NJSC 'Kazakh National Research Technical University named after K.I. Satbayev'
Institute of Metallurgy and Industrial Engineering
Department of Metallurgical Processes, Heat Engineering and Technology of Special Materials
Department of Metallurgy and Mineral Processing

EDUCATIONAL PROGRAM

"NAME of the EDUCATIONAL PROGRAM"
(profile direction (1.5 years)

Master of engineering and technology in the educational program "7M07209 -" metallurgy and mineral processing "

on the basis of the following specialty of the invalidated Specialty Classifier:
6M070900-Metallurgy

1st edition
in accordance with the State Educational Standard of Higher Education 2018

Almaty 2020

САТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

The program was drawn up and signed by the parties:

from KazNRTU named after K. Satpayev:

1. Head of the department "MaMP» Barmenshinova M.B.
2. Head of the Department «MPHEaTSM» Chepushtanova T.A.
3. Director of the Institute of Metallurgy and industrial engineering Yelemesov K.K.
4. The chairman EMG chairs MaMP and MPHEaTSM, assoc. Professor Baimbetov B.S.

From employers:

1. Co-Chair of the Advisory council IMaIE, first deputy executive Director of the ALE "AGMP Mukhanov T.M.
2. Head of the Department of Integrated processing of technogenic raw materials LLP "Kazakhmys", Doctor of Technical Sciences Ospanov E.A.
3. The main concentrator of KAZ Minerals LLP Dzhetybaeva U.K.

From partner university:

Worcester Polytechnic Institute (USA) Mishra B.

Approved at a meeting of the Educational and Methodological Council of the Kazakh National Research Technical University named after K. Satpayev. Minutes No. 4 dated 14.01.2020.

Qualification:

Level 7 of the National Qualifications Framework:
7M07 Engineering, Manufacturing and Construction Industries
7M072 Manufacturing and manufacturing industries (master):

Professional competence:

Solving organizational and production problems in the implementation of innovative projects in the field of mineral processing and metallurgy, preparation for the development of plans and programs for organizing innovative activities at enterprises of mineral processing and metallurgy along the entire chain of the innovation cycle "fundamental research - research and development (R&D) - production of new types products ", possession of modern methods and techniques of working with personnel, methods of creating innovative teams, possession of modern methods of digital format of mineral processing and digital metallurgy.

Brief description of the program:

1 *The objectives of the educational program of the scientific and pedagogical magistracy* in the direction of "Metallurgy and mineral processing" are:

– formation of personnel for an innovative economy in metallurgy and mineral processing, covering modern energy-saving technologies, project activities, innovative solutions, entrepreneurship in the high-tech field of mineral processing;

– formation of design and decision-making skills, culture of self-government, organization of communication and coordination of points of view, design and presentation of results, use of modern software products and technical means, maintenance of the technological process, management of preparation and loading of equipment, monitoring the condition of equipment and rational use of raw materials and materials;

– skills in conducting innovative production management in the field of mineral processing and metallurgy;

– the development of personal scientific-metric indicators of the student;

- formation of skills in planning and conducting research work in the field of metallurgy and mineral processing, teaching in universities.

2 Professional activities

Graduates of the educational program of the *scientific and pedagogical magistracy* "Metallurgy and mineral processing" can carry out the following types of professional activities: design, engineering, production, technology, organizational, and management, research and teaching.

A distinctive feature of the master's program is that the educational program provides knowledge, skills and abilities in the use of energy-saving and "green" technologies and materials, production and sale of products of processing and metallurgical processing; on the development of regulatory and technical documentation for the mining and processing and mining and metallurgical sectors; for the improvement and preparation of the means of mining and metallurgical production. Graduates acquire knowledge in the development and implementation of beneficiation and metallurgical technologies, production of innovative metallurgical products, enhanced consumer properties; graduates have high leadership and organizational qualities; are capable of creating small knowledge-intensive mining and processing and metallurgical businesses.

The mission of the educational program of the master's program "Metallurgy and mineral processing" on the basis of the specialty 6M070900- "Metallurgy" is the formation of students' social and personal qualities and professional competencies, which allow graduates to successfully solve production, technological, organizational and managerial, project tasks in the field of mineral processing minerals and metallurgy, and contributing to their sustainable demand in the labor market, as well as compliance with international educational standards; providing enterprises with highly qualified specialists in the field of metallurgy and mineral processing, specializing in the

implementation of promising fundamental, innovative, digital and applied research and the development and implementation of modern technological processes that ensure high quality products at minimal cost.

3. Objects of professional activity. The objects of professional activity of graduates are enrichment factories, enterprises of ferrous and nonferrous metallurgy, chemical, mining, chemical and machine-building industries, industrial research and design institutes, factory laboratories, higher and secondary vocational educational institutions, government authorities and organizations of various organizational and legal forms.

Types and subjects of professional activity.

The subjects of professional activity are technological processes of the mining and processing and metallurgical industries, processing of raw materials and the production of metal products with increased consumer properties, technologies for obtaining and processing metals and materials, studying the structure and properties, equipment for mining and metallurgical production, automatic control systems for metallurgical production and quality control final products.

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

Education level code - 07 Engineering, manufacturing and construction industries, 7 Engineering sciences and technologies, 7M072 - Manufacturing and manufacturing industries.

PASSPORT OF THE EDUCATIONAL PROGRAM

Scope and content of the program

The term of study in the master's program is determined by the amount of acquired academic credits Upon mastering the established amount of academic credits and achieving the expected learning outcomes for obtaining a master's degree, the master's educational program is considered fully mastered. The scientific and pedagogical magistracy provides 125 academic credits for the entire period of study, including all types of educational and scientific activities of the undergraduate.

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

The master's degree in scientific and pedagogical direction implements educational programs of postgraduate education for the preparation of scientific and scientific and pedagogical personnel for universities and scientific organizations with in-depth scientific, pedagogical and research training.

The content of the Master's degree program consists of:

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

2) practical training of undergraduates: various types of practices, scientific or professional internships;

3) research work, including the implementation of a master's thesis for a scientific and pedagogical magistracy

4) final certification.

The content of the educational program includes the following modules: general education, general engineering, engineering and professional modules.

