

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:	Level 6-higher education and practical experience
ORC Level:	Level 6 – a wide range of special (theoretical and practical) knowledge (including innovative ones). Independent search, analysis and evaluation of professional information
Duration of training:	4 years old
Loan:	240

Almaty 2024

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

Protocol No. $\frac{1}{20}$ dated $\frac{3}{20} \times \frac{20}{20}$.

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

Protocol No. 6 dated $(49) \approx 04 = 2024$.

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

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Acade	mic Committe	ee:		,
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Students				
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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 \mathbb{N}_{2} 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 \mathbb{N}_{2} 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 manmade 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 «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;

- independence: executive and C2 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 them solve various choice ways in changing working of to development conditions. Organization of the production process. 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

N⁰	Field name	Note
1	Code and classification	6B07-Engineering, manufacturing and construction industries
	of the field of	
	education	
2	Code and classification	6B072 – Manufacturing and processing industries
	of training areas	
3	Group of educational	B071 – Mining and Mining
	programs	
4	Name of the	Mineral Processing
_	educational program	
5	Brief description of the	The educational program 6B0/213 - "Mineral processing "(code
	educational program	according to the classifier of specialties of higher and
		5B072700 "Minoral 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 mineral and man-made raw materials processing for
		the mining and metallurgical complex of the Republic of
		Kazakhstan, who have professional and personal competencies
		that allow performing calculation and design, production and
		technological, research, organizational and managerial and
		entrepreneurial activities at processing plants and industrial
		facilities.
7	Type of EP	New
8	NQF level	Level 6-higher education and practical experience
9	ORC Level	Level $6 - a$ while range of special (theoretical and practical)
		knowledge (including innovative ones). Independent search,
10	Distinctive features of	
10	the FP	110
11	List of educational	Professional competencies:
	program competencies:	Research competencies:
		Basic competencies and knowledge;
		Communication skills;
		Universal competencies;
		Cognitive competencies;
		Creative competencies;
		Information and communication skills.
12	Learning outcomes of	LO1 - apply knowledge of mathematics, science and technology
	the educational	to solve professional problems.
	program:	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
1		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 manmade 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 manmade waste in a global, economic, environmental and social context. LO9 - the need for lifelong learning and learning on your own. 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 job
14	Duration of training	4 years old
15	Loan volume	240
16	Languages of instruction	Kazakh/Russian
17	Academic degree awarded	Bachelor of Engineering and Technology
18	Developer(s) and	Barmenshinova M. B.
	authors:	Dyusenova S. 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		Generated learning outcomes (codes)									
			credits	L01	LO2	LO3	LO4	L05	LO6	L07	L08	L09	LO10	L011
		Cycle of general edu	cation discip	olines										
		Required co	mponent											
1	Foreign language	English is a compulsary subject. According to the results	10	V										
		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.												
2	Kazakh (Russian) language	Kazakh (Russian) language	10	V										
		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.												
3	Physical Culture	The purpose of the discipline is to master the forms and	. 8	V										
		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.												
4	Information and	The aim of the course is to gain theoretical knowledge in	5				V							
	communication technologies	information processing, the latest information												
	(in English)	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.	-		1.6									
5	History of Kazakhstan	I ne purpose of the discipline is to provide objective	5		V									
		nistorical knowledge about the main stages of the history	1											
		of Kazakhstan from ancient times to the present day; to	1											
1		acquaint students with the problems of the formation and												

		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 Kazelbatan 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			V				
7	Module of socio-politica 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			V				
8	Module of socio-politica 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	lines	V					
		Component of Compo	of choice	miles						

	1									
9	Fundamentals of anti	Purpose: to increase the public and individual legal	5	V						
	corruption culture and law	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.								
10	Fundamentals of economic	Purpose: To develop basic knowledge of economic	5	V		 				
10	and entrepreneurship	processes and skills in entrepreneurial activities	5							
	and one opticitied simp	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								
11	Eundemontals of scientifi	The purpose of the discipline "Fundementals of research	5	V						
11	research methods	methods" is the formation of students' skills and abilities	5	v						
	research methods	includes is the formation of students skins and admittes								
		In the field of methodology of scientific knowledge.								
		Brief description of the discipline. Methodological								
		roundations of scientific knowledge. The concept of								
		scientific knowledge. Methods of theoretical and								
		empirical research. Choice of the direction of scientific								
		research. Stages of research work. Research topic and its								
		relevance. Classification, types and tasks of the								
		experiment. Metrological support of experimental studies.								
		Computational experiment. Methods for processing the								
		results of the experiment. Formulation of research results.								
		Presentation of research work.								
12	Ecology and life safety	Purpose: formation of ecological knowledge and	5	V						
		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								
1		man-made nature.								
13	Basics of financial literacy	Purpose: formation of financial literacy of students on the				V	V	V	V	
		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 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.	disciplines							
		University level	component							
14 N	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	V						
15 N	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		V					
16 F	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 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.	5	V						
17 E g	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.	5	V						

