



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

EDUCATIONAL PROGRAM

8D07212 - Metallurgical Engineering

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:	D117 – Metallurgical engineering
The level of the NRK:	8
ORC Level:	8
Duration of training:	3 years
Volume of loans:	180

The educational program «8D07212 - 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 «8D07212 - Metallurgical Engineering» 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:				
Baimbetov B.S.	c.t.s., docent	Professor of the Department of MaMP	KazNRTU named after K.I.Satpaeva	
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Employers:				
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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 - 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

The theoretical component of the doctoral program comprises 45 academic credits within the total volume of the educational program. It consists of core (hereinafter – CC) and specialized (hereinafter – SC) course cycles, which include university component courses (hereinafter – UC) and elective component courses (hereinafter – EC), as well as practical training. The ratio between the volume of CC and SC is determined independently by the higher education institution (HEI).

The list of UC and EC courses is also defined independently by the HEI, taking into account labor market demands, employer expectations, and the needs and interests of doctoral students.

As a rule, course and module programs are interdisciplinary and multidisciplinary in nature, ensuring the preparation of specialists at the intersection of multiple 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 the HEI 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 metallurgical engineering.

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

The educational program includes the following stages of doctoral students' training: scientific research methods, academic writing, highly efficient processes, devices and technologies for the production of non-ferrous, rare and precious metals and their compounds, sustainable development, resource conservation and green technologies in metallurgy, the science of sustainable development, the mathematical theory of experiment and statistical processing of research results, innovative technologies, principles of «gentle metallurgy» of the copper industry, forecasting and designing of innovative metallurgical technologies, obtaining innovative products of the rare metal industry, principles of circular metallurgy.

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 EIRA) 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.

The HEI independently determines the form, place, and timing of the organization of the EIRA.

Within the framework of the EIRA, 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 HEI 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 the HEI 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 the HEI scientific seminar.

Requirements for the EIRA of a student in the doctor's program by profile:

- 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 EIRA for doctoral programs in the field of education «Engineering, manufacturing and construction industries» is conducted on the basis of a partner enterprise and is aimed at conducting applied research and 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 HEI independently.

The doctoral thesis is carried out during the EIRA period.

The final result of the EIRA 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 the HEI 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 that the doctoral thesis is completed and that the principles of academic integrity are respected, and that the thesis is submitted for defense in a timely manner.

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 EIRA 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 scientific 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).

Doctoral programs 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 dissertation 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 «8D07212 – Metallurgical Engineering» is:

– training of doctors in the field who have professional knowledge about the production of non-ferrous, ferrous, rare and precious metals and their compounds using the latest devices and technologies, who have an understanding of the planning and organization of experimental research, statistical processing of scientific research results, and also take into account the principles of sustainable development, such as the rational use of natural resources, reducing negative impact on the impact of metallurgy on the environment and the introduction of energy-efficient technologies.

The objectives of OP «8D07212 – Metallurgical Engineering» are:

– to analyze, evaluate and compare various theoretical concepts in the field of metallurgy research and draw conclusions and develop strategies to minimize them;

– to conduct independent scientific research on metallurgy, characterized by academic integrity, based on modern theories and methods of analysis, while ensuring environmental safety, economic feasibility and social responsibility;

– generate your own new scientific ideas, communicate your knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge, as well as contribute to the development of innovative solutions that support the goals of sustainable development;

– understand the areas of study and demonstrate the quality and effectiveness of selected scientific methods from the perspective of sustainable development.

3. Requirements for the assessment of learning outcomes of the 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 (IEP) 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. Intermediate and final certification

- annual report on the implementation of the IEP (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	D117 –Metallurgical Engineering
4	Name of the educational program	8D07212 – Metallurgical Engineering
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 metallurgical engineering.
6	Goal EP	training of doctors in the field who have professional knowledge about the production of non-ferrous, ferrous, rare and precious metals and their compounds using the latest devices and technologies, who have an understanding of planning and organizing experimental research, statistical processing of research results, and also take into account the principles of sustainable development, such as the rational use of natural resources, reducing negative impacts. the impact of metallurgy on the environment and the introduction of energy-efficient technologies.
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 competencies; Management competencies; Cognitive competencies; Creative competencies; Information and communication competencies.
12	Learning outcomes of the educational program:	RO1 - They analyze, evaluate and compare various theoretical concepts in the field of metallurgy research, draw conclusions and develop strategies to minimize them.;

