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

EDUCATIONAL PROGRAM

8D07214 - Mineral processing

Code and classification of the field of education:	8D07 – Engineering, manufacturing and construction industries
Code and classification of training areas:	8D072 – Manufacturing and processing industries
Group of educational programs:	D118 – Mineral processing
The level of the NRK:	8
ORC Level:	8
Duration of training:	3 years
Volume of loans:	180

Almaty 2025

The educational program «8D07214 - 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 «8D07214 - Mineral processing» was developed by Academic committee based on direction of «8D072 – 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:				
Shautenov M.R.	c.t.s., docent	Professor of the Department of MaMP	KazNRTU named after K.I.Satpaeva	
Telkov Sh.A.	c.t.s., docent	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:				
Kucherbaev B.R.	master of engineering science	Doctoral student 2 year of study	JSC «AK Altynalmas»	

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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 - State obligatory 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;

SQF - Sectoral Qualifications Framework;

LO - learning outcomes;

KC - key competencies;

SDG - Sustainable Development Goals.

1. Description of the educational program

Theoretical training accounts for 45 academic credits in the total volume of the doctoral program and consists of cycles of basic (hereinafter referred to as basic disciplines) and profile (hereinafter referred to as profile disciplines, which include the disciplines of the university component (hereinafter referred to as the University component) and the elective component (hereinafter referred to as the Elective Component), practice. At the same time, the ratio of the volume of basic disciplines and profile disciplines is determined by organizations of higher and postgraduate education independently.

The list of disciplines of the university component and the elective Component is determined by the organizations of higher and postgraduate education independently. This takes into account the needs of the labor market, the expectations of employers, and the needs and interests of doctoral students.

The programs of disciplines and modules, as a rule, are interdisciplinary and multidisciplinary in nature, providing training at the junction of a number of fields of knowledge.

Doctoral training is carried out in two directions:

1) scientific and pedagogical (PhD) - based on the Master's degree program;

2) specialized, including an industrial PhD program and a DBA program – based on a master's degree or higher specialized education program equivalent to a specialized master's degree.

Upon admission, if the profile of the doctoral program does not match the master's degree program, the doctoral student is given prerequisites for mastering, which must cover the main learning outcomes of the program profile of the previous level of education.

The list and amount of necessary prerequisites and the time frame for their development are determined by higher and postgraduate education organizations independently.

The educational program for the preparation of a doctor in the profile involves fundamental educational, methodological and research training, experimental research work in the relevant field of professional activity in mineral processing.

Doctoral educational programs in terms of professional training are developed based on the study of the experience of foreign organizations of higher and postgraduate education and research centers that implement accredited PhD or doctoral training programs.

The educational program includes the following stages of doctoral students' training: research methods, academic writing, current trends in the field of ore preparation of mineral and man-made raw materials, current trends in the theory and practice of processing ores and man-made raw materials by flotation methods, science of sustainable development, current trends in the theory and practice of processing ores and man-made raw materials by gravity methods, new raw materials sources of raw materials and waste recycling, current trends in

wastewater treatment and auxiliary facilities of processing plants, theory and practice of operation and repair of processing equipment.

The educational program of the specialized doctoral program includes industrial practice.

The doctoral student's internship is conducted in order to consolidate the theoretical knowledge gained during the training process and improve his professional level.

The doctoral student's internship in the specialized doctoral program in the field of Engineering, Manufacturing and Construction Industries is conducted on the basis of a partner enterprise in order to form doctoral students with fundamental integrated scientific knowledge and professional competencies, a strategic vision for the development of the industry, the ability to create scientific applied innovations, and generate new engineering solutions.

The content of the production practice is determined by the topic of the doctoral thesis.

The scientific component of the doctoral program is formed from the experimental research work (hereinafter referred to as the experimental research work of a doctoral student) of a doctoral student, scientific publications, writing and defending a doctoral thesis.

The volume of experimental research work of a doctoral student is 123 academic credits in the total volume of the doctoral program.

organizations of higher and postgraduate education independently determine the form, place and timing of the organization of experimental research work of a doctoral student.

As part of the experimental research work of a doctoral student, an individual doctoral student's work plan for familiarizing himself with innovative technologies and new types of production provides for mandatory internships in scientific organizations and (or) organizations of relevant industries or fields of activity, including abroad.