	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.								
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		V					
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			V				
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				V			
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	4	V						

	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.								
22 Fundamentals of M Processing (in English)	lineral 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		V					
23 Ore preparation pro- and equipment	cesses 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 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	5			V				

calculation of mills. Classification.							
24 Metrology and The purpose of the discipline -is to develop knowledge	5			V			
standardization in the and practical skills of future bachelors in the use and							
processing industry 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.							
25 Gravitational enrichmentPurpose. The purpose of teaching the discipline is for	5			V			
methods students to master the theory and practice of gravitational	C						
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 hodies in the environment. Theoretical foundations of							
gravitational enrichment processes Hydraulic							
classification Classification in the centrifugal field of							
forces Envidement of ores in beauty successions							
Soperators for the aprichment of ores in heavy							
suggenerations for the antichment of ores in neavy							
suspensions. Separators for the enrichment of ores in							
neavy 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							
26 General Metallurgy (inPurpose: to form students' knowledge and skills in the	5			V			
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 metalls: metallurgy of							

27 Chemistry of Flotation Purpose: Reagents (in English) flotation r and relate physical a regularitie reagents of	to master the theory and practice of the use of reagents in the flotation of ores of non-ferrous ed rare metals. The structure and composition, and chemical properties of reagent, and the	4			V				
Reagents (in English) flotation r and relate physical r regularitie reagents (reagents in the flotation of ores of non-ferrous ed rare metals. The structure and composition, and chemical properties of reagents, and the	-			•				
and relate physical a regularitie reagents of	ed rare metals. The structure and composition,								
physical a regularitie reagents of	and chamical proparties of reagants and the								
regularitie reagents of									
reagents	es of the mechanism of action of flotation								
	depending on their properties and structure are								
described.									
Content:	students gain knowledge in the field of								
chemistry	of surface phenomena in flotation processes.								
28 Power supply and The main	purpose of the discipline "Power supply and	5				V			
electrical equipment of electrical	equipment of processing plants" is to form								
processing plants students'	solid knowledge in the field of principles of								
building r	power supply of processing plants: the study of								
external	power supply, power sources and methods of								
transmissi	ion 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								
normaliza	tion of illumination and the competent								
applicatio	n of knowledge in calculating electrical loads								
and deterr	mining the power of transformer substations.								
	Cycle of basic	disciplines							
	Component	of choice	 	r					
29 Magnetic and special The purpo	ose of the discipline is as follows: acquaintance	5	V						
enrichment methods with the	main metallurgical processes used in the								
production	n of ferrous metals; acquaintance with modern								
technolog	ies for the preparation and processing of								
metallurg	ical raw materials and aggregates for their								
implemen	itation, directions for their improvement,								
including	from the point of view of environmental								
triendline	ss, efficient use of energy resources and the								
possibility	y of waste-free production; familiarization with								
the theore	etical foundations and description of specific								
metallurgi	ical processes, the basics of technological								
calculation	t the main indicators of processes								
equipmen	The role of magnetic and special enrichment								
Contanta	The fole of magnetic and special enrichment		1	1					
Contents:	in industry Conditions affacting the indicators								
Contents: methods i	in industry. Conditions affecting the indicators								
enrichment methods with the production technolog metallurgi implemen including friendline possibility the theore metallurgi calculation equipmen	main metallurgical processes used in the n of ferrous metals; acquaintance with modern ies for the preparation and processing of ical raw materials and aggregates for their tation, directions for their improvement, from the point of view of environmental ss, efficient use of energy resources and the y of waste-free production; familiarization with etical foundations and description of specific ical processes, the basics of technological ns, selection of raw materials and selection of t, the main indicators of processes.								

