational and Methodological Council

Protocol № 3 dated « 20 » 12 2024 y.

Educational program «6B07213 – Mineral Processing» was developed by Academic committee based on direction of «6B072 – Manufacturing and processing industries»

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Barmenshinova M.B.	c.t.s., associate professor	Head of the Department of MaMP	KazNRTU named after K.I.Satpaeva	
Teaching staff:				
Mambetaliyeva A.R.	PhD doctor	Associate professor of the Department of MaMP	KazNRTU named after K.I.Satpaeva	
Employers:				
Dzhetybaeva U.K.	c.t.s.	Main enrichment	«Kaz Minerals» LLP	
Students				
Zheksembai A.S.	-	4th year student	KazNRTU named after K.I.Satpaeva	

Table of contents

List of abbreviations and symbols

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

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

MSaHE RK - Ministry of Science and Higher Education of the Republic of Kazakhstan;

EP – educational program;

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

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

WC – working curriculum;

CED – catalog of elective disciplines;

UC – university component;

CC – component of choice;

NQF – National Qualifications Framework;

IQF – Industry qualifications framework;

LO – learning outcomes;

KC – key competencies.

1. Description of the educational program

It is intended for the implementation of specialized bachelor's training under the "Mineral Processing" educational program at the K. I. Satpayev KazNRTU and was developed in the framework of the "Manufacturing and Processing Industries" direction.

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:

- Law of the Republic of Kazakhstan "On Education" with amendments and additions in the framework of legislative changes to increase the independence and autonomy of higher education institutions of 04.07.18 No. 171-VI;
- Law of the Republic of Kazakhstan "On Amendments and additions to certain Legislative Acts of the Republic of Kazakhstan on expanding the academic and managerial independence of higher educational institutions" dated 04.07.18 No. 171-VI;
- Order of the Minister of Education and Science of the Republic of Kazakhstan dated 30.10.18 No. 595 "On approval of Standard Rules for the activities of relevant types of educational organizations";
- State mandatory standard of higher education (Appendix 7 to the Order of the Minister of Education and Science of the Republic of Kazakhstan No. 604 dated 31.10.18;
- Resolution of the Government of the Republic of Kazakhstan dated 19.01.12 № 111 "On approval of Standard rules for admission to study in educational organizations implementing educational programs of higher education" with amendments and additions dated 14.07.16 № 405;
- Resolution of the Government of the Republic of Kazakhstan dated 27.12.2019 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 of 16.06.2016 of the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations;
– Industry qualification framework "Mining and Metallurgical Complex" No. 1 dated 30.07.2019.

Currently, the list of scarce and in-demand professions of the mining and metallurgical complex of Kazakhstan, along with professions that ensure the introduction of automated systems, robotics and digital technologies, includes the profession of "concentrator".

In the world practice of mining and processing of ores, the problem of depletion of mineral reserves or depletion of ore reserves is noted. Therefore, it becomes necessary to make technological adjustments to the methods of extraction

and enrichment of mineral raw materials in production. In addition, in the light of increasing environmental requirements for waste disposal, it is necessary to recycle tailings, sludge, and industrial waste. Here, a special role is assigned to the concentrator, who will have to master different types of technologies for processing and using man-made raw materials, determine the most effective one and apply it.

The "Mineral Processing" educational program includes fundamental, natural science, general engineering and professional training of bachelors in the field of ore and man-made raw materials processing in accordance with the development of science and technology, as well as the changing needs of the mining and metallurgical industry.

Graduates of the developed educational program have knowledge of technology about boore thickening ferrous, non-ferrous, precious, radioactive, rare and other metals, as well as processing of man-made raw materials.

Mission statement educational programs "Mineral Processing": preparation of bachelors-concentrators who know the mineral and raw material base, technologies of ore and technogenic raw materials processing, production technologies and areas of metal consumption, who have a fundamental training in physics, mathematics, chemistry, physical and chemical fundamentals of enrichment technologies and metallurgy carelessness students ' knowledge, skills and abilities that allow them to analyze problems in the field of professional activity. research activities and find ways to solve them, solve engineering problems of designing technologies and equipment of processing plants, conduct experimental research using information technologies and mathematical modeling.

Field of professional activity. Specialists who have completed a bachelor's degree perform production, technological and organizational work at industrial enterprises, as well as conduct research work on the enrichment of minerals, the production of mineral fertilizers, and the production of mineral fertilizers. ore concentrates ferrous, non-ferrous, rare and radioactive metals.

Objects of professional activity. The objects of professional activity of graduates are processing plants, enterprises of ferrous and non-ferrous metallurgy, chemical, mining and chemical and machine-building industries, branch research and design institutes, factory laboratories, secondary professional and higher educational institutions.

Subjects of professional activity these are technological processes of the mining and processing and metallurgical industries, processing of ore and man-made raw materials, etc concentrate emissions advanced consumer properties, mining and metallurgical production equipment, automatic control systems processing equipment production and quality control of final products.

Types of economic activity: screening machine operator, dosing machine operator, crushing machine operator, concentrator operator, mill operator, washing machine operator, roaster operator, concentration product controller, thickener apparatchik, filter operator, equipment maintenance and repair locksmith, aggregate repair locksmith, control panel operator, dryer, flotator, mineralogical analysis laboratory assistant.

2. The purpose and objectives of the educational program

Goal EP «6B07213-Mineral Processing» it is aimed at training highly qualified, competitive and in-demand specialists in the labor market in the field of mineral and man-made raw materials processing for the mining and metallurgical complex of the Republic of Kazakhstan, have professional and personal competencies that allow you to: perform calculation and design, production and technological, research, organizational and managerial and entrepreneurial activities at processing plants and industrial facilities.

EP tasks 6B07213 - «Mineral Processing»:

- study the cycle of general education disciplines to ensure 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;
- study of the cycle of basic disciplines to ensure knowledge of natural science, general technical and economic disciplines, as the foundation of professional education;
- the cycle of specialized disciplines is focused on the study of key theoretical and practical aspects of ore and man-made raw material processing, rational use of natural resources;
- study of disciplines that form knowledge, skills and abilities of planning and organizing research, designing works in the field of mineral processing and man-made raw materials;
- familiarization with technologies and equipment of processing plants during various types of practical training.
- acquisition of skills in laboratory research, technological calculations, equipment selection and design using modern computer technologies and programs.

The Sustainable Development Goals (SDGs) in the OP «6B07213-Mineral Processing are aimed at:

– providing affordable and high-quality education, developing professional skills, eliminating gender inequality, supporting sustainable development and inclusive learning environments;

– improve water quality by reducing pollution, recycling and safe use of wastewater;

– improving resource efficiency, creating sustainable production and consumption patterns, and supporting economic growth without harming the environment;

– development of sustainable industrialization, modernization of infrastructure, support for scientific research and innovative technologies;

– efficient use of natural resources, minimization of waste, rational management of chemicals;

– support for international cooperation, development and dissemination of environmentally sound technologies.

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

B – basic knowledge, skills and abilities

B1 – study the modern history of the Republic of Kazakhstan, stages and prospects of state development;

B2 – with inability to use modern technologies to gain access to and exchange information sources. Possess the skills of working on a computer as a means of managing, storing and processing information and performing calculations using general and applied software products.

B3 – be proficient in the state language, Russian, and one of the most widely spoken foreign languages in the industry at a level that ensures 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 – ability to use knowledge and methods of general engineering disciplines (fundamentals of automation and mechanics) in practical activities.

B6-awareness in the field of financial analysis and project evaluation, project management and business, in the basics of macro-and microeconomics, knowledge and understanding of risks in market conditions.

B7 – familiarization with technological processes and skills of working in processing plants.

B8 – know and master the main business processes in an industrial enterprise.