The OVPO independently determines the place and time of the doctoral student's internship, while the duration of the internship is at least 30 calendar days.

The content of the internship program corresponds to the doctoral student's research profile.

The internship program is approved by organizations of higher and postgraduate education in conjunction with the organization on the basis of which the internship is organized.

The internship is carried out by persons who have preliminary research results and/or publications on the research topic.

The results of the internship are reviewed at a scientific seminar of higher and postgraduate education organizations.

Requirements for the experimental research work of a doctoral student studying under the Doctor's degree program:

1) compliance with the main issues of the educational program of the doctoral program on which the doctoral thesis is being defended;

2) relevant and contains scientific novelty and practical significance;

3) it is based on modern achievements of science, technology and production and contain specific practical recommendations, independent solutions to complex, cross-functional management tasks.;

4) performed using advanced information technology;

5) contains experimental and research (methodological, practical) sections on the main protected provisions.

The experimental research work of doctoral students in the field of education "Engineering, manufacturing and construction industries" is carried out on the basis of a partner enterprise and is aimed at conducting applied research, developing an innovation proposal in the form of a technical solution recognized in accordance with the Methodology for determining the levels of technology readiness and technological readiness of organizations., approved by the Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated January 10, 2025 No. 8 (registered in the Register of State Registration of Regulatory Legal Acts under No. 35634).

Every year, at the end of the academic year, a doctoral student is certified for the implementation of an individual work plan. The procedure for the certification of a doctoral student is determined by the organizations of higher and postgraduate education independently.

The doctoral thesis is carried out during the experimental research work of the doctoral student.

The final result of the experimental research work of a doctoral student is a doctoral dissertation.

To manage the doctoral thesis, the doctoral student is assigned scientific guidance within two months after enrollment.

The scientific leadership is approved by the order of the rector of higher and postgraduate education organizations based on the decision of the Academic Council.

The scientific guidance of doctoral students for the degree of doctor in the profile or DBA is carried out by consultants in the number of at least 2 people, one of whom is a highly qualified specialist in the relevant industry or field of activity.

Scientific consultants ensure the completion of the doctoral thesis and compliance with the principles of academic integrity, and timely submission of the thesis for defense.

The topic of the doctoral thesis is determined during the first semester and approved by the decision of the academic Council. Taking into account the results of the experimental research work of the doctoral student and (or) the experimental results obtained or the re-approval of the scientific justification of the dissertation research, it is allowed to adjust the topic of the doctoral thesis.

When information for official use or materials containing state secrets, as well as those constituting a commercial secret, is included in the content of the dissertation research, the topic and dissertation research are assigned the appropriate stamp in accordance with the procedure established by law.

The content of the dissertation research is aimed at the implementation of national priorities, fundamental or applied research.

The main results of the doctoral student's research are published in scientific, scientific-analytical and scientific-practical publications in accordance with the Order of the Minister of Education and Science of the Republic of Kazakhstan dated March 31, 2011 No. 127 "On approval of the Rules for awarding degrees" (registered in the Register of State Registration of Regulatory Legal Acts under No. 6951).

The educational programs of the doctoral program are structured according to the principle of modular learning.

The final certification is at least 12 academic credits in the total volume of the doctoral program and is conducted in the form of a dissertation or a series of articles, the requirements for which are provided by the Rules for Awarding Degrees approved by Order of the Minister of Education and Science of the Republic of Kazakhstan dated March 31, 2011 No. 127 (registered in the Register of State Registration of Regulatory Legal Acts under No. 6951).

The doctoral thesis is checked for the detection of borrowing of the text by other authors, which is carried out by the National Center for State Scientific and Technical Expertise.

The purpose of the final certification of educational programs of the specialized doctoral degree in the field of Engineering, manufacturing and construction industries is to assess the doctoral student's contribution to the research and (or) innovative development of a partner enterprise, engineering and technical solutions and the level of formation of professional and managerial competencies, readiness to independently perform professional tasks and the compliance of his training with the requirements of professional standards and the educational program of doctoral studies.

2. The purpose and objectives of the educational program

The purpose of OP «8D07214 – Mineral processing» is:

– training of doctors with deep theoretical knowledge and practical skills for scientific and technological support of mineral and man-made raw materials processing in the real sector of the economy, with an emphasis on innovative and sustainable technologies that contribute to quality education, rational use of resources, improvement of industrial infrastructure, minimization of environmental impact and achievement of sustainable development.