		and its nonemators. Magnetic monorties of minorals. The								
		and its parameters. Magnetic properties of minerals. The								
		ninuence of the magnetic properties of innerals of the								
		process of magnetic enformment. 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	Purpose: Knowledge about the methods of ore and man-	5		V					
	ores and man-made rav	vmade raw materials enrichment, as well as various								
	materials	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.								
31	Hydroaeromechanics o	fIn the discipline, the physical properties of liquids and	5			V				
	enrichment processes	gases, the basics of hydrostatics and hydrodynamics, the	-							
	I I I I I I I I I I I I I I I I I I I	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								
		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	5			V		-		
		technological processes of coal enrichment using various	5			•				
		methods and techniques aimed at improving their quality								
31	Hydroaeromechanics o enrichment processes	ways of processing man-made raw materials in order to extract valuable metals. fIn 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 porous partitions, two And three-phase systems, suspensions, hydroaeromechanical processes occurring during the enrichment of minerals, aeration and mixing of suspensions The purpose of this discipline is to study the technological processes of coal enrichment using various methods and techniques aimed at improving their quality	5			V				

and increasing production efficiency. The content of the discipline includes the study of main theoretical and practical aspects of coal enrichment including the physico-chemical properties a composition of coals, methods and technologies enrichment, as well as equipment and tools used in the processes.	ne .t, .d of se								
33 Processes and devices processing production of Goal: students master the theory of enrichment process of various types of mineral raw materials; 2) stude master the practice of operating devices used in beneficiation of mineral raw materials: 3) teach stude to navigate the variety of processes and devices used the beneficiation of mineral resources, select and just optimal schemes and options for preparatory, main a auxiliary processes, draw up technological and hardw diagrams; 4) instilling skills in the active use of techni literature when studying issues of disintegration; Contents: Screening and classification process Screening and classification devices. Crushing a grinding processes. Apparatus for crushing and grindin Processes of gravitational enrichment. Apparatuses magnetic and electrical methods. Flotation process Apparatus for flotation enrichment processes. Special a combined enrichment processes. Dehydration processes Apparatus for dehydration processes.	es 5 ts in fy in fy id re al s. id g. or of s. id s.			V					
34 Auxiliary economy mineral processing and their subsequent processing. To do this, in necessary to be able to quickly and efficiently organ the processes of ore transportation, sorting a enrichment, as well as ensure reliable maintenance equipment and mechanisms. Content: An important aspect is the environmental safe of production processes in order to minimize the negat impact on the environment.	of 5 is is is id of i y re			V					
35 Fundamentals of sustainable Purpose: the goal is for students to master the theoreti development and ESG projects in KazakhstanESG foundations and practical skills in the field of sustainal development and ESG, as well as to develop understanding of the role of these aspects in the mode economic and social development of Kazakhstan. Contents: introduces the principles of sustainal	al 5 le n n				V	V	V	V	

		development and the implementation of ESG practices in							
		Kazakhstan includes the study of national and							
		international standards analysis of successful FSG							
		projects and strategies for their implementation in							
		onterprises and organizations							
26	Automation of production	The course provides for the study of the following main	5			V			
50	Automation of production	topics for mestering the discipline of oprichment	5			v			
	plocesses at concentrating	giopics for mastering the discipline of enforment							
	plants	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.							
37	Flotation reagents in minera	The main goal of studying this discipline is to understand	5			V			
	processing	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,							
		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,							

-						1			1	1 1		
		methods of preparation, structure and properties. Organic										
		depressants, methods of preparation, structure and										
		properties. Flocculants, methods of production, structure										
		and properties.										
3	8 Legal regulation	of Purpose: the goal is to form a holistic understanding of	5					V	V	V		V
	intellectual property	the system of legal regulation of intellectual property,										
	1 1 2	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										
3	9 Theory and practice	ofPurpose: theoretical and practical training of students in	5		1			V				
5	hydrometallurgical processe	s the field of hydrometallurgical processes of production of	5					v				
	nyurometanurgicar processe	metals and non-ferrous metal allows to solve practical and										
		scientific problems in the study selection and										
		implementation of innovative technologies in										
		matallurgical practice										
		Contents: Carbonates and oxides formation and thermal										
		dissociation Detterns of formation and thermal										
		dissociation of oxides and carbonates. Peduction of										
		matal avides Thermodynamics and kinetics of										
		metallurgical malta. Thermodynamics and kinetics of the										
		head the second se										
		benavior of narmiul impurities. Theoretical foundations										
		of the processes occurring during oxidative refining,										
_		desulturization, deoxidation and degassing of iron melts.										
4	0 Development of innovati	vellihe main goal of the development of innovative										
	equipment in enrichment	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										
		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.										
4	1 Fundamentals of Artifici	alPurpose: to familiarize students with the basic concepts,	5	V	V						V	V