P – professional competencies, including those that meet the requirements of industry-specific professional standards

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

P2 – proficiency in professional terminology and the ability to work with educational and scientific materials in the specialty in the original state, Russian and foreign languages. Ability to logically correct, well-reasoned, and clearly construct oral and written speech in three languages

P3 – knowledge of the requirements of Occupational Safety and Health Regulations at work and the ability to apply them in practice.

P4 – proficiency in professional safety culture; ability to identify hazards and assess risks in their field; knowledge of basic methods of protecting production personnel and the public from possible consequences of accidents, catastrophes, natural disasters and improving working conditions in the field of professional activity.

P5-willingness to apply professional knowledge to prevent and minimize negative environmental impacts in the workplace.

P6 – ability to use regulatory legal documents in their activities.

P7 – choose rational methods for processing ferrous and non-ferrous metal ores and man-made raw materials that meet the requirements of integrated technology, economics and ecology.

P8 – be able to understand the social significance of your future profession. Have knowledge of the formation and development of the mining and processing industry in Kazakhstan and current priority trends

P9 – to be able to combine the theory of problems and practice for solving engineering problems, to conduct balanced thermal, hydraulic, and aerodynamic calculations of processes and apparatuses, based on practical data.

P10 – be able to apply in practice the principles of rational use of natural resources and environmental protection.

P11 – be able to select measuring instruments in accordance with the required accuracy and operating conditions.

P12 – be able to implement and adjust technological processes in the enrichment of mineral and man-made raw materials.

P13 – be able to identify objects for improvement in engineering and technology.

P14 – the ability to identify processing and metallurgical apparatuses and systems for transporting melts (reagents, pulps, etc.) that have low efficiency, an increased level of danger, and determine the necessary measures to improve the equipment and/or production technology.

P15 – be able to apply the methods of technical and economic analysis. Calculate and analyze chemical and physico-chemical processes, mass transfer processes occurring in the technological processes of processing (enrichment) of mineral raw materials.

P16 – be able to choose research methods, plan and conduct the necessary experiments, interpret the results and draw conclusions.

P17-Calculate and analyze hydrometallurgical processes and apparatuses, select optimal technological modes.

P18 – have the ability to analyze and synthesize. Conduct literary and analytical reviews.

P19 – be able to use the basic concepts, laws and models of thermodynamics, chemical kinetics, heat and mass transfer. Be able to select and apply appropriate modeling methods for physical, chemical, and technological processes.

P20 – be able to perform project elements.

P21-independently perform: calculations of equipment; drawings of parts and structural elements; calculations for strength and rigidity; calculations of machine parts and mechanisms; choose electrical equipment and calculate its operating modes; offer an automation system for the main equipment.

P22 – be able to justify the choice of equipment for the implementation of technological processes.

P23-conduct a feasibility study of processing processes. Plan the volume of production and perform calculations of production and sales costs, determine break-even conditions. Carry out approximate calculations of harmful emissions

and assess the environmental status of existing and projected technological processes and aggregates.

P24 – independence: performing independent work in typical situations and under guidance in difficult situations of professional activity; independent organization of training. Responsibility: for the results of work performed; for your own safety and the safety of others; for meeting environmental protection requirements and fire safety. Complexity: solving typical practical tasks; choosing a method of action from known ones based on knowledge and practical experience: conducting the main technological process in accordance with your field of professional activity.

O – universal, social and ethical competencies

O1-take care of the environment in your work and daily life.

O2-consider ethical and legal norms in interpersonal communication, knowledge and understanding of your rights and obligations as a citizen of the Republic of Kazakhstan.

O3 – ability to critically generalize, analyze and perceive socio-political information using the basic laws of social development in solving social and professional problems, the ability to analyze socially significant problems and processes in society. Possess the culture and logic of thinking, an understanding of the general laws of social development and the ability to analyze them.

O4-awareness of the need and acquisition of the ability to independently learn and improve their skills throughout their work.

O5-understanding and practical use of healthy lifestyle standards, including prevention to improve performance

O6 – ability to build interpersonal relationships and work in a group (in a team).

C – special and managerial competencies

C1-independent management and control of the processes of work and educational activities within the framework of the strategy, policy and goals of the organization, discussion of the problem, reasoning of conclusions and competent operation of information;

C2 – independence: executive and managerial activity for the implementation of tasks under management, which provides for the independent definition of tasks, organization and control of its implementation by subordinate employees. Responsibility: for the results of implementing the norm; for your own safety and the safety of others; for meeting the requirements for environmental protection and fire protection. safety. Complexity: solving various typical practical tasks that require independent analysis of work situations. Conducting the main technological process in the field of their professional activities, various levels of complexity, mentoring in a team. Quality control of technological processes and finished products.

C3 – independence: atmanagement activity within the technological process section and the company's business strategy. Responsibility: for the evaluation and improvement of their own work, their own training and the training of others; for their own safety and the safety of others; for meeting environmental protection

requirements and fire safety. Complexity: solving practical problems based on the choice of ways to solve them in various changing working conditions. Organization of the production process, development and implementation of new equipment, technologies and assortment, organizational and managerial work to improve the quality of products and production efficiency of the mining and processing industry.

C4 – independence: management activity within the framework of the company's business strategy, which involves coordinating work with other sites. Responsibility: for planning and developing business processes that may lead to significant changes or developments, and responsibility for improving the professionalism of employees. Complexity: an activity aimed at solving problems that involve a choice and variety of ways to solve them. Conducting research and experimental work, designing the expansion and modernization of production, expanding and updating the range of the mining and metallurgical industry, introducing new technologies.

Special requirements for university graduation for this OP:

– the student should have a general understanding of the thesis topic / research plans, and contact potential academic supervisors one year before the expected completion of their studies;

– to get acquainted with potential academic supervisors and speed up students ' choice of topics for their thesis (project), a review meeting is held one year before the expected completion of their studies;

– to collect the necessary data and study current tasks, methods and procedures on the topic of the thesis, the student passes an industrial internship;

– upon completion of the internship, the student contacts the supervisor in writing or orally and informs about the results of the work, but no more than one week after the start of the 4th year of study;

– within 4 weeks after the start of their studies, the student and the supervisor must discuss and decide on the type (research, project or independent study) and topic of the thesis. This is an extremely important discussion and decision, as it is impossible to further change the topic and type of work.;

- the topic of the thesis (project) and the supervisor are assigned to the student or group of students no more than six weeks after the beginning of the final year of study and approved by the order of the rector of the higher educational institution.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	6B07-Engineering, manufacturing and construction industries
2	Code and classification of training areas	6B072 – Manufacturing and processing industries
3	Group of educational programs	B071 – Mining and Mining
4	Name of the educational program	6B07213 – Mineral Processing
5	Brief description of the educational program	The educational program 6B07213 - " Mineral processing "(code according to the classifier of specialties of higher and postgraduate education of the Republic of Kazakhstan 2009 5B073700 – "Mineral processing") includes fundamental, natural science, general engineering and professional training of bachelors in the field of ore and technogenic raw materials processing in accordance with the development of science and technology, as well as the changing needs of the mining and metallurgical industry industries.
6	OP Goal	training of highly qualified, competitive and in-demand specialists in the field of enrichment of mineral and man-made raw materials for the mining and metallurgical complex of the Republic of Kazakhstan, possessing professional and personal competencies that allow them to carry out design, production, technological, research, organizational, managerial and entrepreneurial activities at processing plants and industrial facilities., capable of developing and implementing innovative technologies for processing mineral raw materials, taking into account the principles of sustainable development.
7	Type of EP	New
8	NQF level	6
9	ORC Level	6
10	Distinctive features of the EP	no
11	List of educational program competencies:	Professional competencies; Research competencies; Basic competencies and knowledge; Communication skills; Universal competencies; Cognitive competencies; Creative competencies; Information and communication skills.
12	Learning outcomes of the educational program:	LO1 - apply knowledge of mathematics, science and technology to solve professional problems. LO2 - be able to plan and conduct experiments, as well as analyze and interpret experimental data to develop optimal solutions. LO3 - have the skills to design technological processes for processing mineral and man-made raw materials in order to

