



Mining and Metallurgical Institute named after O.A. Baikonurov

Department of Metallurgy and Mineral Processing

EDUCATIONAL PROGRAM

8D07204 - Metallurgical engineering

Code and classification of the field of education	8D07 – Engineering, manufacturing and construction industries
Code and classification of training directions	8D072 – Industrial and manufacturing branches
Educational program group	D117 – Metallurgical engineering
The level based on NQF	8
The level based on IQF	8
Period of training	3 years
Amount of credits	180

Educational program «8D07204 – Metallurgical engineering» 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 «8D07204 – Metallurgical engineering» was developed by Academic committee based on direction «8D072 – Manufacturing and processing industries»

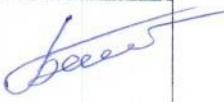
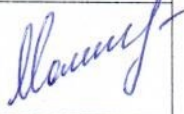
Full name	Academic degree/ Academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Barmenshinova M.B.	c.t.s., associate professor	Head of the Department of MaMP	KazNRTU named after K.I.Satpaeva	
Teaching staff:				
Baimbetov B.S.	c.t.s., docent	Professor of the Department of MaMP	KazNRTU named after K.I.Satpaeva	
Dosmukhamedov N.K.	c.t.s., professor	Professor of the Department of MaMP	KazNRTU named after K.I.Satpaeva	
Mamyrbayeva K.K.	PhD doctor	Associate professor of the Department of MaMP	KazNRTU named after K.I.Satpaeva	
Employers:				
Ospanov Y.A.	d.t.s.	Head of the Department of complex processing of technogenic law materials	«Kazakhmys Corporation» LLP	
Students:				
Dauletbaeva A.A.	master of technical sciences	1st year doctoral student	KazNRTU named after K.I.Satpaeva	

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List of abbreviations and designations

SMSERK – The State mandatory standard of Education of the Republic of Kazakhstan;

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

EP – educational program;

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

TSIS – independent work of a student with a teacher (independent work of a student (master's student, doctoral student) with a teacher);

WC – working curriculum;

CES – catalog of elective subjects;

UC – the university component;

CC – component of choice;

NQF – national qualifications framework;

IQF – industry qualifications framework;

LO – learning outcomes;

KC – key competencies;

SDG – Sustainable Development Goals.

1. Description of educational program

It is intended for the implementation of specialized bachelor's degree training in the educational program "8D07204 – Metallurgical Engineering" at Satbayev University and was developed within the framework of the direction "Manufacturing and processing industries".

Specialty 8D07204 – Metallurgical Engineering" is accredited by the International Agency of the National Academy of Sciences (Kazakhstan). A distinctive feature of the doctoral program is that the educational program provides international training for specialists of the highest category, capable of independently conducting research and innovation and project activities, conducting high-tech business, capable of being leaders in world-class scientometric indicators. The program is accredited by the NAAR (Kazakhstan). The educational program provides knowledge in the field of development and implementation of metallurgical technologies, production of innovative metallurgical products, increased consumer properties; graduates have high leadership and organizational qualities; are capable of creating small knowledge-intensive metallurgical businesses.

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

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

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

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

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

- Resolution of the Government of the Republic of Kazakhstan dated January 19, 12, No. 111 "On approval of the Standard Rules for admission to study in educational organizations implementing educational programs of higher education" with amendments and additions dated July 14, 2016, No. 405;

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

- Resolution of the Government of the Republic of Kazakhstan dated December 31, 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 the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations dated 06/16/2016;
- Industry Qualifications Framework "Mining and Metallurgical Complex" dated 07/30/2019 No. 1;
- Strategy "Kazakhstan-2050": a new political course of the established state. The Message of the President of the Republic of Kazakhstan - Leader of the Nation N.A. Nazarbayev to the people of Kazakhstan. Astana, 12/14/2012;
- "New development opportunities in the context of the Fourth Industrial Revolution". The Message of the President of the Republic of Kazakhstan N. Nazarbayev to the people of Kazakhstan. 10.01.2018;

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

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



Figure 1 - The concept of scientific and educational programs

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

Modern needs require graduates not only to have in-depth knowledge in their chosen field of science, but also to understand the mechanisms and tools for putting their ideas into practice. The program corresponds to the unified state policy of long-term socio-economic development of the country, the training of highly qualified personnel based on the achievements of science and technology, and the effective use of the republic's domestic scientific, technological and human resources potential.

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

The program is aimed at training specialists in key areas of the mining and metallurgical industry, adapted to activities in high-tech sectors of the economy of the Republic of Kazakhstan based on the development of priority areas of science and technology, the development of high-tech industries, competitive technologies in the field of processing man-made raw materials and waste.

