Mining and Metallurgical Institute named after O.A. Baikonurov

Department «Metallurgy and Mineral Processing»

EDUCATIONAL PROGRAM
7M07233 – Metallurgical Engineering

Code and classification of the field of education:	7M07 – Engineering, manufacturing and construction industries
Code and classification of training directions:	7M072 – Manufacturing and processing industries
Group of educational programs:	M117 – Metallurgical Engineering
Level based on NQF:	7
Level based on IQF:	7
Study period:	1,5 years
Amount of credits:	90

Almaty 2025

Educational program «7M07233 – 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 «7M07233 – Metallurgical Engineering» was developed by Academic committee based on direction «7M072 – 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 Departament of MaMP	KazNITU named after K.I. Satpaeva	
Teaching staff:				
Moldabayeva G.Zh.	c.t.s., associate professor	Professor of the Departament of MaMP	KazNITU named after K.I. Satpaeva	
Ussoltseva G.A.	c.t.s	Associate professor of the Departament of MaMP	KazNITU named after K.I. Satpaeva	
Teaching staff:				
Ospanov E.A.	d.t.s.	Head of Department of complex processing of technogenic raw materials	Kazakhmys Holding LLP	
Students:				
Sagyndyk A.N.	bachelor of engineering and technology	2nd year master's student	«Kaz Minerals» LLP	

Table of contents

	List of abbreviations and designations	4
1.	Description of educational program	5
2.	Purpose and objectives of educational program	6
3.	Requirements for the evaluation of educational program learning outcomes	6
4.	Passport of the educational program	9
4.1.	General information	9
4.2.	The relationship between the achievability of the formed learning outcomes according to the educational program and academic disciplines	11
5.	The curriculum of the educational program	18

List of abbreviations and designations

NCJS K.I. Satbayev KazNRTU – NCJS «Kazakh National Research Technical university named after K.I.Satbayev»

NQF – national qualifications framework;

IQF – industry qualifications framework;

LO – learning outcomes;

KC – key competencies;

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;

SDGs – Sustainable Development Goals

1. Description of the educational program

The volume of completed academic credits determines the duration of master's studies. When mastering the established volume of academic credits and achieving the expected learning outcomes for obtaining a master's degree, the master's degree program is considered fully mastered. In the specialized master's program there are 90 academic credits with a duration of study of 1.5 years.

Planning of the content of education, the method of organizing and conducting the educational process is carried out by the university and scientific organization independently based on credit education technology.

Master's programs in the relevant field implement postgraduate educational programs for the training of management personnel with in-depth professional training.

The meaningful educational program includes several modules:

– M-1. Training module (university component, elective component);

– M-2. Module of specialized training (university component, optional component);

– M-3. Practice-oriented module;

– M-4. Experimental research module;

– M-5. Final certification module.

The educational program includes the following stages of undergraduates' training: Foreign language (professional), Management, Management Psychology, Calculations of metallurgical processes and equipment, Methods and means of analysis of metallurgical processes and metallurgical products, Extraction, sorption in metallurgy of rare metals, Waste management of the metallurgical industry, Technology of production of refractory materials, Resource and energy conservation in metallurgy.

The possibility of choosing the following disciplines from the catalog of elective disciplines of Satbayev University: Ion exchange processes and equipment, Thermophysical foundations of metallurgical furnace design, Modern problems of materials and process sciences, Special chapters on heat transfer of metallurgical processes, Intellectual property and scientific research, Processes of direct alloying of steel, Mass transfer in heterophase metallurgical systems, Project management, Technologies for processing secondary raw materials, Chemistry of complex compounds, Radiation safety and dosimetry, Hardware design of processes for the production of radioactive metals.

2. Purpose and objectives of educational program

Purpose of EP «7M07233 – Metallurgical engineering»: formation of personnel for the innovative metallurgy economy, covering modern energy-saving technologies, design activities, innovative solutions, entrepreneurship in the high-tech field of mineral processing, training of highly qualified specialists for the metallurgical industry, capable of developing and implementing innovative, resource-saving and environmentally friendly technologies in accordance with the goals of sustainable development.

