MINISTRY OF SCIENCE AND EDUCATION
OF THE REPUBLIC OF KAZAKHSTAN

«APPROVED»
by the decision of the meeting of the Academic Council of the Institute
protocol № dated _____ 2019

Chairman of the Academic Council_____A. Naizabekov

MODULAR EDUCATIONAL PROGRAM

7M072 - Manufacturing and processing industries
code and name of the educational program

7M07204 – Metallurgy
Name of the educational program

Educational program level: Master's degree
Period of education – 2 years

Developers:

Head of the Department, Candidate of Technical Sciences

Kuzmin S. L. _____
sign date

Members of the working team on the development of the educational program

Senior lecturer, Candidate of Technical Sciences

Professor Lejnev S. N. _____
sign date

1. Passport of the educational program

The graduate of the scientific and pedagogical master's degree in the field of training "7M072 Manufacturing and processing industries" is awarded the academic degree "Master of Technical Sciences".

The educational program of the scientific and pedagogical magistracy contains:

1) theoretical training, including the study of cycles of basic and core disciplines;

2) practical training in the form of pedagogical and research practice;

3) research work of a master's student, including internship and completion of a master's thesis;

4) final certification.

The educational program "Metallurgy" is implemented in two training paths: 1 – "Ferrous and non–ferrous metallurgy"; 2 – "Metal processing by pressure".

The purpose of the educational program is to train competent highly qualified specialists in relevant areas of the metallurgical industry, who possess research methods, teaching and learning skills, modern computer design and progressive organization of metallurgical production technologies, with professional and personal competencies sufficient for successful activity at enterprises of domestic and international labor markets.

Requirements for the *key competencies* of graduates of the scientific and pedagogical master's degree: a graduate of the educational program must:

- *have an idea* of: advanced achievements and discoveries in the field of metallurgy and prospects for their use; about the directions of higher school pedagogy, research activities; about the use of computer modeling of technological processes in the metallurgical industry;

– *know*: state, Russian and foreign languages that provide communication in professional activities; modern theoretical foundations of production and processing of metals and alloys; fundamentals of pedagogy and psychology; methods of research; standards in the field of product quality management; technologies for obtaining new innovative materials; basic methods of research, control and analysis of materials;

– *be able to*: formulate and solve practical tasks, perform managerial functions, conduct bibliographic work with the involvement of modern information technologies; integrate knowledge of various disciplines to solve production and management tasks in new conditions for metallurgical enterprises; creatively approach problem solving and make effective decisions in non-standard situations when organizing the activities of a metallurgical enterprise;

- *have the skills of*: designing modern equipment and aggregates of the metallurgical industry, developing innovative technologies for the production and processing of ferrous and non–ferrous metals and alloys, using information and computer technologies in the field of professional activity; using scientific methods of research;

- *be competent*: in matters of scientific methodology, the use of modern software products, processing the results and forms their representations.

The scope of professional activity of the Master of Technical Sciences is related to the design and operation of metallurgical enterprises; engineering research in the metallurgical industry; conducting scientific research and educational activities.

Types of activities of Masters of Technical Sciences:

– settlement and design and technical and economic;

– organizational and managerial;

– production, technological and operational;

– expert and consulting;

– research;

– educational (pedagogical).

The objects of professional activity of the Master of Technical Sciences are: organizations of higher and secondary vocational education; research and design institutions; companies, firms and organizations (enterprises) of the mining complex; organizations (enterprises) of other economic infrastructures.

The graduate of the educational program must have *general cultural competencies*:

– the ability to abstract thinking, analysis, synthesis;

– willingness to act in non–standard situations, to bear social and ethical responsibility for the decisions made;

- readiness for self-development, self-realization, use of creative potential.

As a result of mastering the educational program, the graduate must have general professional competencies:

– readiness to communicate in the state, Russian and foreign languages to solve the tasks of professional activity;

– willingness to lead a team in the field of professional activity, tolerantly perceiving social, ethnic, confessional and cultural differences; the ability to use in practice skills and abilities in the organization of scientific and production work, team management, to assess the quality of performance results;

– the ability and willingness to navigate in the formulation of the problem, apply knowledge about modern research methods, analyze, synthesize and critically summarize information;

– the ability to demonstrate knowledge of fundamental and applied disciplines of the master's degree program;

– the ability to independently acquire new knowledge and skills with the help of information technology and use in practice; expand and deepen their scientific worldview;

– the ability to use skills and abilities in practice in the organization of research and scientific-production work, in team management, to influence the formation of team goals, to influence the socio-psychological climate to achieve goals, to assess the quality of activities;

- the ability to demonstrate skills in a scientific team, the ability to generate new ideas;

– the ability to understand the main problems of their subject area, in solving which there is a need for complex selection tasks requiring the use of quantitative and qualitative methods;

– the ability and willingness to conduct scientific experiments using modern research equipment and instruments, evaluate research results;

– the ability to design, present and report the results of the work performed.