The content of the educational program includes the following modules: general education, general engineering, engineering and technical and professional modules. The educational program includes the following stages preparation of graduates: foreign language (professional), management psychology, management, modern and perspective technologies of processing of natural resources ferrous and nonferrous metallurgy, special methods of hydrometallurgical technology for associated extraction of light rare earth metals extraction and sorption in metallurgy of heavy nonferrous metals, biogeotechnology metals, the processes of direct alloying of steel, special chapters of extractive metallurgy (English), electrolysis of an aqueous and non-aqueous environments, calculations of metallurgical processes and equipment, chlorine and vacuum technologies in metallurgy, hardware design of processes for obtaining radioactive metals, refining in metallurgy of radioactive and precious metals, mass transfer in heterophase metallurgical systems, plasma metallurgy.

Possibility to choose disciplines from the Satbayev University elective courses catalog.

The objectives of the educational program are:

1. Competence of graduates in design and engineering and technological work in the implementation of projects to improve and optimize concentration and metallurgical processes, increase their productivity and improve the quality of products.

2. Competence of graduates in the implementation of the development and implementation of technological processes for the processing of mineral, natural and technogenic raw materials;

3. Competence of graduates in assessing innovative and technological risks when introducing new technologies;

4. Competence of graduates in the system of digitalization of the mineral processing and metallurgy industries. Acquisition of competencies in production management at all stages of the product life cycle;

5. Competence in the implementation of the marketing of high technologies.

2 Requirements for applicants

The previous level of education of applicants is higher professional education (bachelor's degree). The applicant must have a diploma of the established sample and confirm the level of knowledge of the English language with a certificate or diplomas of the established sample.

The procedure for admitting citizens to a magistracy is established in accordance with the "Standard rules for admission to training in educational organizations that implement educational programs of postgraduate education."

The formation of a contingent of undergraduates is carried out by placing a state educational order for the training of scientific and pedagogical personnel, as well as paying for training at the expense of citizens' own funds and other sources. The state provides citizens of the Republic of Kazakhstan with the right to receive, on a competitive basis, in accordance with the state educational order, free postgraduate education, if they receive education of this level for the first time.

At the "entrance", a master's student must have all the prerequisites necessary for mastering the corresponding educational master's program. The list of required prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, the master student is allowed to master them on a paid basis.

3 Requirements for completing studies and obtaining a diploma

Awarded degree / qualifications: The graduate of this educational program is awarded the academic degree "Master of Engineering" in the direction of "Metallurgy and Mineral Processing".

A graduate who has mastered the master's program must have the following general professional competencies:

– the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities;

– The ability to independently formulate research goals, to establish a sequence for solving professional problems;

– the ability to apply in practice the knowledge of fundamental and applied disciplines that determine the focus (profile) of the master's program;

– the ability to professionally choose and creatively use modern scientific and technical equipment for solving scientific and practical problems;

– the ability to critically analyze, represent, defend, discuss and disseminate the results of their professional activities;

– possession of the skills of compiling and preparing scientific and technical documentation, scientific reports, reviews, reports and articles;

– willingness to lead a team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences;

– readiness for communication in oral and written forms in a foreign language to solve problems of professional activity.

A graduate who has mastered the master's program must have professional competencies corresponding to the types of professional activities that the master's program is focused on:

- *research activities:*
- the ability to form diagnostic solutions to professional problems by integrating the fundamental sections of science and specialized knowledge gained during the master's program;
- the ability to independently conduct scientific experiments and research in the professional field, generalize and analyze experimental information, draw conclusions, formulate conclusions and recommendations;
- the ability to create and explore models of the studied objects based on the use of in-depth theoretical and practical knowledge in the field of metallurgy and mineral processing;
- *research and production activities:*
- the ability to independently carry out production and research and production, laboratory and interpretation work in solving practical problems;
- the ability to professionally operate modern laboratory equipment and instruments in the field of the mastered master's program;
- the ability to use modern methods of processing and interpreting complex information to solve production problems;
- *project activities:*
- the ability to independently compose and submit projects of research and development work;
- readiness to design complex research and development work in solving professional problems;
- *organizational and management activities:*

- the willingness to use the practical skills of organizing and managing research and development work in solving professional problems;
- readiness for the practical use of regulatory documents in the planning and organization of scientific and production work;
- *scientific and educational activities:*
- the ability to conduct seminars, laboratory and practical classes;
- the ability to participate in the management of scientific and educational work of students in the field of metallurgy and beneficiation.

When developing a master's program, all general cultural and general professional competencies, as well as professional competencies related to those types of professional activities that the master's program is focused on, are included in the set of required results of mastering the master's program.

4 Working curriculum of the educational program

4.1. The term of study is 1,5 years

WORKING curriculum
7M07209 - "Metallurgy and mineral processing"
Group of educational programs M117 - " Metallurgical Engineering",
Set 2020-2021

form of study: full-time | duration of study: 1,5 year | academic degree: master of engineering and technology

Year of study	The code	Name of the discipline	Cycle	Academic loans	Lk / lb / pr / IWM	Prerequisites	The code	Name of the discipline	Cycle	Academic loans	Lk / lb / pr / IWM	Prerequisites
1	**1 semester**						**2 semester**					
	LNG202	Foreign language (professional))	BD HC	6	0/0/3/3		MET241	Modern and promising technologies for processing raw materials of ferrous and non-ferrous metallurgy	BD CC	4	2/0/1/1	
	MNG274	Management	BD HC	6	2/0/1/3		MET732	Special methods of hydrometallurgy	PD CC	6	2/0/1/3	
	HUM204	Psychology of management	BD HC	4	1/0/1/2		1303	ELECTIVE	PD CC	6		
	1201	ELECTIVE	BD CC	6			1304	ELECTIVE	PD CC	6		
	1301	ELECTIVE	PD CC	6			1305	ELECTIVE	PD CC	6		
	1302	ELECTIVE	PD CC	6			AAP221	Experimental research work of a master's student, including internship and implementation of a master's project	ERW M	4		
		Total		**34**				**Total**		**32**		
2	**3 semester**											
	AAP246	Production practice	PD CC	9								
	AAP220	Experimental research work of a master's student, including internship and implementation of a master's project	ER WM	14								
	ECA206	Registration and defense of the master's project	FC	12								
		Total		**35**								
				101								

ELECTIVE DISCIPLINES for recruitment for 2020-2021 account. year
educational program " 7M07209-metallurgy and mineral processing"Group of educational programs M117 - " Metallurgical Engineering"

form of study: full-time duration of study: 1,5 year academic degree: master of engineering and technology