Tasks of EP «7M07233 – Metallurgical engineering»:

– the competence of graduates in design and technological work in the implementation of projects to improve and optimize metallurgical processes, increase their productivity and improve the quality of products;

– the competence of graduates in the implementation of the development and implementation of technological processes for processing mineral, natural and man-made raw materials;

– the competence of graduates in the assessment of innovation and technological risks in the introduction of new technologies;

– the competence of graduates in the system of digitalization of metallurgy industries. Acquisition of competencies in production management at all stages of the life cycle of manufactured products;

– competence in the marketing of high-tech technologies.

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

3. Requirements for evaluating the educational program learning outcomes

The requirements for the master's degree level are determined based on the Dublin descriptors of the second level of higher education (Master's degree) and reflect the acquired competencies expressed in the achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire Master's degree program and at the level of individual modules or academic disciplines.

Descriptors reflect learning outcomes that characterize the student's abilities:

1) Demonstrate developing knowledge and understanding in the field of metallurgy under study, based on advanced knowledge of metallurgy, when developing and (or) applying ideas in the context of research;

2) apply their knowledge, understanding and abilities at a professional level to solve problems in a new environment, in a broader interdisciplinary context;

3) To collect and interpret information for the formation of judgments, taking into account social, ethical and scientific considerations;

4) Clearly and unambiguously communicate information, ideas, conclusions, problems and solutions to both specialists and non-specialists;

5) Learning skills necessary for independent continuation of further education in the field of metallurgy under study;

6) to critical thinking and problem solving, taking into account the principles of sustainable development.

Requirements for the key competencies of graduates of the specialized master's degree. The graduate must:

1) Have an idea:

– About current trends in the development of scientific knowledge;

– On current methodological and philosophical problems of natural (social, humanitarian, economic) sciences;

– On the contradictions and socio-economic consequences of globalization processes;

– On the current state of the economic, political, legal, cultural and technological environment of the global business partnership;

– On the organization of strategic enterprise management, innovation management, leadership theories;

– About the main financial and economic problems of the functioning of enterprises.

2) Know:

– Methodology of scientific knowledge;

– The main driving forces of the change in the structure of the economy;

– Features and rules of investment cooperation;

– At least one foreign language at a professional level that allows you to conduct scientific research and practical activities.

3) Be able to:

– To apply scientific methods of cognition in professional activity;

– Critically analyze existing concepts, theories and approaches to the study of processes and phenomena;

– integrate knowledge gained in different disciplines; use it to solve analytical and managerial tasks in new unfamiliar conditions;

– To carry out a microeconomic analysis of the economic activity of the enterprise and use its results in the management of the enterprise;

– To put into practice new approaches to the organization of marketing and management;

– To make decisions in difficult and non-standard situations in the field of organization and management of business activities of the enterprise (firm);

– To apply in practice the norms of the legislation of the Republic of Kazakhstan in the field of regulation of economic relations;

– think creatively and be creative in solving new problems and situations;

– To carry out information-analytical and information-bibliographic work with the involvement of modern information technologies;

– To summarize the results of experimental research and analytical work in the form of a master's thesis, an article, a report, an analytical note, etc.

4) Have skills:

– Solutions to standard scientific and professional tasks;

– Scientific analysis and solution of practical problems in the organization and management of economic activities of organizations and enterprises;

– research problems in the field of management and marketing and use the results to improve enterprise management methods;

– professional communication and intercultural communication;

– Oratory, correct and logical presentation of their thoughts in oral and written form;

– expanding and deepening the knowledge necessary for daily professional activities and continuing education in doctoral studies;

– The use of information and computer technologies in the field of professional activity.