As a result of mastering the educational program, the graduate must have *professional competencies:*

– knowledge and skills of using methods of design and reconstruction of metallurgical enterprises, their calculation using, including specialized software products;

– willingness to carry out a technological assessment of an existing metallurgical enterprise;

– ability to develop technologies for the production and processing of ferrous and non-ferrous metals and alloys;

– the ability to develop methods, plans and programs for research and development, prepare tasks for performers, organize experiments and tests, analyze and summarize the results;

– ability to collect, analyze and systematize information on the research topic, prepare scientific and technical reports, reviews of publications on the research topic;

– the ability to develop physical and mathematical (computer) models of phenomena and objects related to the profile of activity;

– possession of methods of protection of intellectual property objects, management of the results of research activities and commercialization of intellectual property rights;

– ability, based on knowledge of pedagogical techniques, to take a direct part in the educational activities of structural units of an educational organization in the profile of the field of training.

2. The content of the educational program

Module	Expected learning outcomes	ECTS credits	semester	Module Components						Emerging competencies
				Discipline code	Name of the components of the module (disciplines, practices and other)	The cycle of discipline	IC или CC	ECTS Credits	Form of control	
1	2	3	4	5	6	7	8	9	10	11
Baz. Basic	Knowledge of the subject and basic concepts of modern philosophy of science. Understanding the importance of science in the culture of modern civilization. Knowledge about the origin of science and the main stages of its historical evolution. Improvement of communicative and intercultural competence to the level of the international standard in various fields of professional and scientific activity. Knowledge of the main categories and essence of pedagogical science, problems of the global education crisis, current trends in the development of the world educational space. Understanding the basics of the professional and pedagogical culture of a high school teacher, mastering the theoretical foundations of modern pedagogical science and forming readiness for creative solutions to professional tasks. Understanding the technology of effective interpersonal communication as the basis for the modernization of public consciousness, knowledge of techniques and techniques of effective communication. Skills of written reasoned presentation of one's own point of view, discussion and practical analysis. The ability to practically use the analysis of inventive tasks in professional (industrial and scientific) activities. Knowledge of modern theoretical foundations of production and processing of various metals and alloys. Knowledge about the basic methods of substantiating design decisions at metallurgical enterprises. The ability to use bibliometric indicators in Thomson Reuters resources and use them as search and analysis tools	**32**	1	IFN 1101	History and philosophy of science	BD	IC	5	E	general cultural, general professional
			1	IYa (P) 1102	Foreign language (professional)	BD	IC	4	E	
			1	PVSh 1103	Higher school pedagogy	BD	IC	5	E	
			1	PU 1104	Management Psychology	BD	IC	3	E	
			1	TPNIPD 1105/ TRIZ 1105	Theory and practice of scientific research in professional activity / Theory of inventive problem solving	BD	CC	5	E	
			1	STOPM SPM 1106/ STOOM D/ 1106	Modern theoretical foundations of the production of metals, alloys and advanced materials / Modern theoretical foundations of materials processing by pressure	BD	CC	5	E	
			2	MOPRMP 1107/ Nau 1107	Methods of substantiation of design decisions at metallurgical enterprises / Scientometrics	BD	CC	5	E	