Elective code	Discipline Code	Name of disciplines	Cycle	Lk / lb / pr / IWM	Prerequisite
1 semester (AUTUMN 2020)					
1201	MET244	Technologies of associated extraction of light, rare and rare earth metals	B	1/0/1/4	
	MET251	Extraction and sorption in metallurgy of heavy non-ferrous metals		1/0/1/4	
1301	MET710	Biogeotechnology of metals	P	2/1/0/3	
	MET240	The processes of direct alloying of steel		2/0/1/3	
1302	MET279	Special Chapters of Extractive Metallurgy (in English)	P	2/0/1/3	
	MET305	Electrolysis of aqueous and non-aqueous media		2/1/0/3	
		Total		**18**	
2 semester (SPRING 2021)					
1303	MET282	Calculations of metallurgical processes and equipment	P	2/1/0/3	
	MET283	chlorine and vacuum technologies in metallurgy		2/1/0/3	
1304	MET202	hardware design of processes for obtaining radioactive metals	P	2/0/1/3	
	MET294	refining in the metallurgy of radioactive and precious metals		2/0/1/3	
1305	MET209	mass transfer in heterophase metallurgical systems	P	2/0/1/3	
	MET214	Plasma metallurgy		2/0/1/3	
		Total		**18**	
		Total		**36**	

MODULAR CURRICULUM

Education program **"7M07209 - Metallurgy and mineral processing"**

Form of study: full Duration of training: 1.5 years *Academic degree: Master*

The cycle	code	Name of disciplines	Semester	Acad. credits	lec.	lab.	prac	IWS	Type of control	Chair
Profile training module										
Basic disciplines (BD) (26 credits)										
Required component (20 credits)										
BD	LNG202	Foreign language (professional)	1	6	0	0	3	3	Exam	EL
BD	HUM204	Management psychology	1	4	1	0	1	2	Exam	SECPM
BD	MNG274	Management	1	6	2	0	1	3	Exam	SECPM
BD	MET241	Current and future technologies for processing raw materials ferrous and non-ferrous metallurgy	2	4	2	0	1	1	Exam	M&MP
By choice module (6 credits)										
BD	MET244	Technologies for the associated extraction of light, rare and rare earth metals	1	6	1	0	1	4	Exam	M&MP
BD	MET251	Extraction and sorption in metallurgy of heavy non-ferrous metals			1	0	1	4	Exam	M&MP
Profile studies (PS) (45 credits)										
Required component (6 credits)										
PS	MET732	Special methods of hydrometallurgy	2	6	2	0	1	3	Exam	MPHE&TSM
By choice module (30 credits)										
PS	MET710	Metal biogeotechnology	1	6	2	1	0	3	Exam	M&MP
PS	MET240	The processes of direct alloying of steel	1		2	0	1	3	Exam	M&MP
PS	MET279	Special chapters of extractive metallurgy (in English)	1	6	2	0	1	3	Exam	MPHE&TSM
PS	MET305	Electrolysis of water and non-water media	1		2	1	0	3	Exam	MPHE&TSM
PS	MET282	Calculations of metallurgical processes and equipment	2	6	2	1	0	3	Exam	M&MP
PS	MET283	Chlorine and vacuum technologies in metallurgy	2		2	1	0	3	Exam	M&MP
PS	MET202	Hardware design of processes for obtaining radioactive metals	2	6	2	0	1	3	Exam	MPHE&TSM
PS	MET294	Refining in the metallurgy of radioactive and precious metals	2		2	0	1	3	Exam	MPHE&TSM
PS	MET209	Mass transfer in heterophase metallurgical systems	2	6	2	0	1	3	Exam	MPHE&TSM
PS	MET214	Plasma metallurgy	2		2	0	1	3	Exam	MPHE&TSM
Practice-oriented module										
	AAP246	Work placement	3	9					Report	M&MP, MPHE&TSM
Research Module (18 credits)										
MSERW	AAP221	Master's student experimental research work	2	4					Report	M&MP, MPHE&TSM
MSERW	AAP220	Master's student experimental research work	3	14					Report	M&MP, MPHE&TSM
Module of final attestation (12 credits)										
FA	ECA205	Registration and defense of the master's thesis	3	12						M&MP, MPHE&TSM
		Total		**101**						

5 Descriptors of the level and amount of knowledge, abilities, skills and competencies

The requirements for the level of preparation of a master's student are determined on the basis of the Dublin descriptors of the second level of higher education (master's) and reflect the acquired competencies, expressed in the achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire educational program of the master's program, and at the level of individual modules or academic discipline.

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

1) demonstrate developing knowledge and understanding in the studied field of metallurgy and mineral processing, based on advanced knowledge of metallurgy and mineral processing, while developing and / or applying ideas in the context of research;

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

3) collect and interpret information to form judgments, taking into account social, ethical and scientific considerations;

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

5) learning skills necessary for independent continuation of further education in the studied field of metallurgy and mineral processing.

6 Completion Competencies

6.1 Requirements for the key competencies of graduates of the scientific and pedagogical *magistracy* must:

1) have an idea:

– on the role of science and education in public life;
– about current trends in the development of scientific knowledge;
– on topical methodological and philosophical problems of natural sciences;
– about the professional competence of a higher school teacher ;
– on the contradictions and socio-economic consequences of globalization processes;
– about the latest discoveries in the chosen field of activity, the prospects for their use for the construction of technical systems and devices;
– about mathematical and physical modeling of systems in the field of technology and equipment development;
– on design and engineering, research, inventive, innovative activities in the field of mineral processing and metallurgy;
– about the possibilities of advanced scientific methods and technical means, to use them at the level required in the study of mining and processing and metallurgical processes and equipment.

2) know:

– methodology of scientific knowledge;
– principles and structure of the organization of scientific activity;
– psychology of students' cognitive activity in the learning process;
– psychological methods and means of increasing the efficiency and quality of education;
– international and domestic standards, decrees, orders, orders of higher and other domestic organizations, methodological normative and guidance materials related to the work performed;
– the current state and prospects of the technical and technological development of concentration and metallurgical processes, the features of the activities of an institution, organization, enterprise and related industries;
– goals and objectives for a specialist in the field of mineral processing and metallurgy for the development and implementation of the latest science-intensive production technologies;
– research methods of concentration and metallurgical processes, equipment operation;
– basic requirements for technical documentation, materials and products;
– rules and regulations of labor protection, issues of environmental safety of technological processes;
– methods of expert assessment in the field of life safety and environmental protection;
– quality management standards;
– advances in science and technology, advanced domestic and foreign experience in the field of mineral processing and metallurgy;
– at least one foreign language at a professional level, allowing for research and practical activities;
– methodology for conducting all types of training sessions and independent work of students.