Intalliganca	methods and technologies in the field of artificial							
intelligence	intelligence: machine learning computer vision netwol							
	languaga processing etc.							
	Contente: general definition of artificial intelligence							
	intelligent agents information rational and state anage							
	avaloration logical agents architecture of artificial							
	intelligence systems expert systems observational							
	lagming statistical lagming methods probabilistic							
	magazzing of linguistic information computing medals							
	processing of iniguistic information, semantic models,							
42 Taskaslasian fam	natural language processing systems.	5			V			
42 Technologies for	the ine purpose of this discipline is to study methods and	5			v			
enrichment of non-fe	errousteennologies aimed at increasing the concentration of							
metal ores	non-terrous 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.						 	
43 Reagent economy	of The purpose of this discipline is to study the basics of	6				V		
concentrating plants	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.							
44 Tall economy and se	ewagePurpose: to study and develop effective methods for the	6				V		
treatment of concent	ratingtreatment and purification of wastewater generated during							
factories	the mining process.							
	Contents: Wastewater treatment plays a key role in							
	preventing pollution of water resources and preserving							
	biodiversity. Modern technologies make it possible to							
	effectively remove pollutants from wastewater, reducing							
	their impact on the environment.							
	Cycle of profile	disciplines	;					נ
	University level	component	t					
1								

45 Assay and control concentrating processes	of 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			<i>√</i>		
46 Exploitation and repair concentrating equipment	of 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.	5					
47 Fundamentals of mini technology	ngPurpose: 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	6					

	1		$\mathbf{M}_{\mathbf{M}} = \mathbf{M}_{\mathbf{M}} + $					1		
10		.1 1	complexes. Methods of intra-quarry ore averaging.			14			-	
48	Flotation	methods	of Purpose: to provide students with the necessary	5		V				
	enrichment		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							
			toundations 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,							
			toaming 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							
10		<u> </u>	the flotation department of the factory.				 			
49	Enrichment	of polymeta	IncPurpose: To study the features of the technology of	4			V			
	ores		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,							
			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.							

		Cycle of profile Component by to	disciplines your choic	e						Proce
							T 4	 		
50	0 Technologies for processingpurpose: to have fundamental kn	nowledge in the field of	5				V			
	uranium-containing ores and enrichment and processing of uran	nium-containing mineral								
	concentrates faw materials, as wen as to have	bis technology								
	Contents: Mechanical processing	this technology.								
	and corbonate leaching of uran	ium oros Underground								
	leaching of uranium. The phenom	henon of well colmation								
	Condensation Sorption method or	f uranium concentration								
	Classification of ion-exchange	materials and basic								
	requirements for ionites Rege	pheration of a sorbent								
	saturated with uranium.	inclution of a solution								
51	1 Enrichment of rare metal orespurpose: theoretical and practical	l training of students in	5				V			
_	the field of traditional and m	odern technologies for	-							
	processing raw materials contai	ning precious and rare								
	metals.	01								
	Contents: Types and deposits of	f rare ores. Preliminary								
	enrichment of ores and placer	s of rare metals. Ore								
	preparation operations for proces	sing ores and placers of								
	rare metals. Technology of enrich	ment and integrated use								
	of the main types of ores and plac	ers.								
52	2 Dewatering and dust Purpose: to maintain an optima	al level of humidity in	4				V			
	collection(ССО да кате materials and the environment	. This helps to avoid								
	жазылган) various problems such as the dest	truction of materials, the								
	growth of bacteria and mold, corr	rosion of equipment and								
	other negative consequences.									
	The content of the discipline inclu	udes the study of various								
	methods and technologies of	dewatering and dust								
	collection, the principles of	their operation, the								
	characteristics of various types	s of equipment, safety								
	measures and environmental aspe	cts of this process.	4						 	
53	3 Modeling of concentrating The purpose of the discipline is	s to study methods and	4				V			
	processes techniques of mathematical	modeling of mineral								1