1	2	3	4	5	6	7	8	9	10	11
RE. Resource conservation and ecology	Knowledge of the main methods of solving environmental problems and energy saving problems in the metallurgical industry, including through the use of modern equipment and aggregates. The ability to conduct studies of the environmental situation, both inside and outside the metallurgical enterprise and to identify violations, as well as to choose and confidently apply in practice the appropriate methods of theoretical and technological calculations of modern equipment of metallurgical production.	**8**	1	EPM 1201/ REPOM D 1201	Environmental problems in metallurgy / Resource conservation and ecology in metalworking processes by pressure	PD	C C	3	E	general professional professional
			3	SOAMO 2206/ ONTLPO MD 2206	Modern equipment and aggregates in the metallurgical industry / Equipment of new technological lines in the processes of metal processing by pressure	PD	C C	5	E	
MKK. Modeling and quality control	The ability to create and analyze mathematical models of the processes and objects under study, apply methods of numerical modeling of processes. Ability to plan and conduct analytical, simulation and experimental studies; critically evaluate data and draw conclusions. Ability to analyze technological processes to select ways, measures and means of product quality management. Knowledge of basic research methods, control of various materials and assessment of their quality. Knowledge of analytical methods and multi-criteria problems of optimization of metallurgical processes, materials and their properties, methods of their production.	**14**	2	KMOTP 1202	Computer modeling and optimization of technological processes	PD	IC	5	E	general professional professional
			2	MKA 1204/ SMIEM 1204	Methods of control and analysis / Modern methods of research and examination of materials	PD	C C	5	E	
			2	KOK 1205	Qualimetry and quality assessment	PD	IC	4	E	
IMT. Innovative materials and technologies	Knowledge of modern technologies for processing raw materials of ferrous and non-ferrous metallurgy in order to obtain a finished commercial product or semi-product for further processing. Knowledge of the basic technologies for the production of new materials, including nanostructured materials, and their pressure treatment. The ability to develop technological solutions for the production and processing of various new metal-based materials in order to obtain ultra-fine-grained and nanostructured materials with unique properties. The ability to make design and technological decisions aimed at improving the technological process towards improving product quality, energy saving, improving the environment.	**10**	2	NTM 1203/ UNMMP 1203	Nanotechnologies in metallurgy / Ultrafine-grained and new materials and methods of their production	PD	C C	5	E	professional
			3	ITPSRCh ZM 2207/ NTRPOM D 2207	Innovative technologies for processing raw materials of ferrous and non-ferrous metallurgy / New technological solutions in metal pressure treatment processes	PD	C C	5	E	

1	2	3	4	5	6	7	8	9	10	11
NIRM. Research work of a master's student	Relevance, scientific novelty and practical significance of the work. The use of modern methods of scientific research, theoretical, methodological and technological achievements, international best practices. The content of research (methodological, practical) sections.	**24**	2 3 4	NIRM 1301	Research work of a master's student, including internship and completion of a master's thesis	RWoMS		3 3 18		general cultural, general professional professional
Pra. Practicum	Consolidation of theoretical knowledge gained in the learning process, formation of practical skills of teaching and learning methods. Knowledge of the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.	**20**	2	PP 1107	Pedagogical practice	BD	IC	3	Д3	general cultural, general professional professional
			3	IP 220 8	Research practice	PD	IC	17	Д3	
OZMD. Preparation and defense of a master's thesis	Knowledge of key competencies.	**12**	2	IA (OZMD) 2401	Final certification (preparation and defense of a master's thesis)	FC (PaDo MT)		12		general cultural, general professional professional

3. Summary table on the scope of the educational program

Course of study	Semester	Number of modules to be mastered	Number of subjects studied		Number of ECTS credits						Total in hours	Quantity and form of control	
			IC	CC	theoretical training	research work of a master's student	pedagogical practice	research practice	final certification	total		exam	differentiated credit
1	1	2	4	3	30	–	–	–	–	30	900	7	–
	2	4	3	3	24	3	3	–	–	30	900	5	1
2	3	+3	1	2	10	3	–	17	–	30	900	2	1
	4	1+1	–	–	–	18	–	–	12	30	900	–	–
Total		7	8	8	64	24	3	17	12	120	3600	14	2

4. Learning outcomes of the educational program

Graduates of the educational program have the following abilities:

1) demonstrate developing knowledge and understanding in the metallurgical industry based on advanced knowledge and methods of calculating technologies and equipment of metallurgical enterprises;

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

3) to collect and interpret information in the field of scientific and technical problems and prospects for the development of the metallurgical industry in order to form judgments taking into account social, ethical and scientific considerations;

4) clearly and unambiguously communicate information, ideas, conclusions, problems and solutions in the field of development, development and implementation of resource-saving and environmentally friendly metallurgical technologies;

5) to acquire the skills necessary for independent continuation of further education in the field of metallurgy.