3) be able to:

– develop technological processes for obtaining conditioned concentrates from ore, as well as metals from concentrates, processing metals and alloys, diagrams of enrichment and metallurgical processes, substantiate operating parameters and indicators;
– draw up a business plan for a technological project;
– to develop energy and resource saving technologies in the field of mineral processing, metallurgy and metalworking;
- to develop measures to protect the environment for enrichment and metallurgical production;
- plan experimental research, choose research methods;
– develop the scheme and design of the experimental setup, carry out installation and debugging;

– process data using planning techniques, regression and correlation analysis, digitalization methods;

- to carry out activities for the organization of production in accordance with the regulations;

- use the knowledge gained for the original development and application of ideas in the context of scientific research;

- critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena;

- to integrate the knowledge gained in different disciplines to solve research problems in new unfamiliar conditions;

- by integrating knowledge, make judgments and make decisions based on incomplete or limited information;

- to apply the knowledge of pedagogy and psychology of higher education in their teaching activities;

- apply interactive teaching methods;

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

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

- be fluent in a foreign language at a professional level, allowing for scientific research and teaching of special disciplines in universities;

- to summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc..;

4) have skills:

- research activities, solving standard scientific problems;

- implementation of educational and pedagogical activities on credit technology of education;

- methods of teaching professional disciplines;

- the use of modern information technologies in the educational process;

- professional communication and intercultural communication;

- oratory, correct and logical design of your thoughts in oral and written form;

- expanding and deepening the knowledge necessary for daily professional activities and continuing education in doctoral studies.

5) be competent:

– in the field of research methodology;

– in the field of scientific and scientific-pedagogical activity in higher educational institutions;

– in matters of modern educational technologies;

– in the implementation of scientific projects and research in the professional field;

– in ways to ensure constant updating of knowledge, expanding professional skills and abilities.

B - Basic knowledge, abilities and skills

B1 - Know the history and philosophy of science, pedagogy and psychology;

B 2 - Ability to independently apply methods and means of knowledge, learning and self-control to acquire new knowledge and skills, including in new areas that are not directly related to the field of activity.

B 3 - To know the state, Russian and one of the most common foreign languages in the industry at a level that ensures human communication.

B4 - Be able to use fundamental general engineering knowledge, the ability to practically use the foundations and methods of mathematics, physics and chemistry in their professional activities.

B5 - Proficiency in professional terminology and the ability to work with educational and scientific materials in the specialty in the original in a foreign language. Ability to be logically correct, reasoned and clearly build oral and written speech.

B6 - General engineering skills.

B7 - Possession of fundamental knowledge of the theory of mineral processing and metallurgical processes;

B8 - Basic knowledge of waste management, metal recycling.

B9 - Possession of modern and promising technologies of metallurgical production.

B10 - Know and own the main business processes in an industrial enterprise.

B11 - Ability to conduct pedagogical work using modern methods and technologies.

P - Professional competencies:

P1 - a wide range of theoretical and practical knowledge in the professional field;

P2 - capable of analyzing technological lines of mineral processing and metallurgical processes.

P3 - ready to carry out installation, commissioning and operation of production systems for mineral processing and metallurgical processes;

P4 - ready to participate in the development and design of new technologies and production lines for mineral processing, production of finished metal-containing products.

P5 - Have the skills of drawing up an apparatus and technological scheme

P6 - Have the skills to carry out technological, heat engineering and energy calculations

P7 - Be able to calculate aerodynamics and hydrodynamics according to the scheme of the apparatus chain

P8 - Be able to calculate and select the main and auxiliary equipment

P9 - Be able to design and select drawings of equipment, buildings and structures

P10 - Be able to develop technological processes for the production and processing of metals and alloys

P11 - Be able to develop a diagram of the beneficiation and metallurgical processes, substantiate operating parameters and indicators

P12 - Be able to draw up a business plan for a technological project

P13 - Be able to develop energy and resource saving technologies in the field of metallurgy and metalworking

P14 - Be able to develop measures to protect the environment for metallurgical production

P15 - Be able to conduct a literary search, draw up reports, reviews, conclusions, etc., choose research methods, plan and conduct the necessary experiments, analyze and summarize research results, file patents

P16 - Mastering the technology of processing slags and industrial products of nonferrous and ferrous metallurgy for additional extraction of valuable components and solving environmental problems of the industrial region

P17 -Ability to use the knowledge, abilities, skills mastered in the preparation process to develop a methodology for conducting research work related to the professional sphere and organize experiments with an analysis of their results

P18 - To identify issues on the modernization and implementation of new technologies and equipment for the intensification of enrichment and metallurgical processes in order to increase the recovery of valuable components contained in it

P19 - Possess practical skills in the field of independent organization and management of research work on the topic

P20 - Ability to apply knowledge, abilities, skills, mastered in the process of training in the educational program of the magistracy.

O - Human, social and ethical competences

O1 - able to freely use English as a means of business communication, a source of new knowledge in the field of automation or robotization of production processes. I am ready to use English in professional activities in the field of beneficiation and metallurgy;

O2 - able to fluently speak the Kazakh (Russian) language as a means of business communication, a source of new knowledge in the field of automation or robotization of production processes. I am ready to use the Kazakh (Russian) language in professional activities in the field of beneficiation and metallurgy;

O3 - know and apply in work and life the basics of applied ethics and ethics of business communication;

O4 - know and apply the basic concepts of professional ethics;

O5 - to know and solve the problems of human influence on the environment.

C - Special and managerial competences

C1 - independent management and control of the processes of labor and educational activities within the framework of the strategy, policy and goals of the organization, discussion of problems, reasoning conclusions and competent handling of information;

C2 - to be a specialist in experimental research of objects of ore processing and metallurgy;

C3 - to be a researcher, a specialist in scientific research of objects of enrichment of ore raw materials and objects of finished metal-containing products;

C3 - to be an engineer for the development and design of concentration and metallurgical workshops, factories, production lines.

6.2 Requirements for the research work of a master student in a scientific and pedagogical magistracy:

1) corresponds to the profile of the master's educational program, according to which the master's thesis is performed and defended;

2) is relevant and contains scientific novelty and practical significance;

3) is based on modern theoretical, methodological and technological achievements of science and practice;

4) carried out using modern scientific research methods;

5) contains research (methodological, practical) sections on the main protected provisions;

6) is based on advanced international experience in the relevant field of knowledge.