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

Types of work activity. Specialists who have completed their doctoral studies carry out production, technological and organizational work at industrial enterprises in leading positions corresponding to the 8th level of the national qualification framework, as well as conduct research in the field of complex processing of mineral raw materials and obtaining innovative products with increased consumer properties.

Types of economic activity: metal ore mining; iron ore mining; underground iron ore mining; open-pit iron ore mining; non-ferrous metal ore mining; uranium and thorium ore mining; uranium and thorium ore mining; other non-ferrous metal ores mining; extraction and processing of aluminum-containing raw materials; extraction and processing of copper ore; mining and processing of lead-zinc ore; mining and processing of nickel-cobalt ores; mining and processing of titanium-magnesium raw materials (ores); mining and processing of tin ore; mining and processing of antimony-mercury ores; mining of precious metals and ores of rare metals; mining of other non-ferrous metals.

Objects of professional activity. The objects of professional activity of graduates are enrichment plants, enterprises of ferrous and non-ferrous metallurgy, chemical, mining, chemical and machine-building industries, branch research and design institutes, factory laboratories, higher educational institutions, consulting companies, scientific and innovation centers, banks.

Professional competence: design, engineering, design and research activities, improvement and optimization of metallurgical industries. Implementation of the development and implementation of technological processes for processing mineral, natural and man-made raw materials. Assessment of innovation and technological risks in the implementation of new technologies.

Competence in marketing high-tech technologies. The skills of setting tasks and problems, their systematic solutions using innovative approaches, methods of building concepts and strategies of activity. Systemic and strategic thinking, skills of making mutually beneficial decisions using logical methods, building and reproducing models of professional activity and interaction in the metallurgical industry.

2 Purpose and objectives of educational program

The purpose of the OP «8D07204 – Metallurgical Engineering» are:

- training of highly qualified specialists with core competencies in solving organizational and production tasks in the implementation of innovative projects in the field of metallurgy;
- training of personnel for the innovative economy in metallurgy, covering modern energy-saving technologies, design activities, innovative solutions, entrepreneurship in the high-tech sector;
- training of specialists capable of developing and implementing environmentally friendly and resource-saving technologies in metallurgy within the framework of ESG and Sustainable Development Goals;

The objectives of the OP «8D07204 – Metallurgical Engineering» are:

- to train professionals in analytical, consulting and research activities;
- independent conduct of research, R&D, and any design activity in the field of metallurgy; compliance with international engineering qualifications;
- training of specialists to carry out pedagogical activities in higher education institutions in the metallurgical field;
- retraining and advanced training of specialists and managers of non-ferrous metallurgy;
- acquisition of knowledge on energy-intensive, innovative technologies in the metallurgical sector, nanotechnology, technologies that meet the requirements of the "green economy" in metallurgy, advanced methods of physico-chemical analysis, software operation in calculations of various metallurgical, thermodynamic, kinetic systems, obtaining special-purpose products; development of design solutions;
- assessment of innovation and technological risks in the implementation of new technologies;
- competence in marketing high-tech technologies;
- development of personal scientometric indicators of the student;
- international internship.

Thus, the program is aimed at creating a sustainable and technologically advanced metal production that meets the requirements of environmental safety and innovative development.

3. Requirements for evaluating the educational program learning outcomes

Persons who have received a PhD degree, in order to deepen their scientific knowledge, solve scientific and applied problems on a specialized topic, carry out a postdoctoral program or conduct scientific research under the guidance of a leading scientist of a chosen university.

A graduate of a scientific and pedagogical doctoral program must:

- 1) have an idea of:
 - the main stages of development and paradigm shift in the evolution of science;
 - on the subject, ideological and methodological specifics of the natural (social, humanitarian, economic) sciences;
 - about scientific schools of the relevant branch of knowledge, their theoretical and practical developments;
 - about scientific concepts of world and Kazakh science in the relevant field;
 - on the mechanism of implementation of scientific developments in practical activities;
 - on the norms of interaction in the scientific community;
 - about the pedagogical and scientific ethics of a research scientist;
- 2) know and understand:
 - current trends, trends and patterns of development of Russian science in the context of globalization and internationalization;
 - methodology of scientific knowledge;
 - achievements of world and Kazakh science in the relevant field;
 - (realize and accept) the social responsibility of science and education;
 - perfect foreign language for scientific communication and international cooperation;
- 3) be able to:
 - to organize, plan and implement the scientific research process;
 - analyze, evaluate and compare various theoretical concepts in the field of research and draw conclusions;
 - analyze and process information from various sources;
 - to conduct independent scientific research, characterized by academic integrity, based on modern theories and methods of analysis;
 - generate your own new scientific ideas, communicate your knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge;
 - to choose and effectively use modern research methodology;
 - plan and predict your further professional development;
- 4) have the skills:
 - critical analysis, evaluation and comparison of various scientific theories and ideas;
 - analytical and experimental scientific activities;
 - planning and forecasting of research results;
 - public speaking and public speaking at international scientific forums, conferences and seminars;