		achieve the set goals within realistic constraints. LO4 - have the skills to work in interdisciplinary teams. LO5 - be able to identify, formulate and solve technical problems in the processing of non-ferrous, ferrous and precious metal ores, non-metallic and uranium-containing raw materials, and man-made waste. LO6-understand professional and ethical responsibility in the process of working in labor communities. LO7 - have effective communication skills in professional and public organizations. LO8-understand the consequences of technical and technological decisions in the processing of non-ferrous, ferrous and precious metal ores, non-metallic and uranium-containing raw materials, and man-made waste in a global, economic, environmental and social context. LO9 - improve your knowledge in the field of mineral processing throughout your professional career. LO10 - be able to analyze current problems and determine the principles of improving technological processes in the processing of mineral and man-made raw materials. LO11 - be able to use the methods, skills and modern engineering tools necessary for engineering practice.
13	Form of training	Full-time
14	Duration of training	4 years old
15	Loan volume	240
16	Languages of instruction	Kazakh, russian, english
17	Academic degree awarded	Bachelor of Engineering and Technology in the educational program «6B07213 – Mineral Processing»
18	Developer and author:	Barmenshinova M. B.

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

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)										
				LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11
Cycle of general education disciplines Required component														
1	Foreign language	English is a compulsary subject. According to the results of placement test or IELTS score, students are placed into groups and disciplines. The name of the discipline corresponds to the level of English. When passing from level to level, prerequisites and postrequisites are respected.	10											
2	Kazakh (Russian) language	Kazakh (Russian) language In this course author considers socio-political, socio-cultural spheres of communication and functional styles of the modern kazakh (russian) language. The course covers the specifics of the scientific style to develop and activate professional communication skills and abilities of students. Also it allows students to leavn the basics of scientific style practically and develop the ability of production structural and semantic text analysis.	10											
3	Physical Culture	The purpose of the discipline is to master the forms and methods of forming a healthy lifestyle within the framework of the vocational education system. Familiarization with the natural-scientific foundations of physical education, possession of modern health technologies, basic methods of independent physical education and sports. And also as part of the course, the student will master the rules of judging in all sports.	8											
4	Information and communication technologies (in English)	The aim of the course is to gain theoretical knowledge in information processing, the latest information technologies, local and global networks, the methods of information protection; Getting the right use of text editor editors and tabulators; creation of base and different categories of applications.	5											
5	History of Kazakhstan	The purpose of the discipline is to provide objective historical knowledge about the main stages of the history of Kazakhstan from ancient times to the present day; to acquaint students with the problems of the formation and	5											

		development of statehood and historical and cultural processes; to promote the formation of humanistic values and patriotic feelings in the student; to teach the student to use the acquired historical knowledge in educational, professional and everyday life; to assess the role of Kazakhstan in world history.													
6	Philosophy	The purpose of the discipline is to teach students the theoretical foundations of philosophy as a way of cognition and spiritual development of the world; developing their interest in fundamental knowledge, stimulating the need for philosophical assessments of historical events and facts of reality, assimilating the idea of unity of the world historical and cultural process while recognizing the diversity of its skills of applying philosophical and general scientific methods in professional activity.	5												
7	Module of socio-political knowledge (sociology, political science)	The objectives of the disciplines are to provide students with explanations on the sociological analysis of society, about social communities and personality, factors and patterns of social development, forms of interaction, types and directions of social processes, forms of regulation of social behavior, as well as primary political knowledge that will serve as a theoretical basis for understanding socio-political processes, for the formation of political culture, the development of personal position and a clearer understanding of the measure of their responsibility; to help master the political-legal, moral-ethical and socio-cultural norms necessary for activities in the interests of society, the formation of personal responsibility and personal success.	3												
8	Module of socio-political knowledge (cultural studies, psychology)	The purpose of the disciplines is to study the real processes of cultural activity of people who create material and spiritual values, to identify the main trends and patterns of cultural development, the change of cultural epochs, methods and styles, their role in the formation of a person and the development of society, as well as to master psychological knowledge for the effective organization of interpersonal interaction, social adaptation in the field of their professional activities.	3												
Cycle of general education disciplines Component of choice															

9	Fundamentals of anti-corruption culture and law	Purpose: to increase the public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Contents: improvement of socio-economic relations of the Kazakh society, psychological features of corrupt behavior, formation of an anti-corruption culture, legal responsibility for acts of corruption in various fields.	5			V								
10	Fundamentals of economics and entrepreneurship	Purpose: To develop basic knowledge of economic processes and skills in entrepreneurial activities. Content: The course aims to develop skills in analyzing economic concepts such as supply and demand, and market equilibrium. It includes the basics of creating and managing a business, developing business plans, risk assessment, and strategic decision-making.	5			V								
11	Fundamentals of scientific research methods	Purpose: The goal of studying the discipline is to develop students' research skills; to introduce students to scientific knowledge, their readiness and ability to conduct research. Objectives of studying the discipline: to contribute to the deepening and consolidation of existing theoretical knowledge by students; to develop practical skills in conducting scientific research, analyzing the results obtained and developing recommendations; to improve methodological skills in independent work with information sources and appropriate software and hardware.	5			V								
12	Ecology and life safety	Purpose: formation of ecological knowledge and consciousness, obtaining theoretical and practical knowledge on modern methods of rational use of natural resources and environmental protection. Contents: the study of the tasks of ecology as a science, the laws of the functioning of natural systems and aspects of environmental safety in working conditions, environmental monitoring and management in the field of its safety, ways to solve environmental problems; life safety in the technosphere, emergencies of a natural and man-made nature.	5			V								
13	Basics of financial literacy	Purpose: formation of financial literacy of students on the basis of building a direct link between the acquired knowledge and their practical application. Contents: using in practice all kinds of tools in the field of								V	V	V	V	

		financial management, saving and increasing savings, competent budget planning, obtaining practical skills in calculating, paying taxes and correctly filling out tax reports, analyzing financial information, orienting in financial products to choose adequate investment strategies.												
Cycle of basic disciplines University level component														
14p lines **University level component**	Mathematics I	Purpose: to introduce students to the fundamental concepts of linear algebra, analytical geometry and mathematical analysis. To form the ability to solve typical and applied problems of the discipline. Contents_ Elements of linear algebra, vector algebra and analytical geometry. Introduction to the analysis. Differential calculus of a function of one variable. The study of functions using derivatives. Functions of several variables. Partial derivatives. The extremum of a function of two variables.	5	√		√	√			√	√			√
15	Mathematics II	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive. To teach how to apply a certain integral to solve practical problems. Contents_ integral calculus of the function of one and two variables, series theory. Indefinite integrals, methods of their calculation. Certain integrals and applications of certain integrals. Improper integrals. Theory of numerical and functional series, Taylor and Maclaurin series, application of series to approximate calculations_	5	√	√	√	√			√	√			
16	Physics	Purpose:To form ideas about the modern physical picture of the world and scientific worldview, the ability to use knowledge of fundamental laws, theories of classical and	5		√			√		√		√	√	√