6.3 Requirements for organizing practices:

The educational program of the scientific and pedagogical magistracy includes two types of practices, which are carried out in parallel with theoretical training or in a separate period:

1) pedagogical in the DB cycle - at the university;

2) research in the PD cycle - at the place of the dissertation.

Pedagogical practice is carried out with the aim of developing practical skills in teaching and learning methods. At the same time, undergraduates are involved in conducting classes in a bachelor's degree at the discretion of the university.

The research practice of the undergraduate is carried out with the aim of acquainting with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.

7 ECTS Diploma Supplement

The application was developed according to the standards of the European Commission, Council of Europe and UNESCO / CEPES. This document is for academic recognition only and is not an official proof of education. Not valid without a university degree. The purpose of completing the European Annex is to provide sufficient information about the holder of the diploma, the qualification obtained, the level of this qualification, the content of the study program, the results, the functional purpose of the qualification, as well as information about the national education system. The application model, which will be used to translate grades, uses the European Credit Transfer or Transfer System (ECTS).

The European Diploma Supplement provides an opportunity to continue education at foreign universities, as well as to confirm national higher education for foreign employers. When going abroad for professional recognition, additional legalization of the educational diploma will be required. The European Diploma Supplement is completed in English upon individual request and is issued free of charge.

Master, level 7 of the national qualifications framework with the right to hold the following positions: technical director, development director, chief mechanic, chief power engineer at the enterprises of the mining and metallurgical industry, according to the Sectoral Qualifications Framework "Mining and Metallurgical Industry" dated August 16, 2016 No. 1 Association of legal entities "Republican Association of Mining and Mining and Metallurgical Enterprises".

Foreign language (professional)
Code – LNG202
CREDIT – 6
PRE-REQUISIT – Academic English, Business English, IELTS 5.0-5.5

PURPOSE AND OBJECTIVES OF THE COURSE
The aim of the course is to develop students' knowledge of the English language for their ongoing academic research and improve their performance in the field of project management.

SHORT DESCRIPTION OF THE COURSE
The course is aimed at building vocabulary and grammar for effective communication in the field of project management and improving reading, writing, listening and speaking skills at the "Intermediate" level. Students are expected to develop their Business English vocabulary and learn grammar structures that are often used in a management context. The course consists of 6 modules. The 3rd module of the course ends with an intermediate test, and the 6th module is followed by a test at the end of the course. The course ends with a final exam. Master students also need to study independently (MIS). MIS - independent work of undergraduates under the guidance of a teacher.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Upon successful completion of the course, students are expected to be able to recognize the main message and message as well as specific details while listening to monologues, dialogues and group discussions in the context of business and management; understand written and spoken English on topics related to management; write management texts (reports, letters, emails, minutes of meetings) following a generally accepted structure with a higher degree of grammatical accuracy and using business words and phrases, talk about different business situations using appropriate business vocabulary and grammatical structures - in pairs and groups discussions, meetings and negotiations.

Management
CODE – MNG274
CREDIT – 6
PRE-REQUISIT –

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of teaching the discipline "Management" is to master the methodology of project management in various fields of activity, to foster a culture that is adequate to modern project management and information technologies, to create conditions for the introduction of new information technologies in the field of project implementation. The course is based on international recommendations for project management (Project Management Body of Knowledge).

BRIEF DESCRIPTION OF THE COURSE
The content of the discipline is aimed at studying modern concepts, methods, and tools of project management in order to apply them in the further practical activities of a specialist to solve problems of project planning and execution.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
Be able to: prepare documents of the project initialization stage, such as a feasibility study, project charter, etc.; develop and analyze documents related to the planning of project activities, apply various methods of decision support; promptly monitor the execution of works and track deadlines; select personnel, resolve contradictions between team members; manage risks arising during the implementation of projects.
Knowledge gained during the course: Modern standards in the field of project management and their characteristics; PMI approach to project management; Investment planning; Accounting for project risks; Methods for optimizing the use of available resources; Ways to resolve conflict situations; Analysis of actual indicators for timely adjustment of the progress of work.
Skills: project management in accordance with modern requirements of project management; apply in the process of project management software MS Project.

Psychology of management
CODE – HUM204
CREDIT – 4
PRE-REQUISIT

PURPOSE AND OBJECTIVES OF THE COURSE
The main goal of the course is aimed at studying the characteristics of the behavior of individuals and groups of people within organizations; determining psychological and social factors influencing the behavior of workers. Also, much attention will be paid to issues of internal and external motivation of people. The main goal of the course is to apply this knowledge to improve the effectiveness of the organization.

SHORT DESCRIPTION OF THE COURSE
The course is designed to provide balanced coverage of all the key elements that make up the discipline. It will briefly review the origins and development of the theory and practice of organizational behavior, followed by a review of the main roles, skills and functions of management with a focus on management effectiveness, illustrated with real life examples and case studies..

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Upon completion of the course, students will know: the basics of individual and group behavior; basic theories of motivation; basic leadership theories; concepts of communication, management of conflicts and stress in the organization; will be able to define the different roles of leaders in organizations; look at organizations from the point of view of managers; understand how effective management contributes to an effective organization.

Hardware design of processes for obtaining radioactive metals
CODE – MET202
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of the course: To form knowledge about the theoretical laws and practice of the main processes of obtaining radioactive metals; about the principles of hardware and technological design of the main and auxiliary processes and operations.
Course objectives:
* transfer the basic theoretical knowledge of the course;
* help students gain skills to perform practical work;
* familiarize with the basic technological schemes for the production of radioactive metals, the principles of operation of equipment, methods of calculation and selection of technological parameters.

BRIEF DESCRIPTION OF THE COURSE
The course provides theoretical regularities and practice of the main processes of obtaining radioactive metals, as well as their hardware and technological design. Leaching devices, sorption, desorption, extraction processes in uranium production, hardware schemes for processing productive uranium solutions are considered. Processes and devices for the production of radium, thorium, polonium, actinium, protactinium and transuranic elements: plutonium, neptunium, americium and curium are also presented.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
as a result of mastering the discipline, students should
1) know the principles of a hardware-technological design of main and auxiliary technological processes of production of radioactive metals; methods of industrial production of radioactive metals; principles of equipment operation, methods of calculation and choice of technological parameters of processes and equipment for the production of radioactive metals;
2) be able to: choose and justify the scheme of processing of specific radioactive metallurgical raw materials; make thermal and material balances of devices for obtaining radioactive metals;
3) possess the skills of: designing typical and specific elements and units of aggregates in which the processes of obtaining radioactive metals take place; apply in practice modern techniques and methods of calculating devices.