		RO2 - They conduct independent scientific research on metallurgy, characterized by academic integrity, based on modern theories and methods of analysis, while ensuring environmental safety, economic feasibility and social responsibility; RO3 - They generate their own new scientific ideas, communicate their knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge, and contribute to the development of innovative solutions that support the goals of sustainable development. RO4 - they understand the areas of study and demonstrate the quality and effectiveness of the chosen scientific methods from the perspective of sustainable development.
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 «8D07212 – Metallurgical Engineering»
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)			
				RO1	RO2	RO3	RO4
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	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
Cycle of basic disciplines Elective component							
3	Highly efficient processes, devices and technologies for the production of non-ferrous, rare and precious metals and their compounds	Purpose: to expand, deepen and consolidate professional knowledge about the production of non-ferrous, rare and precious metals and their compounds using the latest devices and technologies Content: Highly efficient technologies for the production of non-ferrous, rare and precious metals and their compounds using pyro-, hydrometallurgical and electrochemical methods. The main problems of the production of rare metals. Promising methods of processing raw materials and obtaining pure rare metals using fluoride technology. Extraction of rare metals from ash and slag from CHP plants. Autoclave, chloride and extraction processes for the production and separation of non-ferrous, rare and noble metals and their compounds. Processing of by-products and raw materials with a low content of non-ferrous, rare and precious metals	5	V	V		V
4	Sustainable development, resource conservation and green technologies in metallurgy	Purpose: developing knowledge about sustainable development, resource conservation and green technologies in metallurgy, developing skills in transforming technologies according to the principles of sustainable development. Content: principles of sustainable development in metallurgy: critically and strategically important metals for Kazakhstan and the global industry, transformation of existing technologies according to the principles of sustainable development, transition to a	5	V	V		V

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		“green” economy, carbon footprint reduction, resource conservation and energy saving in metallurgy, calculations of CO ₂ emissions with distribution by types of products produced by metallurgical enterprises, waste management.					
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		
Cycle of profile disciplines Component of choice							
6	Mathematical theory of experiment and statistical processing of scientific research results	Purpose: to form a comprehensive understanding of the planning and organization of experimental research, statistical processing of research results. Content: Methods of conducting laboratory and industrial experiments. The basic principles and methods of processing the results of scientific research. Analysis of experimental data, methods for constructing optimal experimental plans. Application of statistical methods and models in practical tasks.	5	V	V		
7	Innovative technologies, principles of «gentle metallurgy» in the copper industry	Purpose: developing knowledge about innovative technologies of the copper industry, the principles of “gentle metallurgy” of the copper industry, developing skills in applying methods of gentle metallurgy on existing technologies. Content: innovative, new technological schemes for the extraction and production of copper, principles of energy and resource saving in the copper industry, waste management of the copper industry, modernization of enterprise equipment to the priorities of gentle metallurgy, ecology and resource conservation, lean production in the copper industry: pyro- and hydrometallurgical schemes.	5	V	V		
8	Forecasting and design of innovative metallurgical technologies	Purpose: formation of knowledge on risk assessment in forecasting and designing innovative technologies. Content: Analysis and systematization of modern scientific achievements in order to create highly efficient metallurgical technologies. Modern world technologies in the field of metallurgy and methods for assessing their effectiveness and cost. Methods and techniques of attracting investments for the development and implementation of modern world-class technologies in the field of metallurgy. Methods for assessing the real feasibility of the projects and programs being developed. Basic principles of planning scientific research and innovative developments	5			V	V
9	Production of innovative products from the rare metal industry, principles of circular metallurgy	Purpose: developing knowledge about the development of environmentally safe technologies for producing innovative products from natural and man-made rare metal raw materials, developing skills in the circular metallurgy industry. Contents: analysis of raw materials of rare and rare earth metals and impurities in them; technologies for obtaining concentrates of rare earth metals; technologies for the associated extraction of rare elements from mother liquors of the technological cycle, obtaining collective extracts of rare earth metals, management of industrial waste in the production of rare metals; technologies for producing highly pure metals: Hg, Zn, Cu,	5	V		V	

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		In; technologies for producing precision alloys.					
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5. Curriculum of the educational program



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«APPROVED»
Decision of the Academic Council
NPJSC «KazNRTU»
named after K. Satbayev»
dated 06.03.2025 Minutes № 10

WORKING CURRICULUM

Academic year
Group of educational programs
Educational program
The awarded academic degree
Form and duration of study

2025-2026 (Autumn, Spring)
D II 7 - "Metallurgical engineering"
8D07212 - "Metallurgical engineering"
Doctor of Engineering (Industry)
full time (professional track) - 3 years

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	Lk/Ab/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							
MET330	Highly efficient processes, devices and technologies for the production of non-ferrous, rare and precious metals and their compounds	1	BD, CCH	5	150	30/0/15	105	E	5							
MET333	Sustainable development, resource conservation and green technologies in metallurgy	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																
MET331	Mathematical theory of experiment and statistical processing of scientific research results	1	PD, CCH	5	150	30/0/15	105	E	5							
MET334	Innovative technologies, principles of "gentle metallurgy" in the copper industry	1	PD, CCH	5	150	30/0/15	105	E	5							
MET332	Forecasting and design of innovative metallurgical technologies	2	PD, CCH	5	150	30/0/15	105	E	5							
MET335	Production of innovative products from the rare metal industry, principles of circular metallurgy	2	PD, CCH	5	150	30/0/15	105	E	5							
M-3. Practice-oriented module																
AAP371	Industrial internship		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	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

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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. B.

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

Zhumagaliyeva A. S.

Director - Mining and Metallurgical Institute named after
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Bysbekov K. .

Department Chair - Metallurgy and mineral processing

Barmenshinova M. .

Representative of the Academic Committee from Employers

Ospanov Y. A.

____Acknowledged____