		modern physics. Contents_ physical fundamentals of mechanics, fundamentals of molecular physics and thermodynamics, electricity and magnetism, vibrations and waves, optics and fundamentals of quantum physics.													
17	Engineering and Computer graphics	Purpose: To develop students' knowledge of drawing construction and skills in developing graphical and textual design documentation in accordance with standards. Content: Students will study ESKD standards, graphic primitives, geometric constructions, methods and properties of orthogonal projection, Monge's projection, axonometric projections, metric tasks, types and features of connections, creating part sketches and assembly drawings, detailing, and creating complex 3D solid objects in AutoCAD.	5	√	√	√	√		√	√					
18	Chemistry	Purpose: formation of knowledge on fundamental issues of general chemistry and skills of their application in professional activity. Summary of the laws, theoretical provisions and conclusions that underlie chemical disciplines; properties and relationships of chemical elements based on the periodic law of D.I.Mendeleev and on modern ideas about the structure of matter; fundamentals of chemical thermodynamics and kinetics; processes in solutions; structure of complex compounds.	5	√		√				√	√		√	√
19	Physical Chemistry	Purpose: to form students' abilities to understand the physico-chemical essence of processes and to use the basic laws of physical chemistry in complex industrial and technological activities. Contents: laws of thermodynamics; basic equations of chemical thermodynamics; methods of thermodynamic description of chemical and phase equilibria in multicomponent systems; properties of solutions; fundamentals of electrochemistry; basic concepts, theories and laws of chemical kinetics and catalysis.	5		√			√		√		√	√	√
20	Basics of automation	The discipline studies basic measuring instruments, primary converters (sensors) of technological parameters, actuators, microcontrollers and automatic control systems of machine tools and technological equipment. Describes the elements of automation systems, time and frequency characteristics of typical links, criteria for the study of linear systems for stability and methods for assessing the quality of the process.	5	√	√					√	√	√	√	

21	Technological mineralogy	The purpose of studying the discipline is for students to study the basics of the theory of the formation of minerals in nature and their basic properties used in the production of various metals and basic raw materials of the Republic of Kazakhstan, as well as to instill skills in the active use of various types of literature. Contents: General information about the development of mineralogy and the structure of the earth. The formation of minerals and a brief description of rocks. Basic concepts of crystals. General properties of minerals and their classification. Silicates and carbonates. Oxides and hydroxides. Sulfides and sulfates. Tungsten and native metals. Halide compounds, phosphates and organic compounds. The concept of minerals and deposits. Properties of minerals used in ore dressing. Raw materials of the metallurgical industry and industrial classification of metals. Deposits of ferrous metal ores and alloys. Deposits of ores of non-ferrous and precious metals. Deposits of ores of rare, scattered, rare earth and radioactive metals.	4	√	√					√	√	√	√	
22	Fundamentals of Mineral Processing (in English)	The purpose of the discipline is to study by students the ways of preparing mineral raw materials for its primary processing and the main methods of mineral enrichment. Contents: Physico-chemical bases of mineral processing. Processes, devices and technologies for the preparation of mineral raw materials for the separation of minerals. Processes, devices and technologies for the enrichment and processing of minerals. Technically and environmentally safe ways of working on the processing of minerals.	6	√	√					√		√	√	√
23	Ore preparation processes and equipment	The purpose of studying this discipline is: 1) students' mastering of the theory and practice of ore preparation processes and crushing and crushing equipment. 2) training of enrichment specialists who are able to most efficiently carry out technological processes of ore preparation, as well as conduct research on processes and equipment of ore preparation, design and construction of factories and new equipment. Content: Granulometric composition of ore and enrichment products. Screening process, screening surfaces. Types and designs of screens. Calculation of the	5	√	√					√	√	√	√	

		performance of vibrating screens. The physical basis of the crushing and grinding processes. Crushing schemes. Jaw crushers. Cone crushers. Roller crushers, impact crushers. Selection and calculation of the crushing scheme. Classification, principle of operation and scope of mills. The design of drum mills. Selection and calculation of the grinding scheme. The principle of calculation of mills. Classification.												
24	Metrology and standardization in the processing industry	The purpose of the discipline -is to develop knowledge and practical skills of future bachelors in the use and compliance with the requirements of complex systems of general technical standards, performing precision calculations and metrological support in enrichment production, studying the basic provisions of the theory of metrology and metrological support, the principles of interchangeability of products according to geometric parameters, the practice of establishing tolerances and landings, the practice of technical measurements, the basic concepts of standardization and metrology to achieve high product quality with high labor efficiency.	5	√	√	√				√			√	√
25	Gravitational enrichment methods	Purpose: The purpose of teaching the discipline is for students to master the theory and practice of gravitational methods of enrichment of various types of mineral raw materials, to instill skills to analyze the operation of gravitational devices and solve relevant applied problems. Contents: Classification of gravitational enrichment methods. Properties of minerals and media used in gravitational enrichment. The main patterns of movement of bodies in the environment. Theoretical foundations of gravitational enrichment processes. Hydraulic classification. Classification in the centrifugal field of forces. Enrichment of ores in heavy suspensions. Separators for the enrichment of ores in heavy suspensions. Separators for the enrichment of ores in heavy suspensions. Ore dressing by jigging. Jigging machines. Theoretical regularities of enrichment in a stream of water flowing along an inclined surface. Enrichment on concentration tables and screw separators. Enrichment in centrifugal concentrators. Washing of ores. Pneumatic enrichment..	5	√	√	√	√		√	√				
26	General Metallurgy (in	Purpose: to form students' knowledge and skills in the	5	√	√	√				√			√	√

	English)	field of metallurgy, to familiarize them with the main methods of metallurgical production, to teach them to analyze the conditions for the implementation of technological processes for the production of cast iron, steel, ferroalloys and non-ferrous metals Contents: Production of cast iron and iron, production of steel, production of non-ferrous metals: metallurgy of copper; metallurgy of nickel; metallurgy of aluminum; production of other non-ferrous metals.												
27	Chemistry of Flotation Reagents (in English)	Purpose: to master the theory and practice of the use of flotation reagents in the flotation of ores of non-ferrous and related rare metals. The structure and composition, physical and chemical properties of reagents, and the regularities of the mechanism of action of flotation reagents depending on their properties and structure are described. Content: students gain knowledge in the field of chemistry of surface phenomena in flotation processes.	4		√			√		√	√	√	√	
28	Power supply and electrical equipment of processing plants	The main purpose of the discipline "Power supply and electrical equipment of processing plants" is to form students' solid knowledge in the field of principles of building power supply of processing plants: the study of external power supply, power sources and methods of transmission of electric energy, the main energy indicators of the energy sector. The importance of the discipline lies in the fact that it introduces students to the normalization of illumination and the competent application of knowledge in calculating electrical loads and determining the power of transformer substations.	5		√			√		√	√	√	√	
Cycle of basic disciplines Component of choice														
29	Magnetic and special enrichment methods	The purpose of the discipline is as follows: acquaintance with the main metallurgical processes used in the production of ferrous metals; acquaintance with modern technologies for the preparation and processing of metallurgical raw materials and aggregates for their implementation, directions for their improvement, including from the point of view of environmental friendliness, efficient use of energy resources and the possibility of waste-free production; familiarization with the theoretical foundations and description of specific	5		√			√	√			√	√	