Refining in the metallurgy of radioactive and precious metals
CODE – MET294
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
The aim of the course is to form knowledge about the theoretical laws and practice of refining methods in the production of radioactive and precious metals.
Objectives of the course: to transfer the basic theoretical knowledge of the course; to help students gain skills in performing practical work; to familiarize them with the basic technological schemes of various purification methods in the production of radioactive and precious metals, their principles and capabilities, prospects and limitations.

BRIEF DESCRIPTION OF THE COURSE
The course covers theoretical principles and practice of the basic processes of refining radioactive metals (uranium, thorium, and plutonium), technology and instrumentation: precipitation and extraction cleaning methods in the technology of uranium refining nitrous-oxide of uranium; purification of compounds of thorium (method of fractional neutralization, the method of deposition of hydrated sulphate of thorium oxalate method of cleaning and extraction cleaning); precipitation technology of separation and purification of uranium and plutonium extraction scheme for separation and purification of uranium and plutonium in organic solvents; dry technology for separation and purification of uranium and plutonium. The course also studies the refining of precious metals: gold, silver (chlorine process, electrolysis refining, acid refining methods) and platinum group metals - processing of platinum concentrate, dissolution and finishing of solutions, processing of mother liquor, production of rhodium and iridium, osmium and ruthenium

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
As a result of mastering the discipline, students should
Know: principles of hardware and technological design of main and auxiliary technological processes and operations of refining of radioactive and precious metals;
Be able to: choose and justify the refining scheme of a particular radioactive or precious metal; make material balances of refining devices;
Possess the skills of: comparative analysis of various refining methods; application of refining methods in solving practical problems.

special methods of hydrometallurgy
CODE – MET732
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of the course: the acquisition of knowledge and skills in the field of technology of processing ore and man-made raw materials with solutions of alkaline reagents and ammonia.

BRIEF DESCRIPTION OF THE COURSE
Thermodynamic probability of leaching reactions of mineral raw materials with alkaline reagents. Kinetics of the leaching process. state of metals in solutions of hydroxyl reagents. Technological features of alumina production by hydro-alkaline method. Organization of associated extraction of vanadium and gallium in the processing of alumina-containing raw materials. Ammonia hydrometallurgy. Equilibrium of complexation in aqueous-ammonia solutions. Physical and chemical prerequisites for the use of mixed solutions of sodium hydroxide and ammonia as leaching reagents. Hardware design of leaching processes. Examples of industrial use of hydro-alkaline processing of mineral and man-made raw materials. Some technological aspects and prospects for the development of ammonia hydrometallurgy.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
As a result of mastering the discipline, undergraduates should be able to conduct a thermodynamic assessment of the probability of leaching reactions of mineral raw materials with alkaline reagents. Know The nature of complexation in ammonia media. Based on the calculation of the equilibrium constant of the reaction of the formation of an ammonia metal complex, the degree of its stability is determined. Understand the features of the hardware design of the processes of hydro-alkali metallurgy; apply the acquired knowledge when performing calculations of equipment in the design of the proposed technological schemes for processing mineral and man-made raw materials.

Plasma metallurgy
CODE – MET214
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of the course: the purpose of teaching the discipline "Plasma Metallurgy" is to form students ' systematic knowledge about the basic principles of plasma metallurgy, technologies in ultra-high temperatures, which open up new opportunities for processing metallurgical raw materials associated with a significant concentration of thermal energy and high rates of basic reactions.
Objectives of the course: students learn the basic laws of plasma chemistry, the principles of operation of plasma torches; use of plasma, students analyze raw materials for the use of plasma technologies, students understand the maximum benefit from the use of plasma technologies; students acquire skills in calculating plasma chemical installations.

BRIEF DESCRIPTION OF THE COURSE
The course covers theoretical principles and practice of the basic processes of refining radioactive metals (uranium, thorium, and plutonium), technology and instrumentation: precipitation and extraction cleaning methods in the technology of uranium refining nitrous-oxide of uranium; purification of compounds of thorium (method of fractional neutralization, the method of deposition of hydrated sulphate of thorium oxalate method of cleaning and extraction cleaning); precipitation technology of separation and purification of uranium and plutonium extraction scheme for separation and purification of uranium and plutonium in organic solvents; dry technology of separation and purification of uranium and plutonium. The course also studies the refining of precious metals: gold, silver (chlorine process, electrolysis refining, acid refining methods) and platinum group metals - processing of platinum concentrate, dissolution and finishing of solutions, processing of mother liquor, production of rhodium and iridium, osmium and ruthenium

knowledge, skills and abilities at the end of the course
as a result of mastering the discipline, students should:
know: about the classification of plasma chemical processes; about the basic scheme of plasma chemical production; about the use of low-temperature plasma in the production of steel and special alloys;
be able to: analyze the basic laws of plasma chemistry; determine and prepare raw materials for plasma chemical technology; distinguish plasma chemical installations; perform calculations on the energy balance of plasma furnaces.
have skills in analyzing the separation and neutralization of products of plasma chemical processes.
have the following competencies: on the use of low-temperature plasma in the production of steel and special alloys; on the classification of plasma chemical equipment.

Modern and promising technologies for processing raw materials of ferrous and non-ferrous metallurgy
CODE – MET241
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
Study of methods of extraction and processing of ferrous, non-ferrous, rare and noble metals by their selective dissolution with chemical reagents at the site of occurrence and subsequent extraction of chemical compounds formed in the reaction zone.

SHORT DESCRIPTION OF THE COURSE
The characteristics of the raw material base of ferrous and non-ferrous metallurgy are considered, the features of the material composition of ferrous and non-ferrous metal ores are considered, technological schemes and modes are described, the issues of preparing ores for enrichment starting from the early stages of mining are disclosed, the optimal conditions for pre-concentration of ores are indicated, mining process and beneficiation. In addition, the principles of the organization of production and the prospects for the development of technology and technology for the beneficiation of ferrous and non-ferrous metals.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
After mastering this discipline, the master student must:
know: types of ores and deposits of ferrous and non-ferrous metals, characteristic features of ores of ferrous and non-ferrous metals, the effect of the material composition of ores on concentration indicators, technological requirements for the quality of ores supplied for concentration.
be able to: work with literature and analyze modern and promising technologies for the processing of raw materials of ferrous and non-ferrous metallurgy.