5) Be competent:

– in the field of research methodology in the specialty;

– in the field of modern problems of the world economy and the participation of national economies in world economic processes;

– in the organization and management of the company's activities;

– in the implementation of industrial relations with various organizations, including public service bodies;

– in ways to ensure constant updating of knowledge, expansion of professional skills and abilities;

– in matters of international cooperation, the introduction and dissemination of environmentally sound technologies.

4. Passport of the educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	7M07 – Engineering, manufacturing and construction industries
2	Code and classification of training directions	7M072 – Manufacturing and processing industries
3	Educational program group	M117 – Metallurgical Engineering
4	Educational program name	7M07233 – Metallurgical engineering
5	Short description of educational program	A specialized educational program focused on the industrial need for personnel, including experimental and production activities in the field of metallurgy; including training in highly efficient processes and technologies for the production of non-ferrous, rare and radioactive metals and their compounds, as well as innovative materials based on them; recycling of secondary raw materials, increasing energy, resource conservation and environmental safety in non-ferrous metallurgy. The program focuses on innovative and environmentally friendly solutions that ensure the sustainable development of the metallurgical industry.
6	Purpose of EP	Formation of personnel for the innovative metallurgy economy, covering modern energy-saving technologies, design activities, innovative solutions, entrepreneurship in the high-tech field of mineral processing, training of highly qualified specialists for the metallurgical industry, capable of developing and implementing innovative, resource-saving and environmentally friendly technologies in accordance with the goals of sustainable development.
7	Type of EP	New
8	The level based on NQF	7
9	The level based on IQF	7
10	Distinctive features of the EP	No
11	List of competencies of educational program	Professional competencies; Research competencies; Basic competencies and knowledge; Communication competencies; Universal human competencies; Management competencies; Cognitive competencies; Creative competencies; Information and communication competencies.
12	Learning outcomes of educational program:	LO1 - is to explain the scientific principles underlying modern and promising technologies for processing ferrous and non-ferrous metallurgical raw materials, including integrated processing, digitalization and sustainable technologies; LO2 - Apply nanostructuring and modification methods for non-ferrous alloys to improve their performance using

		modern physico-chemical approaches; LO3 - To analyze technological schemes of extraction, sorption and associated extraction of heavy, rare and rare-earth metals, taking into account resource and energy-saving aspects; LO4 - is to evaluate the efficiency of processing multicomponent and man-made raw materials, including the processing of metallurgical waste and the production of composite materials based on them; LO5 - is to design technological solutions and justify the choice of equipment for processing raw materials and waste in metallurgy, with an emphasis on reducing the environmental burden and maximizing the extraction of valuable components; LO6 - To use software tools and computer modeling methods (including CAD, CAE, CAM) for the analysis and optimization of metallurgical processes; LO7 - is to synthesize knowledge about modern materials, alloys and nanotechnology to substantiate the directions of innovative development of metallurgical technologies.; LO8 - is to evaluate the potential of using artificial intelligence and big data in the management and optimization of metallurgical industries.
13	Education form	Full-time
14	Period of training	1,5 year
15	Amount of credits	90
16	Languages of instruction	Kazakh, Russian, English
17	Academic degree awarded	Master of Engineering and Technology in the educational program «7M07233 – Metallurgical engineering»
18	Developer and author:	Barmenshinova M.B.

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)							
				LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8
Cycle of basic disciplines University component											
1	LNG212 Foreign language (professional)	The purpose of the discipline is to acquire and improve competencies in accordance with trade standards of foreign education, capable of competing in the labor market, because through a foreign language, the future master gains access to academic knowledge, new technologies and modern information, allowing the use of a foreign language as a means of communication in the intercultural, professional and scientific activities of the future master.	2	ν					ν		
2	MNG726 Management	Purpose: To form a scientific understanding of management as a type of professional activity. Contents: Mastering the general theoretical principles of managing socio-economic systems; acquiring skills and abilities in practical problem-solving of managerial issues; studying global management practices and the specificities of Kazakhstani management; training in solving practical issues related to managing various aspects of organizational activities.	2			ν				ν	ν
3	HUM211 Psychology of management	Objective: To acquire skills in making strategic and managerial decisions, taking into account the psychological characteristics of the individual and the team. Content: the modern role and content of psychological aspects in management activities, methods for improving psychological literacy, the composition and structure of management activities, both at the local and foreign levels, the psychological feature of modern managers.	2			ν				ν	ν