The objectives of OP «8D07214 – Mineral processing» are:

– to possess knowledge in the field of the theoretical foundations of rational processing of mineral and man-made raw materials, to find non-standard and alternative solutions, to be able to generate new ideas, to critical thinking;

– apply advanced knowledge in the field of preparation and processing of mineral and man-made raw materials based on various methods of ore preparation and enrichment in their professional activities;

– apply applied software tools and modern information processing methods;

– to conduct a scientific search for the necessary new information on technological processes in the field of mineral and man-made raw materials processing for their targeted use for scientific purposes;

– to conduct independent scientific research, to teach the rational, integrated and ecological use of mineral and man-made raw materials;

– demonstrate leadership in science and practice in the mining and processing industry.

3. Requirements for evaluating the learning outcomes of an educational program

Evaluation of doctoral students' learning outcomes is carried out in accordance with the principles of academic integrity, objectivity, transparency and compliance with the goals of the educational program. The main focus is on the formation of doctoral students' research and analytical competencies, as well as the successful completion of scientific research and the defense of a dissertation.

The main components of the assessment:

1. Mastery of academic disciplines

– intermediate certification is carried out at the end of each training course;

– assessment scales approved by the university are used (for example, the 100-point scale, ECTS);

– the results of written and oral exams, presentations, case studies, written papers and scientific reviews are taken into account.

2. Research work

– the quality of the implementation of the individual curriculum (IC) of the doctoral student is assessed;

– research results, participation in grants, conferences, seminars are analyzed;

– special attention is paid to the progress in the implementation of the dissertation project.

3. Publication activity

– the publication of scientific articles in international or national peer-reviewed journals recommended by the Committee for Quality Assurance in Science and Higher Education is a mandatory requirement.;

– for admission to the thesis defense, it is necessary to have at least one (1) scientific work in publications indexed in the Scopus and/or Web of Science databases.

4. Completion of a foreign scientific internship

– lasting at least 1 (one) month;

– it is confirmed by the report, the feedback from the host party and the presentation of the scientific results of the internship.

5. Interim and final attestation

– annual report on the implementation of the IC (evaluated by the supervisor, the department and the dissertation council);

– pre-defense of the dissertation work, which evaluates the degree of readiness of the dissertation research;

– thesis defense before the dissertation council with the participation of external reviewers.

6. The final assessment of the doctoral student includes:

– successful development of the educational component of the program;

– execution and protection of original research;

– compliance of the dissertation with the requirements for scientific novelty, validity of the results and practical significance.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	8D07 - Engineering, manufacturing and construction industries
2	Code and classification of training areas	8D072 - Manufacturing and processing industries
3	Group of educational programs	D118 – Mineral processing
4	Name of the educational program	8D07214 – Mineral processing
5	Brief description of the educational program	The educational program for the preparation of a doctor in the profile involves fundamental educational, methodological and research training, experimental research work in the relevant field of professional activity in mineral processing.
6	Goal EP	Training of doctors with deep theoretical knowledge and practical skills for scientific and technological support of mineral and man-made raw material enrichment processes in the real sector of the economy, with an emphasis on innovative and sustainable technologies that contribute to quality education, rational use of resources, improvement of industrial infrastructure, minimization of environmental impact and achievement of sustainable development.
7	View EP	New
8	The level of the NQF	8
9	Software level ORC	8
10	Distinctive features of the EP	no
11	List of competencies of the educational program:	Professional competencies; Research competencies; Basic competencies and knowledge; Communication competencies; Universal human competencies; Managerial competencies; Cognitive competencies; Creative competencies; Information and communication competencies.
12	Learning outcomes of the educational program:	PO1 - Концептуализируют и развивают теоретические основы рациональной переработки минерального и техногенного сырья, формулируя новые научные гипотезы и методологические подходы. Создают и валидируют альтернативные технологические решения, учитывающие принципы устойчивого развития, минимизации отходов и повышения ресурсной эффективности, внося значимый вклад в эволюцию отраслевой науки и инженерной практики. PO2 - Интерпретируют, модифицируют и трансформируют современные методы подготовки и переработки сырья, разрабатывая оригинальные научно-технические решения. Интегрируют принципы циркулярной экономики и