- scientific writing and scientific communication;
 - planning, coordinating and implementing scientific research processes;
 - a systematic understanding of the field of study and demonstrate the quality and effectiveness of selected scientific methods;
 - participation in scientific events, fundamental scientific domestic and international projects;
 - leadership management and team management;
 - responsible and creative attitude to scientific and scientific-pedagogical activities;
 - conducting patent search and experience in the transfer of scientific information using modern information and innovative technologies;
 - protection of intellectual property rights for scientific discoveries and developments;
 - free communication in a foreign language;
- 5) be competent:
- in the field of scientific and scientific-pedagogical activity in conditions of rapid updating and growth of information flows;
 - in carrying out theoretical and experimental scientific research;
 - in setting and solving theoretical and applied problems in scientific research;
 - to conduct a professional and comprehensive analysis of problems in the relevant field;
 - in matters of interpersonal communication and human resource management;
 - in matters of university training of specialists;
 - in carrying out the expertise of scientific projects and research;
- to ensure continuous professional growth.

4. Passport of educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	8D07 – Engineering, manufacturing and construction industries
2	Code and classification of training directions	8D072 – Industrial and manufacturing branches
3	Educational program group	D117 – Metallurgical Engineering
4	Educational program name	«8D07204 - Metallurgical engineering»
5	Short description of educational program	The educational program "8D07204 - Metallurgical Engineering" includes fundamental, natural science, general engineering and professional PhD training in the field of metallurgical engineering in accordance with the development

		of science and technology, as well as the changing needs of the mining and metallurgical and mining processing industries.
6	Purpose of EP	training of highly qualified specialists with core competencies in solving organizational and production tasks in the implementation of innovative projects in the field of metallurgy; training of personnel for the innovative economy in metallurgy, covering modern energy-saving technologies, design activities, innovative solutions, entrepreneurship in the high-tech sector; training of specialists capable of developing and implementing environmentally friendly and resource-saving technologies in metallurgy within the framework of ESG and Sustainable Development Goals.
7	Type of EP	Current
8	The level based on NQF	8
9	The level based on IQF	8
10	Distinctive features of EP	no
11	List of competencies of educational program	<i>1) have an idea of:</i> – the main stages of development and paradigm shift in the evolution of science; – on the subject, ideological and methodological specifics of the natural (social, humanitarian, economic) sciences; – about scientific schools of the relevant branch of knowledge, their theoretical and practical developments; – about scientific concepts of world and Kazakh science in the relevant field; – on the mechanism of implementation of scientific developments in practical activities; – on the norms of interaction in the scientific community; – about the pedagogical and scientific ethics of a research scientist; <i>2) know and understand:</i> – current trends, trends and patterns of development of Russian science in the context of globalization and internationalization; – methodology of scientific knowledge; – achievements of world and Kazakh science in the relevant field; – (realize and accept) the social responsibility of science and education; – perfect foreign language for scientific communication and international cooperation; <i>3) be able to:</i> – to organize, plan and implement the scientific research process; – analyze, evaluate and compare various theoretical concepts in the field of research and draw conclusions; – analyze and process information from various sources; – to conduct independent scientific research, characterized by academic integrity, based on modern theories and methods of analysis;

		– generate your own new scientific ideas, communicate your knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge; – to choose and effectively use modern research methodology; – plan and predict your further professional development; <i>4) have the skills:</i> – critical analysis, evaluation and comparison of various scientific theories and ideas; – analytical and experimental scientific activities; – planning and forecasting of research results; – public speaking and public speaking at international scientific forums, conferences and seminars; – scientific writing and scientific communication; – planning, coordinating and implementing scientific research processes; – a systematic understanding of the field of study and demonstrate the quality and effectiveness of selected scientific methods; – participation in scientific events, fundamental scientific domestic and international projects; – leadership management and team management; – responsible and creative attitude to scientific and scientific-pedagogical activities; – conducting patent search and experience in the transfer of scientific information using modern information and innovative technologies; – protection of intellectual property rights for scientific discoveries and developments; – free communication in a foreign language; <i>5) be competent:</i> – in the field of scientific and scientific-pedagogical activity in conditions of rapid updating and growth of information flows; – in carrying out theoretical and experimental scientific research; – in setting and solving theoretical and applied problems in scientific research; – to conduct a professional and comprehensive analysis of problems in the relevant field; – in matters of interpersonal communication and human resource management; – in matters of university training of specialists; – in carrying out the expertise of scientific projects and research; to ensure continuous professional growth.
12	Learning outcomes of educational program	LO1 - they possess modern knowledge, skills and abilities in the field of information management, integrated monitoring, analysis and synthesis aimed at ensuring sustainable development; they improve their research culture for the introduction of innovative, energy-efficient and environmentally friendly solutions; they know the fundamental laws of basic disciplines and apply