Cycle of basic disciplines Elective component											
4	MEI274 Ion exchange processes and equipment	Purpose: to master the theoretical foundations and technologies of ion exchange processes used in hydrometallurgy Contents: theoretical foundations and technologies of ion exchange processes in hydrometallurgy; classification of sorbents and methods of their preparation; technological schemes of ion exchange processes, ion exchange devices; methods of mathematical description of ion exchange processes and problem solving; mass transfer processes and technology of processing uranium raw materials by leaching methods followed by the use of sorption and separation of impurities; ion exchange methods in devices column type; designs and principles of operation of technological devices.	4					ν		ν	
5	MEI275 Thermal design principles of metallurgical furnaces	Purpose: to study the thermophysical foundations of metallurgical furnace design Contents: Modern metallurgical furnace design tasks: requirements, challenges, development directions, Heat transfer processes in metallurgical furnaces, Design and thermal engineering features of metallurgical furnaces, Innovations and digital design, Modern materials and sustainability.	4					ν		ν	ν
6	MEI298 Nanotechnology and modified non-ferrous alloys	Purpose: To provide students with systematic knowledge about the structure, properties and applications of non-ferrous metals and their alloys, with an emphasis on modern nanotechnology and modification methods aimed at improving the strength, corrosion resistance and operational durability of materials; mastering the principles of nanostructuring, creating nanocoats and applying physico-chemical research methods for modified alloys. Contents: Non-ferrous metals and alloys: structure,	5		ν					ν	

		properties, applications, Hardening mechanisms of non-ferrous metals, Nanostructuring of non-ferrous alloys, Methods for modifying the structure of non-ferrous alloys, Nanocoating and surface modification of non-ferrous metals, Physico-chemical research methods for nanomodified alloys, Corrosion resistance and durability of nanomodified non-ferrous al-loys.										
7	MEI277 Special chapters of heat exchange of metallurgical processes	Purpose: to acquire knowledge and skills on the main processes of heat exchange of metallurgical processes, types of heat transfer. Contents: In-depth theoretical foundations of heat transfer, Mathematical models of heat transfer in non-stationary conditions of metallurgical processes, Heat transfer in specific metallurgical technologies, Numerical modeling and calculation of heat transfer, Applied and interdisciplinary aspects, Materials with controlled thermophysical properties: adaptive linings, nanostructured coatings	5					ν		ν	ν
8	MNG781 Intellectual property and research	The purpose of this course is to provide undergraduates with the knowledge and skills necessary to understand, protect and manage intellectual property (IP) in the context of scientific research and innovation. The course is aimed at training specialists who can effectively work with IP, protect the results of scientific research and apply them in practice.	5	ν		ν					
Cycle of core disciplines University component												
9	MET752 Current and future technologies for processing raw materials of ferrous and nonferrous metallurgy	Purpose: To provide students with a systematic and in-depth understanding of modern and promising technologies for processing ferrous and non-ferrous metallurgy raw materials based on scientific principles, with an emphasis on innovative, digital and sustainable approaches. Contents: Scientific foundations and challenges of	5	ν			ν				ν