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			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							
	54 Geote	echnological methods	of The purpose of this discipline is to teach students the	6				V		
	enric	hing	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.							
	55 Enric	chment of mining a	ndPurpose: students to master general information about the	6				V		
	chem	nical and non-metal	liccharacteristics of mining and chemical and non-metallic							
	raw r	materials	raw materials, the principles of enrichment of raw							
			materials of phosphorus, sulfur, boron, asbestos,							
			wollastonite, silica, clays and their equipment; formation							
1			of students' practical skills and research skills in							
			preparing raw materials for enrichment.							
			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.								
ľ	56	Fechnology of underground	The purpose of the discipline: to study the principles.	5					V		
	1	eaching of ores	methods and technologies of ore leaching by underground	U					·		
	Ĩ		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								
ŀ	57	Magnetic and electrical	The purpose of studying the discipline: the formation of	5					V		
	571	nethods of lightening	students' knowledge bases the development of	5					•		
		nethous of fightening	professional skills and primary skills in the field of								
			electrical magnetic and special enrichment methods and								
			in assessing the parameters of enrichment processes and								
			no assessing the parameters of enfectiveness								
			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:								
	591	Enrichment of forrous metal	Burpose: Theoretical and practical training of students in	5						V	
	501	small of terrous metal	the field of traditional and modern technologies for	5						v	
		nes	me neid of traditional and modern technologies for								
			and technologies for their processing at factories in								
			Kazakhetan content: The material composition of ore raw								
			materials. Theoretical foundations and features of the								
			antichment of various formous and Classification of ore								
			dupped a methods and messages based or construction								
			forces Schemes and devices for the antickment of								
			norces. Schemes and devices for the enrichment of								
1			magnetice, internationagnetice and other ores of complex		1	1		1			

		composition ovidation of iron area and quartzitas brown								
		iron or manganase and abromium area aerbonate iron								
		in on one, manganese and enformation of factories for the								
		and manganese ores. The experience of factories for the								
		enformment 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.								
59	Special and combined	The purpose of the study: the acquisition by students	5					V		
	methods of dressing	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								
		Drocessing of complex or processing of collective								
		concerning of complex ores. Processing of collective								
		concentrates. Processing of complex ofes and concentrates								
()	Endomentale of eximiti	Concentrates. Refinement of concentrates.	5						V	
60	Fundamentals of scientific	r Purpose: to form the student's knowledge, skills and	5						v	
	research in ore dressing	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;								
		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							
61	Ore beneficiation research	Purpose: the formation of qualified scientific knowledge	5					V	
		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.							
62	Industrial water supply	, The purpose of studying this discipline is to ensure the	4						V
	transport and tailings of	ofproper functioning of all engineering systems necessary							
	concentrating factories	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							
		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.	+	V
63 Design of concentrating the purpose of teaching the discipline is to study the 4		v
factory 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 interature.		
Determination of the meduativity of the feature		
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		
screening equipment. Screenion and calculation of		
flushing and desalination. Selection and justification of		
arinding 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		
iustification 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		

		plants.							
64	Digitalization of mining and	The purpose of the discipline is to study the basic	5						V
	processing plants	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 Curriculum of the educational program

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





CURRICULUM of Educational Program on enrollment for 2024-2025 academic year

Educational program 6B07213 - "Mineral processing" Group of educational programs B071 - "Mining and extraction of minerals"

Form of study: full-time Duration of study: 4 years Academic degree: Bachelor of Engineering and Technology