Technologies of associated extraction of light, rare and rare earth metals
CODE – MET244
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
study of the technology of associated extraction of light, rare and rare earth metals.

BRIEF DESCRIPTION OF THE COURSE
Characteristics of the raw material base, technologies for the production of base metals, production of industrial products containing light, rare and rare earth metals. Technologies for processing industrial products of alumina production to produce gallium, vanadium, rubidium, and caesium. Technologies for the processing of lead and tin sublimates to produce indium, thallium, and rhenium. Technologies for the extraction of scandium from the waste of tungsten and tin production. Technologies of extraction of germanium from sublimates of copper, lead, and zinc production. Extraction of light, rare and rare earth metals from industrial products and waste of non-ferrous metallurgy.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
After mastering this discipline, a master's student should:
know the features of the technology for extracting light, rare and rare earth metals;
be able to work with literature and analyze modern technologies and techniques for the production and extraction of light, rare and rare earth metals.

Extraction and sorption in metallurgy of heavy non-ferrous metals
CODE – MET251
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
Study of extraction and sorption processes in the metallurgy of heavy non-ferrous metals.

BRIEF DESCRIPTION OF THE COURSE
The theory and practice of extraction and sorption processes in the metallurgy of heavy non-ferrous metals are considered. The classification of extractants and sorbents is studied. Mechanism and chemistry of the processes of interaction of extractants and sorbents with separate components. Design and operation of extraction and sorption devices in the metallurgy of heavy non-ferrous metals for optimal extraction of them into commercial products. Ways of technological and constructive improvement of extraction and sorption processes in the metallurgy of heavy non-ferrous metals.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
After mastering this discipline, a master's student should:
know: the theory and practice of extraction and sorption processes in the metallurgy of heavy non-ferrous metals.
be able to: work with literature and analyze sorption and extraction processes.

Biogeotechnology of metals

CODE – MET710
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
study of the processes of metal biogeotechnology and application of low-waste technologies that promote the rational use of natural resources.

BRIEF DESCRIPTION OF THE COURSE
A complex of microbiological and technological methodological approaches to solving the main problems of heap, underground and vat bacterial-chemical leaching of sulfide and non-sulfide materials, as well as the extraction of metals from dilute solutions, is considered. Study of the mechanism of bacterial-chemical oxidation of sulfide ores. Study of the role of major microorganisms in bioleaching processes. Study of bacterial leaching processes: heap and underground leaching of copper, zinc, uranium and other metals from poor ores; vat leaching of arsenic gold - and tin-containing copper-zinc concentrates.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
After mastering this discipline, the master's student must:
know: the theory and practice of biogeotechnology of metals, to be guided in the choice and methods of application of biogeotechnologies depending on the composition of raw materials.
be able to: work with literature and analyze the processes of bacterial, heap and subsurface leaching, choose and apply technological schemes of biogeotechnologies.

The processes of direct alloying of steel
CODE – MET240
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
Study of theoretical and technological processes occurring during the melting of cast alloys and during the formation of the structure and properties of castings from ferrous and non-ferrous metals.

SHORT DESCRIPTION OF THE COURSE
The course examines the properties of the most widely used metals and foundry alloys, discusses the conditions and methods for preparing alloys determined by these properties, sets out the basics of filling a casting mold with a melt, examines the laws of crystallization of alloys in real conditions, discusses the solidification of cast billets and their effect on crystallization properties of alloys in cast billets.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know: the properties of metals and elements that make up alloys, for a conscious choice of methods and conditions for preparing alloys, the choice of melting units; - patterns of influence of crystallization conditions and chemical composition for understanding and control of the final structure of alloys in cast billets.

To be able to: select and calculate the optimal, both from a technological and economic point of view, a charge for smelting casting alloys, develop a technological process for smelting, alloying, refining and modifying the most common casting alloys, manage methods of forming the quality of cast shaped castings, describe manufacturing processes cast products from cast iron, steel and non-ferrous alloys

Special chapters of extractive metallurgy (in English)
CODE – MET279
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
Purpose of the course: Formation of undergraduates' systematic knowledge about the basics and principles of extractive metallurgy, methods of processing raw materials, obtaining strategic, critical metals, innovative, modern technologies for extracting metals from raw materials.

Objective of the course: to give undergraduates the following knowledge in English:
about phase transformations and predicting the properties of metals; on the rate of chemical reactions in metallurgical processing, on the importance and types of strategic, critical raw materials, on modern technologies for obtaining metals, on metallurgical technologies of the "green economy".

SHORT DESCRIPTION OF THE COURSE
The course examines the role of extractive metallurgy in the mining and metallurgical sector. Thermodynamics of metallurgical processes. Phase diagrams, phase transformations and prediction of metal properties. Measurement and evaluation of the physical properties of metals at high temperatures. Transport phenomena and properties of metals. Kinetics of metallurgical reactions. Thermoanalytical methods of metal processing. Critical, strategic raw material for extractive metallurgy. Complex processing of mineral, stubborn raw materials. Pyrometallurgical processing of critical raw materials. Innovative technologies for pyrometallurgical processing of metals. Getting cobalt. Electrochemical processes in metallurgy. Getting magnesium, hafnium. Innovative technologies for hydrometallurgical processing of raw materials. Processing of raw materials containing rare and rare earth metals. Understanding of methods for obtaining rare metals (beryllium, bismuth, gallium, niobium, etc.). Complex unconventional raw materials, man-made waste and secondary resources as sources of functional materials.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline, students should
1) know: thermodynamics and kinetics of metallurgical processes as the basis for technology development. progressive technologies for complex and deep processing of natural and technogenic mineral raw materials. technological and environmental aspects of complex processing of refractory mineral and technogenic raw materials in Kazakhstan. complex unconventional raw materials, man-made waste and secondary resources as sources of functional materials. technological problems of complex processing of rare-metal-rare-earth ores and ways to solve them.
2) be able to: perform calculations on thermodynamics and kinetics of metallurgical processes, perform technological calculations for the processing of mineral raw materials, structural calculations for units for processing mineral raw materials;
3) possess the skills: the algorithm for performing the calculation of the technological regulations of the technology, taking into account the technical terminology in English

Electrolysis of aqueous and non-aqueous media
CODE – MET305
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
Purpose of the course: Formation of knowledge on the basics of electrometallurgical and electrochemical processes and the skills of their application in metallurgy.
The objective of the course: to transfer the basic theoretical knowledge of the course of electrolysis proceeding in aqueous and non-aqueous media and molten salts; help students to gain skills in experimental work in the field of anodic dissolution and electrolytic separation of metals from aqueous solutions; teach how to solve typical tasks for electrolytic separation of metals at the cathode; to form students' skills of informal thinking in the field of electrometallurgical processes.