		экологической безопасности в профессиональную практику, формируя новые научные парадигмы и стратегии ресурсосбережения. РО3 - Разрабатывают и адаптируют интеллектуальные цифровые платформы и методы обработки больших данных, направленные на оптимизацию технологических процессов. Создают цифровые решения и инструменты автоматизации, обеспечивающие устойчивость, инновационность и гибкость горно-обогатительных производств в условиях технологической трансформации. РО4 - Ведут передовой научный поиск и синтезируют критически важные данные, формируя авторские подходы к оценке и оптимизации процессов обогащения сырья. Обосновывают и внедряют системы ответственного ресурсопользования, направленные на снижение зависимости от невозобновляемых ресурсов и экологических рисков. РО5 - Проводят оригинальные научные исследования и создают авторские модели рационального и комплексного использования сырья, формируя устойчивые технологические решения в ответ на глобальные экологические вызовы. Осуществляют трансфер знаний, обучая профессиональное сообщество и содействуя формированию экологически ответственной индустрии. РО6 - Выступают научными лидерами в области переработки минерального и техногенного сырья, инициируя и координируя международные исследовательские проекты. Продвигают научные инновации и формируют глобальные партнерства, направленные на трансформацию отрасли через генерацию и распространение новых знаний.
13	Form of training	Full - time
14	Duration of training	3 years
15	Volume of loans	180
16	Languages of instruction	Kazakh, Russian, English
17	Academic degree awarded	Doctor of Industry in the educational program «8D07214 – 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	LO5	LO5	LO6
Cycle of basic disciplines University component									
1	Methods of scientific research	Purpose: It consists in mastering knowledge about the laws, principles, concepts, terminology, content, specific features of the organization and management of scientific research using modern methods of scientometry. Contents: structure of technical sciences, application of general scientific, philosophical and special methods of scientific research, principles of organization of scientific research, methodological features of modern science, ways of development of science and scientific research, the role of technical sciences, computer science and engineering research in theory and practice.	5	V	V			V	
2	Academic writing	Purpose: To form the system competencies of doctoral students and young researchers in the field of academic writing as a key tool for scientific communication and publication activities. Content: Scientific discourse and academic communication; Typology of scientific texts: from dissertation to publication; Creation of original scientific content; Scientific text: structure and logic of construction; Comparative analysis of sources and preparation of a literary review; Work with metadata and scientometric tools; Preparation of articles for international peer-reviewed journals; Work with reviews and the scientific community; Academic mobility and grant support for research; Annotations, patents, reports: science beyond the article; Planning of publication strategy and research career; English language of scientific communication.	5			V			V
Cycle of basic disciplines Elective component									
3	Current trends in the field of ore preparation of mineral and man-made raw materials	Purpose: To provide students with a systematic scientific understanding of current trends and promising areas in the field of ore preparation of mineral and man-made raw materials, including deep processing, mathematical and multiphysical modeling of processes, the use of artificial intelligence and big data analysis, as well as the development and optimization of technological schemes of a new generation. Contents: Introduction to modern trends in the processing of mineral and man-made raw materials; Prospects for deep processing of mineral raw materials and closed cycles; New approaches to the preparation and modification of the surface of mineral particles; Mathematical modeling of grinding, classification and separation processes; Multiphysical modeling of the interaction of solid and liquid phases; Real-time process	5		V		V	V	