		modern metallurgy, Innovative technologies of ferrous metallurgy, Promising approaches in non-ferrous metallurgy, Complex processing of multicomponent raw materials: approaches to maximum extraction of valuable components, Digital and sustainable technologies, New materials and alloys as an incentive for the development of metallurgical processing technologies.									
10	MEI268 Calculations of metallurgical processes and equipment	Purpose: to master the methods of thermodynamic, mass transfer and technological calculations used in the production of non-ferrous metals. Contents: methods of thermodynamic, mass transfer and technological calculations in the production of non-ferrous metals; issues of choosing a technological scheme and basic metallurgical aggregates; drawing up material and thermal balances; plotting balance sheets; plotting dependencies and diagrams; examples of drawing up algorithms for engineering calculations in metallurgy, drawing up flowcharts and programs using Excel and object-based software.oriented programming languages; algorithms and programs for planning experiments and processing experimental data.	5					ν	ν		
11	MEI269 Methods and means of analysis of metallurgical processes and metallurgical products	Purpose: to master methods and tools for analyzing metallurgical processes and products. Contents: basic information about the current state and development of methods for analyzing metallurgical processes; methods for measuring electrical conductivity, vapor pressure of metals and their compounds; methods for studying the equilibria of chemical reactions in metallurgical systems: installations and devices used for research in laboratory and industrial conditions.	5		ν	ν	ν				
12	MEI299 Extraction and sorption of heavy non-ferrous metals in met-allurgy	Purpose: Formation of undergraduates' theoretical knowledge and practical competencies in the field of physico-chemical fundamentals, technological schemes and equipment for extraction and sorption pro-cesses	5					ν	ν		

		aimed at efficient extraction, separation and purification of heavy non-ferrous metals (copper, zinc, lead, cobalt, nickel, etc.), with an emphasis on resource conservation, recycling of secondary raw materials and reducing the environmental burden of metallurgical production. Contents: Physico-chemical bases of extraction and sorption, Technological schemes of extraction and sorption processes, Extraction and sorption of copper and its alloys, Technologies for the extraction of zinc, lead and cadmium, Extraction of cobalt and nickel by sorption and extraction methods, Equipment and apparatus for extraction and sorption processes, Environmental and resource-saving aspects of ex-traction and sorption										
13	MEI700 Technologies of asso-ciated extraction of light, rare and rare-earth metals	Purpose: Formation of students' deep theoretical knowledge and practical skills in the field of physico-chemical properties of light, rare and rare-earth metals, as well as modern methods of their associated extraction from mineral and man-made raw materials; development of technological schemes, equipment and resource-saving approaches aimed at increasing the complexity of processing and reducing the envi-ronmental impact of metallurgical industries. Contents: Physico-chemical properties of light, rare and rare earth metals, Methods of associated extrac-tion of light metals (lithium, beryllium, magnesium, aluminum), Technologies of associated extraction of rare metals (niobium, tantalum, germanium, indium, etc.), Extraction of rare earth elements (REE): gen-eral principles and methods, Equipment and technological schemes for the efficient extraction of metals, Environmental and resource-saving aspects.	5			ν	ν				
14	MEI273 Resource and energy saving in metallurgy	Purpose: to study the principles and methods of resource and energy conservation in metallurgy Contents: Modern challenges and trends in resource	5			ν	ν				ν

		conservation in the metallurgical industry, Energy saving technologies in ferrous and non-ferrous metallurgy, Integrated use of raw materials and waste, Innovative and digital energy saving technologies, Energy audit of metallurgical enterprises: goals, methods, examples										
Cycle of core disciplines Component of choice												
15	MEI701 Technologies for the production of compo-site (building) materi-als from metallurgical waste	Purpose: To provide undergraduates with theoretical knowledge and practical skills in the development and implementation of technologies for the production of composite building materials using metallurgical waste, including the processes of activation and modification of raw materials, composition design, evaluation of operational properties, selection of equipment and forming technologies, as well as analysis of environmental efficiency and the life cycle of the materials obtained. Contents: Fundamentals of the formation of composite building materials. Technologies for the production of building materials from metallurgical slags: silicate bricks, gas-silicate concrete blocks and products, dry building mixes, additives to Portland cement, thermal insulation materials, sealing materials, catalysts. Processes of activation and modification of raw materials. Designing compositions of building composites. Mechanical, thermal insulation and durability characteristics of the obtained materials. Equipment and technologies for forming building materials from metallurgical slags. Environmental performance and life cycle assessment	5				ν	ν			
16	MEI702 Recycling of metallurgical production waste	Purpose: To develop undergraduates' theoretical knowledge and practical competencies in the field of modern technologies for the disposal and processing of solid, liquid and gaseous waste from metallurgical	5	ν			ν	ν			