		metallurgical processes, the basics of technological calculations, selection of raw materials and selection of equipment, the main indicators of processes. Contents: The role of magnetic and special enrichment methods in industry. Conditions affecting the indicators of mineral enrichment by magnetic and special methods. The essence of magnetic enrichment. The magnetic field and its parameters. Magnetic properties of minerals. The influence of the magnetic properties of minerals on the process of magnetic enrichment. The phenomenon of equal reach. Methods of magnetic separation. Dynamics of ore movement in magnetic separators. General characteristics and classification of magnetic separators. Auxiliary equipment for magnetic separation. Sorting of minerals. Types of sorting of mineral raw materials. Radiometric enrichment and its tasks in the sorting of solid mineral raw materials. Equipment for radiometric enrichment of solid minerals. Pneumatic mineral processing. Washing of ores and placers during the enrichment of mineral raw materials. Machines and mechanisms for washing ores and placers. Mineral processing in heavy environments. Separators for the enrichment of mineral raw materials in heavy environments. Enrichment using selective crushing of ores.												
30	Processing of gold-bearing ores and man-made raw materials	Purpose: Knowledge about the methods of ore and man-made raw materials enrichment, as well as various technological processes used in this industry. This allows them to understand the basic principles of the enrichment enterprises and apply them in practice to obtain high economic and environmental performance. Content: During the study, students will learn about the methods of enrichment of gold-bearing ores, about the ways of processing man-made raw materials in order to extract valuable metals.	5					√		√	√	√	√	√
31	Hydroaeromechanics of enrichment processes	In the discipline, the physical properties of liquids and gases, the basics of hydrostatics and hydrodynamics, the laws governing the motion of bodies in a medium, free and constrained motion, the equation of motion of bodies, fluid motion through granular and porous layers, hydrodynamics of fluidized beds, filtration through	5		√				√	√		√	√		

		porous partitions, two And three-phase systems, suspensions, hydroaeromechanical processes occurring during the enrichment of minerals, aeration and mixing of suspensions												
32	Coal enrichment	The purpose of this discipline is to study the technological processes of coal enrichment using various methods and techniques aimed at improving their quality and increasing production efficiency. The content of the discipline includes the study of the main theoretical and practical aspects of coal enrichment, including the physico-chemical properties and composition of coals, methods and technologies of enrichment, as well as equipment and tools used in these processes.	5		V			V		V		V	V	
33	Processes and devices of processing production	Goal: students master the theory of enrichment processes of various types of mineral raw materials; 2) students master the practice of operating devices used in the beneficiation of mineral raw materials: 3) teach students to navigate the variety of processes and devices used in the beneficiation of mineral resources, select and justify optimal schemes and options for preparatory, main and auxiliary processes, draw up technological and hardware diagrams; 4) instilling skills in the active use of technical literature when studying issues of disintegration; Contents: Screening and classification processes. Screening and classification devices. Crushing and grinding processes. Apparatus for crushing and grinding. Processes of gravitational enrichment. Apparatuses for gravitational enrichment. Processes and apparatuses of magnetic and electrical methods. Flotation processes. Apparatus for flotation enrichment processes. Special and combined enrichment processes. Dehydration processes. Apparatus for dehydration processes.	5		V			V		V		V	V	V
34	Auxiliary economy in mineral processing	Purpose: to create conditions for maximum extraction of minerals and their subsequent processing. To do this, it is necessary to be able to quickly and efficiently organize the processes of ore transportation, sorting and enrichment, as well as ensure reliable maintenance of equipment and mechanisms. Content: An important aspect is the environmental safety of production processes in order to minimize the negative	5		V			V	V			V	V	

		impact on the environment.												
35	Fundamentals of sustainable development and ESG projects in Kazakhstan	Purpose: the goal is for students to master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Contents: introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.	5	√	√				√	√	√			
36	Automation of production processes at concentrating plants	The course provides for the study of the following main topics for mastering the discipline of enrichment automation: - concepts of control objects, control systems; - methods for measuring the main technological variables of enrichment processes (temperature, flow, level, pressure, concentration of substances, measuring the pH of solutions, conductometry, etc.); -creation of automated process control systems (APCS), purpose and composition of APCS, varieties of APCS; - mathematical models of objects, mathematical models of typical flows and kinetics of homogeneous and heterogeneous chemical reactions; -experimental determination of the properties of objects, acceleration curve, transients.	5					√	√			√	√	√
37	Flotation reagents in mineral processing	The main goal of studying this discipline is to understand the interaction of reagents with mineral particles to ensure effective separation of valuable components during flotation processing. As part of the training, students study various types of reagents, their classification, properties and application in flotation practice. This discipline is an important element in the educational program of students of mining and technical universities, as well as specialists in the field of mineral processing. Contents: Classification and general information of flotation reagents. Methods of expressing the concentration of flotation reagent solutions. Sulfhydryl collectors, methods of preparation, structure and properties. Oxyhydryl collectors, methods of preparation,	5	√	√					√	√	√	√	√

		structure and properties. Cationic collectors, methods of preparation, structure and properties. Nonionic collectors, methods of preparation, structure and properties. Apolar reagents, methods of preparation, structure and properties. Structure, surface and foaming properties of alcohol foaming agents. Ether foaming agents, methods of production, structure properties. Organic activators, methods of preparation, structure and properties. Organic depressants, methods of preparation, structure and properties. Flocculants, methods of production, structure and properties.													
38	Legal regulation of intellectual property	Purpose: the goal is to form a holistic understanding of the system of legal regulation of intellectual property, including basic principles, mechanisms for protecting intellectual property rights and features of their implementation. Content: The discipline covers the basics of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, and consider legal disputes and methods for resolving them.	5	V	V	V				V	V			
39	Theory and practice of hydrometallurgical processes	Purpose: theoretical and practical training of students in the field of hydrometallurgical processes of production of metals and non-ferrous metal alloys to solve practical and scientific problems in the study, selection and implementation of innovative technologies in metallurgical practice. Contents: Carbonates and oxides formation and thermal dissociation. Patterns of formation and thermal dissociation of oxides and carbonates. Reduction of metal oxides. Thermodynamics and kinetics of metallurgical melts. Thermodynamics and kinetics of the behavior of harmful impurities. Theoretical foundations of the processes occurring during oxidative refining, desulfurization, deoxidation and degassing of iron melts.	5	V	V					V	V	V	V	
40	Development of innovative equipment in enrichment	The main goal of the development of innovative equipment in enrichment is to increase the efficiency of production processes and reduce the cost of mining. Thanks to the introduction of the latest technologies and equipment, it is possible to improve the quality of the final products, increase the productivity of the enterprise	5					V		V	V	V	V	V

		and make the enrichment process more environmentally friendly. Content: Study of the process of designing and creating equipment for mineral processing. The use of modern automation systems to optimize the operation of processing plants.												
41	Fundamentals of Artificial Intelligence	Purpose: to familiarize students with the basic concepts, methods and technologies in the field of artificial intelligence: machine learning, computer vision, natural language processing, etc. Contents: general definition of artificial intelligence, intelligent agents, information retrieval and state space exploration, logical agents, architecture of artificial intelligence systems, expert systems, observational learning, statistical learning methods, probabilistic processing of linguistic information, semantic models, natural language processing systems.	5		√	√			√	√	√			√
42	Technologies for the enrichment of non-ferrous metal ores	The purpose of this discipline is to study methods and technologies aimed at increasing the concentration of non-ferrous metals in ores in order to further process them and obtain metal products. The main content of the discipline includes the study of the physico-chemical properties of ores, the principles of selection and optimization of technological schemes of enrichment, as well as the features of the equipment and processing methods used.	6	√	√	√				√	√		√	√
43	Reagent facilities of processing plants	The purpose of this discipline is to study the basics of chemistry, physics and technology of ore dressing processes using reagents. Content: as part of the study of reagent farming, students will learn about the classification of reagents, their physico-chemical properties, and methods of introduction into the enrichment process. They study the effect of reagents on various stages of enrichment, as well as ways to control their use.	6	√	√					√		√	√	√
Cycle of profile disciplines University level component														
44	Tall economy and sewage treatment of concentrating factories	Purpose: to study and develop effective methods for the treatment and purification of wastewater generated during the mining process. Contents: Wastewater treatment plays a key role in preventing pollution of water resources and	5	√		√				√	√		√	√