		modeling: Digital Twins; Construction of adaptive process models based on experimental data and numerical analysis; Introduction to artificial intelligence and machine learning for mineral processing; Application of machine learning (ML) and deep learning (DL) algorithms; Methodology for developing technological schemes for ore preparation of a new generation; Multi-criteria optimization of processing processes; Automation of design of processing plants using digital platforms; Scientific methodology and formation of hypotheses in the field of enrichment.							
4	Current trends in the theory and practice of processing ores and man-made raw materials by flotation methods	Purpose: To provide students with a systematic understanding of modern scientific and technological approaches to flotation processing of mineral and man-made raw materials, with an emphasis on the development and application of the physico-chemical foundations of flotation, mathematical and multiphysical modeling methods, artificial intelligence and big data analysis for diagnostics, forecasting, optimization and intelligent process management. Contents: Current problems and challenges of flotation of mineral and man-made raw materials; Modern physico-chemical theory of flotation; New approaches to controlling the selectivity of flotation; Mechanisms of interaction of reagents with the mineral surface; Mathematical modeling of flotation: kinetics, selectivity, hydrodynamics; Multiphase and multiphysical modeling in column and chamber flotation; Flotation modeling taking into account mineral texture and grain composition; Artificial intelligence in flotation management: from forecasting to optimization; Machine learning in the analysis of flotation data; Deep learning and neural network models for flotation; Methodology for designing flotation schemes taking into account complex mineralogy; Multi-criteria optimization of flotation processes; Automation and intelligent flotation management systems; Development and substantiation of scientific hypotheses in the field of flotation; Data analysis and scientific justification of technological solutions.	5	V	V		V		
5	Sustainability Science	Objective: to develop a deep understanding among doctoral students of the interactions between natural and social systems, as well as to develop skills for identifying and developing strategies for sustainable development that promote long-term human well-being and environmental preservation. Content: complex interconnections between ecosystems and societies. An analysis of sustainability issues at local, national, and international levels.	5	V	V		V	V	
Cycle of profile disciplines Component of choice									
6	Current trends in the theory and practice of processing ores and man-made raw materials by gravitational methods	Purpose: To provide students with a deep scientific and applied understanding of current trends in the field of gravity processing of mineral and man-made raw materials, including the physical and mechanical foundations of separation, innovative technologies, mathematical and hydrodynamic modeling methods, as well as the use of artificial intelligence and big data analysis for forecasting, optimization and intelligent process management.	5	V		V	V		

		Contents: Modern challenges of gravitational processing of mineral and man-made raw materials; Physico-mechanical foundations of separation in gravitational fields; Classification and principles of operation of modern gravitational devices; Innovative gravitational technologies and new generation equipment; Mathematical modeling of gravitational separation processes; Multiphase and hydrodynamic modeling of gravitational processes (CFD); Modeling of the behavior of mineral particles taking into account the texture, shapes and densities; Numerical methods for optimizing the parameters of gravity enrichment; Digitalization of gravity processes: from sensors to intelligent analysis; Artificial intelligence and machine learning for predicting the effectiveness of gravity separation; Deep learning in analyzing the dynamics of gravity processes; Methodology for constructing and optimizing gravity circuits for ores and waste; Multi-criteria optimization of gravity processes taking into account energy efficiency and extraction; Formation of scientific hypotheses in the field of gravity enrichment; Verification and validation of gravity separation models.							
7	Alternative sources of mineral raw materials and recycling of enrichment waste	Purpose: To develop the ability to critically analyze, interpret and scientifically substantiate the prospects for the development of alternative sources of mineral raw materials and processing of enrichment waste, to form skills in generating new knowledge and scientific approaches to the recycling of man-made raw materials using digital, innovative and resource-saving technologies, as well as to prepare doctoral students to develop original research solutions that contribute to the development of the theory and practice of sustainable the mineral resource complex at the global level. Contents: The concept of alternative sources of mineral raw materials; Man-made mineral raw materials as a source of valuable components; Enrichment waste: classification, properties, technological features; Modern methods of processing mineral processing waste; Recycling in enrichment production: concepts and strategies; Carbon dioxide and organic waste as secondary raw materials; Technical and economic assessment of recycling projects; Environmental consequences and the risks of involving waste in recycling; Foreign experience and international practices in the processing of enrichment waste; Digitalization and innovation in alternative raw materials processing; The future of alternative sources and recycling in the mining industry.	5				V	V	V
8	Current trends in wastewater treatment and auxiliary facilities of processing plants	Purpose: To provide students with a scientifically based and holistic understanding of current trends in wastewater treatment and the organization of auxiliary facilities at processing plants, with an emphasis on physico-chemical, membrane and biotechnological methods, mathematical and hydrodynamic modeling of processes, the use of artificial intelligence and big data analysis for the diagnosis, forecasting and optimization of water circulation systems. Contents: Current problems of wastewater treatment at processing plants; Environmental and technological regulations in the water circulation of mining and processing plants; Modern approaches to the organization of auxiliary facilities at	5				V	V	