		them to describe and model technological processes in metallurgy, taking into account the tasks of responsible environmental management. LO2 - they possess knowledge in the field of theoretical bases of rational use of natural resources, processing of raw materials and products, skills and abilities to rebuild professional activity, to implement author's innovative ideas in education, to find non-standard and alternative solutions, are capable of generating new ideas, to critical thinking. LO3 - they have the skills to apply fundamental general engineering knowledge and are able to critically reflect on accumulated experience; combine theory and practice to solve engineering problems, strive for innovative and sustainable solutions that promote the rational use of resources, minimize environmental impacts and develop environmentally friendly technologies. LO4 - they are able to apply applied software and modern methods of information processing LO5 - they have a system of subject and methodological knowledge, apply theoretical knowledge in professional activities in the field of metallurgy, taking into account the sustainable development of the industry; They have knowledge in the field of scientific and technical innovations, skills in searching, evaluating and selecting information, and contribute innovative ideas and solutions, contributing to the efficient use of resources and minimizing environmental impacts; LO6 - independently conduct scientific search of necessary new information on technological processes in the field of metallurgy for purposeful use of their scientific purposes.
13	Education form	Full-time
14	Period of training	3 years
15	Amount of credits	180
16	Languages of instruction	Kazakh, Russian, English
17	Academic degree awarded	Doctor of Philosophy PhD
18	Developers and authors:	Barmenshinova M.B., Chepushtanova T.A.

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

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)					
				PO1	PO 2	PO 3	PO 4	PO 5	PO 6
Cycle of basic disciplines									
University component									
MET322	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		
LNG305	Academic writing	Objective: to develop academic writing skills and writing strategies for doctoral students in engineering and natural sciences. Content: fundamentals and general principles of academic writing, including: writing effective sentences and paragraphs, writing an abstract, introduction, conclusion, discussion, and references; in-text citation; preventing plagiarism; and preparing a conference presentation.	5		V	V	V		
Cycle of basic disciplines									
Component of choice									
MET309	Scientific research of the processes of complex extraction of	Purpose: To form modern ideas and master the physico-chemical foundations of the basic laws of interaction of components in molten media,	5		V		V		V

	metals from the industrial mining and metallurgical complex	aqueous solutions, gas phases occurring during metallurgical processing of non-traditional raw materials: poor, difficult-to-enrich, complex polymetallic ores. Content: New solutions, methods of processing substandard raw materials with additional extraction of metals from them from the point of view of technology and new requirements for environmental safety and environmental protection. New approaches of the theoretical basis necessary for the development of innovative technologies for the production of non-ferrous metals from non-traditional types of raw materials and waste.							
MET311	Modern trends in the development of theory and technology of metallurgical production	Purpose: To develop doctoral students' professional competence in the analysis of modern technologies, the development of new technologies, the formulation and conduct of research and development work. Content: the course is the current state and trends in the development of the raw material base of metal production. The level of development of technology and equipment in metallurgy. Familiarization with new technological schemes for processing raw materials containing non-ferrous and ferrous metals. Analysis of the principles and patterns of the main processes in metallurgy using new research methods.	5		V		V		V
MNG349	Intellectual property and the global market	Purpose: the goal is to train specialists in the field of intellectual property law who can analyze and predict trends in its development in the global market, develop strategies for the protection and commercialization of intellectual property. Contents: global aspects of intellectual property and its role in international trade and economics, analysis of international agreements and	5	V			V	V	V