		preserving biodiversity. Modern technologies make it possible to effectively remove pollutants from wastewater, reducing their impact on the environment.													
45	Assay and control of concentrating processes	The purpose of this discipline is to master the methods of ore dressing and quality control of the resulting concentrate. The course content includes the study of the main stages of enrichment, analysis of enrichment methods, experimental research, as well as practical skills in the field of quality control and process optimization. This discipline plays an important role in the mining industry and contributes to improving the efficiency of mineral production.	5	√		√			√	√	√		√	
46	Exploitation and repair of concentrating equipment	The purpose of this discipline is to study the basic principles of operation of processing equipment, methods of its operation and repair to ensure continuous and trouble-free operation of production. The content of this discipline includes the study of the main types of enrichment equipment, the principles of its operation, methods of preventive maintenance and scheduled maintenance, as well as methods of diagnostics and repair of equipment. Content: Modern methods of organization and maintenance of industrial equipment. Typical operations during installation of equipment. The theoretical foundations of repair. Occupational safety during repair and installation work.	6		√	√			√	√		√		√
47	Fundamentals of mining technology	Purpose: students gain knowledge of the basic principles of the implementation of underground, open and construction geotechnologies in various mining and geological conditions; mastering mining terminology; acquiring primary skills to assess the scale of mining enterprises, which will later be used in the in–depth study of disciplines that form a set of competencies in the areas of their future professional activity Content: Features of extraction of solid minerals by open and underground methods. Preparation of rocks for excavation (drilling and blasting), excavation and loading operations, transportation of ore and waste rocks, dumping and warehousing. Averaging and loading complexes. Methods of intra-quarry ore averaging.	5	√	√	√				√			√	√

48	Flotation methods of enrichment	Purpose: to provide students with the necessary knowledge on the flotation method of mineral enrichment, to familiarize them with the reagents used and the mechanism of their action, types of flotation schemes and technological characteristics of the flotation equipment used, methods of calculating flotation schemes, selection and calculation of the main equipment used in flotation. Contents: The essence and varieties of the flotation process. Thermodynamics of the interaction of solid, liquid and gaseous phases during flotation. Theoretical foundations of flotation. Theoretical foundations of Flotation. Reagents and methods of their fixation. Collectors and the mechanism of their action during Flotation. Activators and their mechanism of action during flotation. Depressors and their mechanism of action during flotation. Environmental regulators, foaming agents and the mechanism of their action during flotation. Preparation of ores, pulps, industrial and circulating waters for flotation. Flotation modes. Flotation machines and apparatuses. Organization of the work of the flotation department of the factory.	4	√	√	√							√	√
49	ESG principles in inclusive culture	Purpose of the course: It focuses on studying ESG (Environmental, Social, Governance) principles and their interaction with the creation of an inclusive culture within an organization. Content: Students will gain knowledge on how implementing ESG principles contributes to corporate social responsibility, sustainable development, and equal opportunities for all employees, including those who may face various forms of discrimination. The course will help students understand the importance of an inclusive culture in achieving long-term business goals and ensuring sustainable organizational development.	5				√		√	√		√		
Cycle of profile disciplines Component by to your choice														
50	Enrichment of polymetallic ores	Purpose: To study the features of the technology of enrichment of various types of ores and minerals based on domestic and world practice of mineral processing at mining enterprises. summary: technology for processing ores containing apolar minerals and containing native minerals, technology for processing ores, technology for processing ores of non-ferrous and ferrous metals,	5	√	√			√	√				√	√

		technology for processing non-metallic minerals. Contents: Introduction to the enrichment of polymetallic ores. Physico-chemical properties of polymetallic ores. The main methods of enrichment of polymetallic ores. Technological processes for the enrichment of polymetallic ores. Analysis and evaluation of the effectiveness of enrichment. Practical examples of polymetallic ore enrichment. Trends in the development of technologies for the enrichment of polymetallic ores. Economic aspects of polymetallic ore enrichment. Cases of successful practice of polymetallic ore enrichment.												
51	Technologies for processing uranium-containing ores and concentrates	purpose: to have fundamental knowledge in the field of enrichment and processing of uranium-containing mineral raw materials, as well as to have a spatial understanding of the designs of devices used in this technology. Contents: Mechanical processing of uranium ores. Acid and carbonate leaching of uranium ores. Underground leaching of uranium. The phenomenon of well colmation. Condensation. Sorption method of uranium concentration. Classification of ion-exchange materials and basic requirements for ionites. Regeneration of a sorbent saturated with uranium.	5	V	V				V			V	V	
52	Enrichment of rare metal ores	purpose: theoretical and practical training of students in the field of traditional and modern technologies for processing raw materials containing precious and rare metals. Contents: Types and deposits of rare ores. Preliminary enrichment of ores and placers of rare metals. Ore preparation operations for processing ores and placers of rare metals. Technology of enrichment and integrated use of the main types of ores and placers .	4					V	V	V	V		V	
53	Dewatering and dust collection(ССО да кате жазылган)	Purpose: to maintain an optimal level of humidity in materials and the environment. This helps to avoid various problems such as the destruction of materials, the growth of bacteria and mold, corrosion of equipment and other negative consequences. The content of the discipline includes the study of various methods and technologies of dewatering and dust collection, the principles of their operation, the characteristics of various types of equipment, safety measures and environmental aspects of this process.	4	V	V			V	V				V	V

54	Modeling of concentrating processes	The purpose of the discipline is to study methods and techniques of mathematical modeling of mineral processing processes. This includes the study of the basic principles and patterns of the processes of separation and concentration of useful components in ores, ore and non-metallic materials. The content of the discipline includes the study of basic concepts and terms in the field of enrichment technology, principles of operation of enrichment equipment, methods of mathematical modeling and optimization of enrichment processes, as well as the use of computer programs for modeling and analyzing these processes. Content: The method of steep ascent. A complete factorial experiment.Fractional factorial experiment. Reproducibility of experiments according to the Cochran criterion. The Student's criterion. Determination of the reliability of the coefficients in the adequacy equations. The Fisher criterion. A single step. Simplex planning. Application in the planning of experiments and research. Compilation of a spreadsheet of experiments using the simplex planning method. Adjusting the values of factors in the research process	6	√	√			√	√		√		√	
55	Geotechnological methods of enriching	The purpose of this discipline is to teach students the basics of geotechnological enrichment methods and their practical application in the mining and chemical industry. Students study various methods of flotation, hydrometallurgy, pyrometallurgy, as well as technological processes for the enrichment of ores and minerals The content of the discipline includes the study of the basic principles and technologies of ore enrichment, methods for analyzing the composition and properties of rocks, as well as evaluating the effectiveness of various methods of enrichment.	6			√			√	√	√	√		
56	Enrichment of mining and chemical and non-metallic raw materials	Purpose: students to master general information about the characteristics of mining and chemical and non-metallic raw materials, the principles of enrichment of raw materials of phosphorus, sulfur, boron, asbestos, wollastonite, silica, clays and their equipment; formation of students' practical skills and research skills in preparing raw materials for enrichment.	5	√	√			√	√				√	