			Total		T	SIS		A	llocation o	f face-to-f	g based on	based on courses and semester			
Discipline			amount in	Total	classroom	(including	Form	Lee	urse	ILCO	urse	III c	ourse	IVe	ourse
code	Name of disciplines	Cycle	academic	hours	volume of	TSIS) in	of	1	2	2	4		, c		ourse
			credits		lek/lab/pr	hours	control	I	semester	Somester	4 somestor	Samastar	0 comostor	7	8
CYCLE	OF GENERAL EDUCATION D	ISCIPI	INES (GEI))				semester	semester	semester	semester	semester	semester	semester	semester
				-)	M-1.	Module of I	anguage	training							
		GED				inoutic of i	anguage	training		1		1		-	1
LNG108	English language	RC	5	150	0/0/3	105	E	5							
LNG108	English language	GED,	5	150	0/0/3	105	E		5						
LNG104	Kazakh (Russian) language	GED,	5	150	0/0/3	105	Е	5							
LNG104	Kazakh (Russian) language	GED,	5	150	0/0/3	105			5						
		RC			14.2										
RERIOI				_	M-2.	Module of [physical	training	1						
104	Physical Culture	GED, RC	8	240	0/0/8	120	Difcred it	2	2	2	2				
	Г				M-3. Mo	dule of info	rmation	technolog	у						
CSE677	Information and communication technologies (in English)	GED, RC	5	150	2/1/0	105	Е				5				
					M-4. Modu	le of socio-	cultural	developm	ent						
		GED					conurdi	acreiopin							
HUM137	History of Kazakhstan	RC	5	150	1/0/2	105	SE		5						
HUM132	Philosophy	GED, RC	5	150	1/0/2	105	Е		_		5		-		
HUM120	Socio-political knowledge module (sociology, politology)	orp	3	90	1/0/1	60	Е				3				
HUM134	Socio-political knowledge module (culturology, psychology)	RC	5	150	2/0/1	105	E			5					
10			M-5	. Modu	le of anti-co	rruption cu	liture, ec	ology and	life safety	hase					
and a second second	The base of anti-corruption					riupiion ca	inture, ee	ology and	me safety	Dase					
HUM136	culture and law														
MNG489	Fundamentals of economics and														
HPP128	Fundamentals of research	GED, CCH	5	150	2/0/1	105	Е			5					
	methods														
CHE656	Ecology and life safety														
MNG564	Basics of Financial Literacy														
CYCLE O	F BASIC DISCIPLINES (BD)														
				M-6	. Module of	f physical a	nd math	ematical to	raining						
MAT101	Mathematics 1	BD, UC	5	150	1/0/2	105	Е	5							
PHY468	Physics	BD, UC	5	150	1/1/1	105	Е	5							
MAT102	Mathematics II	BD, UC	5	150	1/0/2	105	Е		5		_				
					M-7.	Module of	basic tra	ining							
GEN429	Engineering and computer graphics	BD, UC	5	150	1/0/2	105	Е	5							
CHE495	Chemistry	BD,	5	150	1/1/1	105	Е		5						
CHE127	Physical chemistry	BD,	5	150	1/1/1	105	E			5					
MET516	Magnetic and special	UC			1/1/1					-					
	enrennent methods	BD,													
MET642	Enrichment of gold-bearing ores and technogenic raw materials	GED, RC GED, CCH BD, UC BD, UC BD, UC BD, UC BD, UC BD, UC BD, UC BD, CCH	5	150	2/0/1	105	E			5					

5 V

		-	-	-		-									
MET51	2 Hydroaeromechanics of processing processes	BD, CCH	5	150	2/1/0	105	E				5				
MET64	Coal enrichment Basics of automation	BD,	6	100	2/1/0										
METSO	Processes and devices of	UC	5	150	2/1/0	105	E					5 .			
IVIE 152	processing production	-			2/1/0	_									
ME152.	processing	BD, CCH	5	150	2/0/1	105	5 E					5			
MNG56	development and ESG projects in Kazakhstan				2/0/1										
AUT427	Automation of production processes at concentrating plants	s			1/1/1										
MET517	Flotation reagents in mineral processing	CCH	5	150	2/1/0	105	E						5		
MNG56	Legal regulation of intellectual property				2/0/1										
MET644	Theory and practice of hydrometallurgical processes				2/0/1										
MET645	Development of innovative equipment in enrichment	BD, CCH	5	150	2/0/1	105	E						5		
CSE831	Fundamentals of Artificial Intelligence				1/0/2										
MET646	Technologies for the enrichment of non-ferrous metal ores	BD,	6	180	2/0/2	120	E							•	
MET647	Reagent facilities of processing plants	- CCH	0	180	2/0/2	120	E							6	
AAP173	Educational practice	BD, UC	2		0/0/2				2						
	1			M-	8. Basic tr	aining mod	lule for m	ineral pro	cessing						
MET501	Technological mineralogy	BD, UC	4	120	2/1/0	75	E	4							
MET185	Fundamentals of Mineral Processing (in English)	BD, UC	6	180	2/1/1	120	E			6					
MET502	Ore preparation processes and equipment	BD, UC	5	150	2/1/0	105	E				5				
MSM156	Metrology and standardization in the processing industry	BD, UC	5	150	2/0/1	105	Е					5			
MET505	Gravitational enrichment methods	BD, UC	5	150	2/1/0	105	Е					5			
MET186	General Metallurgy (in English)	BD, UC	5	150	2/0/1	105	E		-			5			
MET188	Chemistry of flotation reagents (in English)	BD, UC	4	120	2/0/1	75	E					4			
ERG512	Power supply and electrical equipment of concentrating plants	BD, UC	5	150	2/0/1	105	E						5		
CYCLE	OF PROFILE DISCIPLINES (P	D)					-								
				M-9. M	odule of pr	ofessional	activity o	n mineral	enrichmen	t					
MET181	I all economy and sewage treatment of concentrating factories	PD, UC	5	150	1/1/1	105	E							5	
MET161	Assay and control of concentrating processes	PD, UC	5	150	1/1/1	105	E							5	
MET184	Exploitation and repair of concentrating equipment	PD, UC	6	180	2/1/1	120	E					-		6	
MİN508	Fundamentals of mining technology	PD, UC	5	150	1/0/2	105	Е				5				
MET507	Flotation methods of enrichment	PD, UC	4	120	2/1/0	75	E						4		
				1 1	M-10.	Profession	al activit	module]
MET531	Enrichment of polymetallic ores	PD			°1/1/1										
MET648	Technologies for processing uranium-containing ores and concentrates	ССН	5	150	2/1/0	105	Е						5		
MET419	Enrichment of rare metal ores	PD,	4	120	2/1/0	74							7950		
MET157	Enrichment of ores of ferrous metals	ССН	4	120	1/1/1	75	Е						4		
MET156	Modeling of concentrating processes	PD.			2/1/1										
MET151	Geotechnological methods of enriching	ССН	6	180 -	2/1/1	120	E							6	
MET536	Enrichment of mining and chemical and non-metallic raw materials	PD,	5	150	2/1/0	105	E							5	
		101.02 State 101		here a											