		conventions, IP management strategies, cases of protection and violation of intellectual property rights in various jurisdictions.							
Cycle of profile disciplines Component of choice									
MET308	Innovative technologies for the production of new types of products from waste and recycled raw materials of non-ferrous metallurgy	Purpose: To study the theory and technology of modern new processes for processing man-made waste and secondary raw materials of non-ferrous metallurgy to obtain new types of products. Content: Characteristics of substandard raw materials: poor, difficult-to-enrich, complex polymetallic ores; man-made waste from metallurgy, chemical industry and energy; secondary raw materials. New technologies for the complex extraction of non-ferrous metals and valuable components from substandard raw materials. The physico-chemical foundations of innovative technologies for processing slag waste, substandard intermediates and recycled materials, including the extraction of base metals and the expansion of the range of new types of marketable products.	5	V			V	V	V
MET313	Technologies of production of nanopowders, nanomaterials and composite materials	Purpose: To study the methods of obtaining composite materials. Physico-chemical bases for the production of composite materials. Nanoscale powders. Physico-chemical bases of electrochemical methods for the production of nanoparticles. Contents: Experimental study of the electrophysical parameters of carbon nanopowders. Volt-ampere characteristics of a carbon nanostructured composite. Investigation of the properties of the obtained materials. Numerical study of powder dispersion based on computer modeling. Development of technology for the production of	5	V				V	V

		nanostructured materials based on carbon nanopowders. The formation of a new phase. Preparation of suspensions of low-dimensional coal powders using the method of hydraulic fractionation. Nanosuspensions based on low-dimensional carbon particles.							
MET314	Increasing the efficiency of extraction extraction of non-ferrous metals	Purpose: based on the knowledge gained about the basics of extraction processes, classes of extractants and the mechanism of extraction, they gain skills in choosing and creating technology for extraction extraction and separation of non-ferrous and rare metals. Content: The course provides methods to improve the efficiency of metal extraction from aqueous solutions. The main patterns and indicators of extraction extraction of non-ferrous and rare metals. Prospects for the development of extraction processes. Examples of extraction applications in metallurgical practice.	5	V				V	V
MET323	Complexation in metallurgical systems and processes	Purpose: to obtain knowledge by doctoral students on the chemistry of coordination compounds, on the nature of the chemical bond in coordination compounds and their structure. Contents: Gaining knowledge on the chemistry of complex compounds (CS), the nature of the chemical bond in CS, their structure, transformations in solutions and solid phase; the main directions of CS use in industry, science and technology.	5	V			V		V

5 Curriculum of educational program

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



«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

D117 - "Metallurgical engineering"

Educational program

8D07204 - "Metallurgical engineering"

The awarded academic degree

Doctor of Philosophy PhD

Form and duration of study

full time (scientific and pedagogical 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							
MET309	Scientific research of the processes of complex extraction of metals from the industrial mining and metallurgical complex	1	BD, CCH	5	150	30/0/15	105	E	5							MET251, MET269, MET123, MET1331, MET1402
MET311	Modern trends in the development of theory and technology of metallurgical production	1	BD, CCH	5	150	30/0/15	105	E	5							MET241, MET117, MET123, TEC237
MNG349	Intellectual property and the global market	1	BD, CCH	5	150	30/0/15	105	E	5							
M-3. Practice-oriented module																
AAP350	Pedagogical practice		BD, UC	10				R		10						
CYCLE OF PROFILE DISCIPLINES (PD)																
M-2. Module of professional activity																
MET308	Innovative technologies for the production of new types of products from waste and recycled raw materials of non-ferrous metallurgy	1	PD, CCH	5	150	30/0/15	105	E	5							MET142, MET123
MET313	Technologies of production of nanopowders, nanomaterials and composite materials	1	PD, CCH	5	150	30/0/15	105	E	5							MET239, MET123
MET314	Increasing the efficiency of extraction extraction of non-ferrous metals	2	PD, CCH	5	150	30/0/15	105	E	5							MET429, MET430
MET323	Complexation in metallurgical systems and processes	2	PD, CCH	5	150	30/0/15	105	E	5							
M-3. Practice-oriented module																
AAP355	Research practice		PD, UC	10				R			10					
M-4. Experimental research module																
AAP336	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	5				R	5							
AAP347	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	20				R		20						
AAP347	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	20				R			20					
AAP356	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	30				R				30				
AAP356	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	30				R					30			
AAP348	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	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	
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Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	University component (UC)	Component of choice (CCH)	Total
GED	Cycle of general education disciplines	0	0	0	0
BD	Cycle of basic disciplines	0	20	5	25
PD	Cycle of profile disciplines	0	10	10	20
Total for theoretical training:		0	30	15	45
RWDS	Research Work of Doctoral Student				123
ERWDS	Experimental Research Work of Doctoral Student				0
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. B.

Head of Department - Department of Educational Program
Management and Academic-Methodological Work

Zhumagaliyeva A. S.

Director - Mining and Metallurgical Institute named after
O. A. Baikonurov

Rysbekov K. .

Department Chair - Metallurgy and mineral processing

Barmenshinova M. .

Representative of the Academic Committee from Employers

Ospanov Y. A.

____Acknowledged____