		Content: Enrichment of soluble salts of alkali metals. Enrichment of phosphate raw materials. Enrichment of barite and fluorite ores. Enrichment of magnetite and calcite ores. Enrichment of boron ores. Enrichment of sulfur ores. Talc enrichment. Enrichment of clays. Enrichment of quartz-feldspar ores, quartz raw materials. Enrichment of mica. Enrichment of asbestos. Enrichment of wollastonite ores. Enrichment of mineral raw materials for the production of construction industry materials.												
57	Technology of underground leaching of ores	The purpose of the discipline: to study the principles, methods and technologies of ore leaching by underground method. Students will have to study the basics of hydrometallurgical processes, chemical reactions occurring during the leaching process, and the operation of underground leaching plants. Content:Fundamentals of the underground ore leaching process.Chemical reactions occurring during the leaching process.Technologies and equipment for underground ore leaching.Design and calculation of underground leaching plants. Environmental aspects and safety of underground ore leaching.Practical examples of successful implementation of PVR technology.	5	V				V		V		V		V
58	Magnetic and electrical methods of lightening	The purpose of studying the discipline: the formation of students' knowledge bases, the development of professional skills and primary skills in the field of electrical, magnetic and special enrichment methods, and in assessing the parameters of enrichment processes and possible ways to increase their effectiveness. Contents: study of theoretical material on the processes of magnetic and electric enrichment; study of types of devices for magnetic and electric enrichment methods; study of calculation methods and equipment selection;	5									V		
59	Enrichment of ferrous metal ores	Purpose: Theoretical and practical training of students in the field of traditional and modern technologies for processing raw materials, features of ore raw materials and technologies for their processing at factories in Kazakhstan. content: The material composition of ore raw materials. Theoretical foundations and features of the enrichment of various ferrous ores. Classification of ore dressing methods and processes based on separating forces. Schemes and devices for the enrichment of	5									V		

		magnetite, titanomagnetite and other ores of complex composition, oxidation of iron ores and quartzites, brown iron ore, manganese and chromium ores, carbonate iron and manganese ores. The experience of factories for the enrichment of ferrous ores. Ways of integrated use of ferrous minerals. Contents: General principles of enrichment of ferrous ores. Physico-chemical properties of ferrous metal ores and their effect on the enrichment process. Technologies for the enrichment of ferrous ores: flotation, magnetic separation, gravity methods, etc. Analysis and processing of the obtained concentrates. Problems and prospects of development of modern technologies for the enrichment of ferrous ores. Economic aspects of the enrichment process and its impact on industry.													
60	Special and combined methods of dressing	The purpose of the study: the acquisition by students specializing in the field of mineral processing, knowledge on the theory, technology and practice of enrichment, as well as the study of devices used for processing various ores, obtaining skills in setting up and operating laboratory and industrial equipment, skills in setting up research works in the field of ore enrichment of complex material composition. Content: Special enrichment methods. Manual and mechanized mining. Magnetic enrichment methods. Electrical enrichment methods. Combined enrichment methods. Production of artificial concentrates. Processing of oxidized copper ores. Processing of oxidized zinc ores. Processing of complex ores. Processing of collective concentrates. Processing of complex ores and collective concentrates. Refinement of concentrates.	5										V	
61	Fundamentals of scientific research in ore dressing	T Purpose: to form the student's knowledge, skills and abilities to carry out independent scientific research in the field of technology and technologies of the agro-industrial complex, planning and conducting experiments, statistical processing and evaluation of the results of experiments, development of scientifically based conclusions and proposals for production Content: familiarization with the basics of organization and management of science; study of the basics of methodology, methods and methods of scientific research;	5										V	

		Contents: Introduction to ore dressing: basic concepts and definitions Ore dressing methods: flotation, gravity methods, magnetic methods. Ore purification technologies: flotation plants, gravity enrichment, magnetic processing. Analysis and testing of enrichment processes. Innovative technologies in ore processing. The use of computer modeling in ore dressing research. Economic aspects of ore dressing. Practical examples of successful enrichment processes. Evaluation of ore dressing efficiency and ways of optimization												
62	Ore beneficiation research	Purpose: the formation of qualified scientific knowledge among students about the main stages of carrying out research on mineral raw materials for enrichment and the acquisition of practical research skills:The discipline studies methods of sampling technological samples, preparing them for research on enrichment, drawing up schemes for cutting samples, the material and mineralogical composition of ore using various methods of analysis, the use of experiment planning, the methodology of conducting circuit experiments, the procedure for conducting semi-industrial and industrial tests. Contents: An introduction to the study of ores for enrichment. Physico-chemical properties of ore minerals. Methods of ore enrichment. Gravitational enrichment methods. Flotation methods of enrichment. Magnetic enrichment methods. Classification of enrichment processes. Ore enrichment analysis. Laboratory methods of ore research. Modeling of ore dressing processes. Technical means of ore enrichment. Current trends in ore enrichment research.	4											V
63	Industrial water supply, transport and tailings of concentrating factories	The purpose of studying this discipline is to ensure the proper functioning of all engineering systems necessary for the production and processing of minerals. This includes providing sufficient water for production purposes, ensuring safe and efficient transportation of materials and equipment, as well as proper treatment and disposal of industrial waste. The content of the discipline: includes the study of the basic principles of water supply, transport and waste treatment systems, technology and	4											V

		equipment used in these systems, as well as regulatory requirements and standards governing industrial activities. Contents: Fundamentals of planning and design of industrial water supply. Technologies of water purification and treatment for industrial needs. Principles and methods of calculation and selection of equipment for water supply of enterprises. Organization and operation of transport facilities in production. Logistics and warehouse management at a manufacturing enterprise. Design and construction of a tailings facility for the processing and disposal of industrial waste. Evaluation of the efficiency and optimization of the work of industrial water supply, transport and tailings facilities.												
64	Design of concentrating factory	The purpose of teaching the discipline is to study the principles of technological design of processing plants, to master the methods of selection and calculation of technological schemes and equipment and to instill skills in the use of technical and reference literature. Content: The project of the enrichment plant. Determination of the productivity of the factory, workshops and departments. Selection and justification of crushing schemes, the method of calculating the crushing scheme. Selection and calculation of crushing and screening equipment. Selection and calculation of equipment for hydraulic classification, disintegration, flushing and desalination. Selection and justification of grinding schemes, the method of calculating the grinding scheme. Selection and calculation of equipment for grinding and classification by size in grinding schemes. The basic principles of equipment placement in the crushing and crushing department. Selection and justification of basic schemes for the enrichment of non-ferrous metal ores. The methodology for calculating quantitative enrichment schemes, calculation of the water - sludge scheme and water balance. Selection and calculation of the main processing equipment. The basic principles of equipment placement in the departments of flotation, gravity, magnetic and electric enrichment. Design of dewatering and dust collection departments. Design of auxiliary workshops and departments of processing plants. Design of master plans for processing	5											V

		plants.												
65	Digitalization of mining and processing plants	The purpose of the discipline is to study the basic principles and methods of digitalization of production processes at mining and processing enterprises, as well as to master the skills of using modern information technologies to improve management and monitoring of production activities. Contents: Fundamentals of digitalization of industry and its application at mining and processing plants. The specifics of digital technologies in the mining industry. Application of automation and control systems at mining and processing enterprises. Fundamentals of data analytics and their application to optimize production processes.	5		V			V	V	V			V	

5 Curriculum of the educational program

NON-PROFIT JOINT STOCK COMPANY
"KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

SATBAYEV UNIVERSITY

«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	**B071 - "Mining and mineral extraction"**
Educational program	**6B07213 - "Mineral processing"**
The awarded academic degree	**Bachelor of engineering and technology**
Form and duration of study	**full time - 4 years**