		processing plants; Physico-chemical purification methods: coagulation, flocculation, flotation; Membrane, sorption and ion exchange technologies; Biotechnologies in industrial wastewater treatment; Dewatering, disposal and reuse of sediments and pollution concentrates; Mathematical modeling of wastewater treatment and water circulation cycles; Hydrodynamic modeling of wastewater treatment plants (CFD); Modeling of mass transfer and transfer in multiphase media of wastewater streams; Artificial intelligence and machine learning in the diagnosis and prediction of purification processes; Deep learning and computer vision in the analysis of precipitation and filtration processes; Methodology for constructing water circulation and water treatment schemes at enrichment plants; Multi-criteria optimization of water treatment processes; Formation of scientific hypotheses in the field of wastewater treatment; Verification, calibration and validation of purification and precipitation models; Scientifically based analysis and evaluation of the effectiveness of integrated solutions in the water circulation systems of processing plants.							
9	Theory and practice of operation and repair of processing equipment	Purpose: to train specialists who are able to effectively apply modern methods of scientific modeling, artificial intelligence (AI) and big data analysis to optimize the processes of operation and repair of processing equipment. Contents: Introduction to mineral processing and basic processing equipment; Scientific modeling in processing and operation of equipment; Artificial intelligence and its application in processing processes; Optimization of processing equipment using artificial intelligence and big data analysis; Diagnostics and forecasting of processing equipment malfunctions using artificial intelligence; Automation of the process of repair and maintenance of processing equipment equipment; The impact of automation on the efficiency of processing equipment and reduction of operating costs; Prospects for the development of processing equipment, taking into account new technologies and digitalization; Modeling the sustainability of processing processes, taking into account the dynamics of changes in equipment parameters and raw materials.	5		V			V	

5. The 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	**D118 - "Mineral processing"**
Educational program	**8D07214 - "Mineral processing"**
The awarded academic degree	**Doctor of Engineering (Industry)**
Form and duration of study	**full time (professional track) - 3 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		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
CYCLE OF BASIC DISCIPLINES (BD)															
M-1. Module of basic training															
MET322	Methods of scientific research		BD, UC	5	150	30/0/15	105	E	5						
LNG305	Academic writing		BD, UC	5	150	0/0/45	105	E	5						
MET324	Current trends in the field of ore preparation of mineral and man-made raw materials	1	BD, CCH	5	150	30/0/15	105	E	5						
MET325	Current trends in the theory and practice of processing ores and man-made raw materials by flotation methods	1	BD, CCH	5	150	30/0/15	105	E	5						
MNG350	Sustainability Science	1	BD, CCH	5	150	30/0/15	105	E	5						
CYCLE OF PROFILE DISCIPLINES (PD)															
M-2. Module of professional activity															
MET326	Current trends in the theory and practice of processing ores and man-made raw materials by gravitational methods	1	PD, CCH	5	150	30/0/15	105	E	5						
MEI300	Alternative sources of mineral raw materials and recycling of enrichment waste	1	PD, CCH	5	150	30/0/15	105	E	5						
MET328	Current trends in wastewater treatment and auxiliary facilities of processing plants	2	PD, CCH	5	150	30/0/15	105	E	5						
MET329	Theory and practice of operation and repair of processing equipment	2	PD, CCH	5	150	30/0/15	105	R	5						
M-3. Practice-oriented module															
AAP371	Industrial intership		PD, UC	20				R		20					
M-4. Experimental research module															
AAP372	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	5				R	5						
AAP376	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	10				R		10					
AAP374	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	30				R			30				
AAP374	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	30				R				30			
AAP374	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	30				R					30		
AAP375	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	18				R						18	
M-5. Module of final attestation															
ECA325	Final examination (writing and defending a doctoral dissertation)		FA	12										12	
Total based on UNIVERSITY:									30	30	30	30	30	30	
									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	0	0	0	0

BD	Cycle of basic disciplines	0	10	5	15
PD	Cycle of profile disciplines	0	20	10	30
Total for theoretical training:		**0**	**30**	**15**	**45**
RWDS	Research Work of Doctoral Student				0
ERWDS	Experimental Research Work of Doctoral Student				123
FA	Final attestation				12
TOTAL:					**180**

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. Б.
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____	Zhetybayeva U. K.