								6	50	1	50		50	6	0
	Total based on UNIVERSITY:							31	29	28	32	29	31	33	27
AAP500	Military affairs	ATT	0												
					M-13. Mod	ule of addi	tional typ	es of trair	ning				L		
ECA109	Writing and defense of the thesis / project	FA	8												8
					M-12	. Module o	f final att	estation							
MET649	Digitalization of mining and processing plants	CCH	5	150	2/0/1	105	E			_					5
MET564	Design of concentrating factory	PD,	5	150	2/1/0	105	F								
					N	1-11. Modu	le of "Rð	&D''							
AAP183	Production practice II	PD, UC	3		0/0/3								3		
AAP180	Production practice I	BD, UC	2		0/0/2						2				
MET453	Industrial water supply, transport and tailings of concentrating factories	PD, CCH	4	120	2/0/1	75	Е							-	4
MET574	Ore beneficiation research				2/1/0										
MET572	Fundamentals of scientific research in ore dressing	ССН		150	2/1/0	105	E								5
MET571	Special and combined methods of dressing	PD,	5	150	1/1/1	105	F	1							
MET537	Enrichment of ferrous metal ores	ССН	5	150	1/1/1	105	L								5
MET570	Magnetic and electrical methods of lightening	PD,	5	150	2/1/0	105	F								
MET569	Technology of underground leaching of ores				2/1/0										

	Number of credits for the en	tire perio	d of study	,						
	Cycles of disciplines	Credits								
Cycle code		required component (RC)	university component (UC)	component of choice (CCH)	Total					
GED	Cycle of general education disciplines	51		5	56					
BD	Cycle of basic disciplines		74	31						
PD	Cycle of profile disciplines		32	39	176					
	Total for theoretical training:	51	106	75	232					
FA	Final attestation	8			8					
	TOTAL:	59	106	75	240					

Decision of the Academic Council of KazNRTU named after K.Satpayev. Protocol No<u>12, 22. D4, 2024</u> Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Protocol No<u>6, 19.04, 2024</u> Decision of the Academic Council of MaMI named after O. Baikonurov. Protocol No<u>7, 27. 03. 2024</u>

Vice-Rector for Academic Affairs
Director of the Mining and Metallurgical Institute named after
O. A. Baikonurov
Head of department "Metallurgy and mineral processing"
Representative of the employers' council of the LLP "KAZ Minerals"
Representative of the employers' council of the JSC "Corporation Kazakhmys"
Representative of the employers' council of the Weizmann RI
B. Kashway
A.K. Arinov
Representative of the employers' council of the Weizmann RI
B. Kashway
A.K. Kaplan