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters								Prerequisites
									1 course		2 course		3 course		4 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	7 sem	8 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																	
M-1. Module of language training																	
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E	5								
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E	5								
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E		5							
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E		5							
M-2. Module of physical training																	
KFK101	Physical culture I		GED, RC	2	60	0/0/30	30	E	2								
KFK102	Physical culture II		GED, RC	2	60	0/0/30	30	E		2							
KFK103	Physical culture III		GED, RC	2	60	0/0/30	30	E			2						
KFK104	Physical culture IV		GED, RC	2	60	0/0/30	30	E				2					
M-3. Module of information technology																	
CSE677	Information and communication technology		GED, RC	5	150	30/15/0	105	E			5						
M-4. Module of socio-cultural development																	
HUM137	History of Kazakhstan		GED, RC	5	150	15/0/30	105	GE		5							
HUM134	Module of socio-political knowledge (cultural studies, psychology)		GED, RC	5	150	30/0/15	105	E			5						
HUM132	Philosophy		GED, RC	5	150	15/0/30	105	E				5					
HUM120	Module of socio-political knowledge (sociology, political science)		GED, RC	3	90	15/0/15	60	E				3					
M-5. Module of anti-corruption culture, ecology and life safety base																	
CHE656	Ecology and life safety	1	GED, CCH	5	150	30/0/15	105	E				5					
MNG489	Fundamentals of economics and entrepreneurship	1	GED, CCH	5	150	30/0/15	105	E				5					
PET519	Fundamentals of scientific research methods	1	GED, CCH	5	150	30/0/15	105	E				5					
HUM136	Fundamentals of anti-corruption culture and law	1	GED, CCH	5	150	30/0/15	105	E				5					
MNG564	Basics of Financial Literacy	1	GED, CCH	5	150	30/0/15	105	E				5					
CYCLE OF BASIC DISCIPLINES (BD)																	
M-6. Module of physical and mathematical training																	
MAT101	Mathematics I		BD, UC	5	150	15/0/30	105	E	5								
PHY468	Physics		BD, UC	5	150	15/15/15	105	E	5								

MAT102	Mathematics II		BD, UC	5	150	15/0/30	105	E		5							MAT101
M-7. Module of basic training																	
GEN429	Engineering and computer graphics		BD, UC	5	150	15/0/30	105	E	5								
CHE494	Chemistry		BD, UC	5	150	15/15/15	105	E		5							
AAP173	Practical training		BD, UC	2				R		2							
MET516	Magnetic and special enrichment methods	1	BD, CCH	5	150	15/15/15	105	E			5						
MET642	Enrichment of gold-bearing ores and technogenic raw materials	1	BD, CCH	5	150	30/0/15	105	E			5						
CHE127	Physical chemistry		BD, UC	5	150	15/15/15	105	E				5					
MET512	Hydroaeromechanics of processing processes	1	BD, CCH	5	150	30/15/0	105	E				5					
MET643	Coal enrichment	1	BD, CCH	5	150	30/15/0	105	E				5					
AUT424	Basics of automation		BD, UC	5	150	30/15/0	105	E					5				
MET521	Processes and devices of processing production	1	BD, CCH	5	150	30/15/0	105	E					5				
MET522	Auxiliary economy in mineral processing	1	BD, CCH	5	150	30/0/15	105	E					5				
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan	1	BD, CCH	5	150	30/0/15	105	E					5				
CHE950	ESG principles in inclusive culture	1	BD, CCH	5	150	30/0/15	105	E					5				
AUT427	Automation of production processes at concentrating plants	1	BD, CCH	5	150	15/15/15	105	E						5			
MET517	Flotation reagents in mineral processing	1	BD, CCH	5	150	30/15/0	105	E						5			
MNG562	Legal regulation of intellectual property	1	BD, CCH	5	150	30/0/15	105	E						5			
MET644	Theory and practice of hydrometallurgical processes	2	BD, CCH	5	150	30/0/15	105	E						5			
MET645	Development of innovative equipment in enrichment	2	BD, CCH	5	150	30/0/15	105	E						5			
CSE831	Fundamentals of Artificial Intelligence	2	BD, CCH	5	150	15/0/30	105	E						5			
MET646	Technologies for the enrichment of non-ferrous metal ores	1	BD, CCH	6	180	30/0/30	120	E							6		
MET647	Reagent facilities of processing plants	1	BD, CCH	6	180	30/0/30	120	E							6		
M-8. Basic training module for mineral processing																	
MET501	Technological mineralogy		BD, UC	4	120	30/15/0	75	E	4								
MET185	Fundamentals of Mineral Processing (in English)		BD, UC	6	180	30/15/15	120	E			6						
MET502	Ore preparation processes and equipment		BD, UC	5	150	30/15/0	105	E				5					
MSM156	Metrology and standardization in the processing industry		BD, UC	5	150	30/0/15	105	E					5				
MET505	Gravitational enrichment methods		BD, UC	5	150	30/15/0	105	E					5				
MET186	General Metallurgy (in English)		BD, UC	5	150	30/0/15	105	E					5				
MET188	Chemistry of flotation reagents (in English)		BD, UC	4	120	30/0/15	75	E					4				
ERG512	Power supply and electrical equipment of concentrating plants		BD, UC	5	150	30/0/15	105	E						5			
CYCLE OF PROFILE DISCIPLINES (PD)																	
M-9. Module of professional activity on mineral enrichment																	
MIN508	Fundamentals of mining technology		PD, UC	5	150	15/0/30	105	E			5						
MET507	Flotation methods of enrichment		PD, UC	4	120	30/15/0	75	E						4			
MET181	Tall economy and sewage treatment of concentrating factories		PD, UC	5	150	15/15/15	105	E							5		MET153, MET157, MET180
MET161	Assay and control of concentrating processes		PD, UC	5	150	15/15/15	105	E							5		MET180
MET184	Exploitation and repair of concentrating equipment		PD, UC	6	180	30/15/15	120	E							6		MET175
M-10. Professional activity module																	
AAP102	Production practice I		PD, UC	2				R				2					
AAP183	Production practice II		PD, UC	3				R						3			
MET531	Enrichment of polymetallic ores	1	PD, CCH	5	150	15/15/15	105	E						5			
MET648	Technologies for processing uranium-containing ores and concentrates	1	PD, CCH	5	150	30/15/0	105	E						5			

MET419	Enrichment of rare metal ores	2	PD, CCH	4	120	30/15/0	75	E						4			MET175
MET157	Enrichment of ores of ferrous metals	2	PD, CCH	4	120	15/15/15	75	E						4			MET180
MET156	Modeling of concentrating processes	1	PD, CCH	6	180	30/15/15	135	E							6		MET180
MET151	Geotechnological methods of enriching	1	PD, CCH	6	180	30/15/15	120	E							6		MET153
MET536	Enrichment of mining and chemical and non-metallic raw materials	2	PD, CCH	5	150	30/15/0	105	E							5		
MET569	Technology of underground leaching of ores	2	PD, CCH	5	150	30/15/0	105	E							5		
MET570	Magnetic and electrical methods of lightening	1	PD, CCH	5	150	30/15/0	105	E								5	MET175
MET537	Enrichment of ferrous metal ores	1	PD, CCH	5	150	15/15/15	105	E								5	
MET571	Special and combined methods of dressing	2	PD, CCH	5	150	15/15/15	105	E								5	MET175
MET572	Fundamentals of scientific research in ore dressing	2	PD, CCH	5	150	30/15/0	105	E								5	
MET574	Ore beneficiation research	3	PD, CCH	4	120	30/15/0	75	E								4	
MET453	Industrial water supply, transport and tailings of concentrating factories	3	PD, CCH	4	120	30/0/15	75	E								4	MET180
M-11. Module of "R&D"																	
MET564	Design of concentrating factory	1	PD, CCH	5	150	30/15/0	105	E								5	MET153, MET173, MET180
MET649	Digitalization of mining and processing plants	1	PD, CCH	5	150	30/0/15	105	E								5	
M-12. Module of final attestation																	
ECA 103	Final examination		FA	8												8	
Additional type of training (ATT)																	
AAP500	Military training																
Total based on UNIVERSITY:									31	29	28	32	29	31	33	27	
									60		**60**		**60**		**60**		

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	University component (UC)	Component of choice (CCH)	Total
GED	Cycle of general education disciplines	51	0	5	56
BD	Cycle of basic disciplines	0	76	31	107
PD	Cycle of profile disciplines	0	30	39	69
Total for theoretical training:		**51**	**106**	**75**	**232**
FA	Final attestation				8
TOTAL:					**240**

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 - Metallurgy and mineral processing — Barmenshinova M. .

Representative of the Academic Committee from Employers ____Acknowledged____ — Dzhetybayeva U. K.