		production, including metal extraction processes from secondary resources, design of integrated recycling schemes, equipment selection, as well as assessment of the environmental and resource-saving efficiency of processing processes. Contents: Main directions of solid waste disposal, Recycling of dusts, ashes and slimes, Processing of liquid and gaseous waste, Metal recovery from secondary resources, Complex processing of metallurgical waste, Equipment and technological lines for recycling, Environmental and resource-saving aspects of recycling									
17	MNG705 Project Management	Goal: Gaining knowledge about the components and methods of project management based on modern models and standards. Objectives: study of behavioral models of project-oriented management of business development; mastering international standards PMI PMBOK, IPMA ICB and national standards of the Republic of Kazakhstan in the field of project management; analysis of the features of organizational management of business development through the integration of strategic, project and operational management.	5			ν				ν	ν
18	MET239 Processes and production of super-pure metals	Purpose: Theoretical foundations of modern methods of obtaining ultrapure metals, widely used in the field of high technology, acquiring skills to solve specific problems on the technology of obtaining extremely pure non-ferrous metals. Content: Apparatus and technology for obtaining extra pure metals in non-ferrous metallurgy. Refining and purification of base metals from impurities in non-ferrous metallurgy. Influence of apparatus pressure, neutral gas and temperature for fractional separation of volatile components of non-ferrous metals and their compounds. Zone crystallization and condensation processes for	4			ν				ν	

		obtaining particularly pure metals. Vacuum and plasma production of especially pure metals.										
19	MEI703 Mathematical and computer modeling of metallurgical processes	Purpose: To develop undergraduates' systemic knowledge and practical skills in the field of constructing and applying mathematical and computer models for the analysis, optimization and digitalization of metallurgical processes. Contents: General approaches to the construction of mathematical models of metallurgical processes, Modeling of heat and mass transfer in metallurgical systems, Mathematical description of chemical and phase transformations, Modeling of dynamics of metallurgical apparatuses and processes, Fundamentals of numerical modeling of metallurgical problems, Application of CFD (Computational Fluid Dynamics) in metallurgy, Software tools for modeling metallurgical processes, Optimization of metallurgical processes using models, Modeling in the management and digitalization of metallurgical production	4						ν		ν
20	MEI704 Digital design of metallurgical processes	Purpose: To develop undergraduates' competencies in the field of digital design of metallurgical processes. Contents: Fundamentals of digital models of metallurgical processes, Computer-aided design (CAD) systems, Application of CAE and CAM in metallurgical engineering, Design of metallurgical processes based on digital twins, CFD and multiphysical modeling in digital design, Integration of digital design into production management, Digital technologies in the life cycle of metallurgical facilities	5					ν	ν		ν
21	MEI705 Artificial intelligence in metallurgy	Purpose: To develop undergraduates' knowledge and skills in the use of artificial intelligence for the analysis, optimization and management of metallurgical processes Contents: Introduction to artificial intelligence and its role in metallurgy, Artificial intelligence in metallurgical	5						ν	ν	ν

		process management, Artificial intelligence in technical diagnostics and predictive maintenance, Big data processing and visualization in metallurgy, Artificial intelligence for optimizing the compositions and properties of metal products, Digital platforms and software with artificial intelligence for metallurgy										

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 20.02.2025 Minutes № 9

WORKING CURRICULUM

Academic year	2025-2026 (Autumn, Spring)
Group of educational programs	M117 - "Metallurgical Engineering"
Educational program	7M07233 - "Metallurgical engineering"
The awarded academic degree	Master of engineering and technology
Form and duration of study	full time (professional track) - 1,5 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	
									1 sem	2 sem	3 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)												
CYCLE OF BASIC DISCIPLINES (BD)												
M-1. Module of basic training												
LNG212	Foreign language (professional)		BD, UC	2	60	0.0/30	30	E	2			
MNG726	Management		BD, UC	2	60	15.0/15	30	E	2			
HUM211	Psychology of management		BD, UC	2	60	15.0/15	30	E	2			
MEI275	Thermal design principles of metallurgical furnaces	1	BD, CCH	4	120	15.0/15	90	E	4			
MEI274	Ion exchange processes and equipment	1	BD, CCH	4	120	15/15.0	90	E	4			
MEI277	Special chapters of heat exchange of metallurgical processes	2	BD, CCH	5	150	30.0/15	105	E	5			
MNG781	Intellectual property and research	2	BD, CCH	5	150	30.0/15	105	E	5			
MEI298	Nanotechnology and modified non-ferrous alloys	2	BD, CCH	5	150	30.0/15	105	E	5			
CYCLE OF PROFILE DISCIPLINES (PD)												
M-2. Module of professional activity												
MET752	Current and future technologies for processing raw materials of ferrous and nonferrous metallurgy		PD, UC	5	150	30/15.0	105	E	5			
MEI269	Methods and means of analysis of metallurgical processes and metallurgical products		PD, UC	5	150	30.0/15	105	E	5			
MEI268	Calculations of metallurgical processes and equipment		PD, UC	5	150	30.0/15	105	E	5			
MEI273	Resource and energy saving in metallurgy		PD, UC	5	150	15/15/15	105	E		5		
MEI299	Extraction and sorption of heavy non-ferrous metals in met-allurgy		PD, UC	5	150	30/15.0	105	E		5		
MEI700	Technologies of asso-ciated extraction of light, rare and rare-earth metals		PD, UC	5	150	30/15.0	105	E		5		
MEI701	Technologies for the production of compo-site (building) materi-als from metallurgical waste	1	PD, CCH	5	150	30.0/15	105	E		5		
MEI702	Recycling of metallurgical production waste	1	PD, CCH	5	150	30/15.0	105	E		5		
MNG705	Project Management	1	PD, CCH	5	150	30.0/15	105	E		5		
MET239	Processes and production of super-pure metals	2	PD, CCH	5	150	30.0/15	105	E		5		MET115, MET140, MET114, MET117, MET133
MEI703	Mathematical and computer modeling of metallurgical processes	2	PD, CCH	5	150	30.0/15	105	E		5		
MEI704	Digital design of metallurgical processes	1	PD, CCH	4	120	15.0/15	90	E			4	
MEI705	Artificial intelligence in metallurgy	1	PD, CCH	4	120	15.0/15	90	E			4	
M-3. Practice-oriented module												
AAP248	Internship		PD, UC	5				R		5		
M-4. Experimental and research module												
AAP249	Experimental research work of a master student, including an internship and the implementation of a master's project		ERWMS	18				R			18	
M-5. Module of final attestation												

ECA213	Design and defense of the master's project		FA	8							8	
Total based on UNIVERSITY:									30	30	30	
									60		**30**	

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	6	9	15
PD	Cycle of profile disciplines	0	35	14	49
Total for theoretical training:		**0**	**41**	**23**	**64**
RWMS	Research Work of Master's Student				0
ERWMS	Experimental Research Work of Master's Student				18
FA	Final attestation				8
TOTAL:					**90**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 4 dated 03.02.2025

Decision of the Academic Council of the Institute. Minutes № 5 dated 23.01.2025

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___ — Ospanov Y. A.