SHORT DESCRIPTION OF THE COURSE
The course "Electrolysis of aqueous and non-aqueous media" examines the laws, theoretical provisions and examples of the practical application of electrolysis in metallurgical practice.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline, students should
know: basic electrochemical laws, concepts and patterns of electrochemical reactions of dissolution and deposition of metals, basic technological methods that allow the use of electrochemical processes in metallurgical practice.
be able to: solve problems in electrolysis, using the acquired knowledge, describe the equations of electrochemical reactions, make technological calculations using the basic electrochemical laws.
possess the skills: navigate the basic concepts of electrolysis; acquire the skills to experimentally conduct anodic dissolution and electrolytic deposition of metals from aqueous media.

Calculations of metallurgical processes and equipment
CODE – MET282
CREDIT – 6
PRE-REQUISIT – MET223

PURPOSE AND OBJECTIVES OF THE COURSE
The aim of the course: study of basic metallurgical processes used in the production of non-ferrous metals; a study of modern technologies for processing raw materials and their instrumentation, familiarity with the directions of their improvement, including – from the point of view of environmental friendliness, efficient use of energy resources and the possibility of non-waste production; - familiarity with theoretical foundations and a description of the specific metallurgical processes fundamentals of process calculations, size and select equipment, key process indicators.
The objectives of the course are: - the development of students the main methods for processing raw materials with the purpose of complex extraction of nonferrous metals, the theoretical foundations of technological processes and the dependence of the process results from the conditions of their implementation; to learn to perform technological calculations of production processes non-ferrous metals production, including using special software to form ideas about how waste and semi-products of metallurgical production and the ways of complex use of polymetallic raw materials.

BRIEF DESCRIPTION OF THE COURSE
The course includes calculations of metallurgical processes and equipment. Calculations of processes and devices of technological schemes of processing of copper, lead, zinc, REM, precious metals. Study of hardware design of modern technologies for processing copper, lead, zinc, rare earth metals, and precious metals. The discipline studies methods of thermodynamic, mass transfer and technological calculations in the production of non-ferrous metals, including: the choice of technological scheme and basic metallurgical units; drawing up material and thermal balances; plotting balance sheets; building dependency graphs and diagrams. examples of drawing up algorithms for engineering calculations in metallurgy, drawing up flowcharts and programs using excel and object-oriented programming languages are considered. algorithms and programs for planning experiments and processing experimental data are studied.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
as a result of mastering the discipline, students should
know: methods of thermodynamic, mass transfer and technological calculations in the production of non-ferrous metals, the basic theoretical foundations of technologies for processing copper, lead, zinc, rare earth metals, precious metals.
be able to: solve problems and make calculations of material balances and flows, calculations of the main and auxiliary equipment for processing copper, lead, zinc, REM, precious metals, make block diagrams and programs, algorithms for engineering calculations.
possess the skills of: basic metallurgical calculations and the basics of.

Chlorine and vacuum technologies in metallurgy
CODE – MET283
CREDIT – 6
PRE-REQUISIT –

PURPOSE AND OBJECTIVES OF THE COURSE
Studying the theory and technology of chlorination and vacuum metallurgy processes, acquiring skills for solving specific problems in chlorination and vacuum technology for producing non-ferrous and rare metals. Chlorination and vacuum technology hardware design, their features and disadvantages.

SHORT DESCRIPTION OF THE COURSE
Modern methods of processing various raw materials using chlorine and vacuum technology. Characterization of chlorides and thermodynamics of chlorination, forms of occurrence of non-ferrous and valuable metals. Selection and justification of chlorine and vacuum technology in the processing of materials containing non-ferrous and valuable metals, economic analysis and assessment.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Master students will gain knowledge on the theoretical foundations of chlorine and vacuum technologies in metallurgy. Students will acquire the ability to navigate in a variety of processes and devices; perform technological heterophase circuits and select equipment; be able to use scientific, technical and advertising literature for acquaintance and analysis of new technologies and devices.

Mass transfer in heterophase metallurgical systems
CODE – MET209
CREDIT – 6
PRE-REQUISIT –

PURPOSE AND OBJECTIVES OF THE COURSE

Purpose: to give knowledge about the transfer of matter (mass) within one phase and (or) between different phases.

Tasks: to evaluate the throughput and limiting stages for mass transfer processes; to determine concentrations, equilibrium, kinetics of mass transfer in the phase.

SHORT DESCRIPTION OF THE COURSE

Basic concepts and general characteristics of mass transfer, its types and stages. Systems: gas-liquid, vapor-liquid, liquid-liquid, liquid-solid, solid-solid. Calculation of the coefficients of mass transfer and mass transfer. Concentrations, ways of expressing the composition of phases and recalculation. Diagram of concentration distribution in phases in the process of mass transfer. Mass transfer kinetics in the phase. Material balance and mass transfer equation. Mass transfer at the level of the reaction volume. Average driving force, its calculation. The number of transfer units. The height of the transfer unit. Molecular diffusion. Turbulent diffusion. Convective transport. Substance flows, direct and countercurrent movement. Conveying capacities and limiting stages of mass transfer. Step counterflow, graphic-analytical and analytical calculations. Mass transfer when cross-connecting devices in a network. Periodic and protracted processes. Mass transfer with solids.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Knowledge: basic concepts and relationships of mass transfer, regularities of matter transfer in heterophase systems.

Skills and skills: calculate the average driving force of mass transfer processes, mass transfer and mass transfer coefficients, compose the material balance of mass transfer processes, build working and equilibrium lines of mass transfer.

Experimental research work of a master's student
CODE – AAP221
CREDIT – 4
PRE-REQUISIT –

PURPOSE AND OBJECTIVES OF THE COURSE
The aim of the EIRM is to develop the ability to independently perform experimental research work related to solving professional problems, which is necessary in the further professional activities of master managers and master marketers.
The tasks of experimental research work of a master's student include:
- development of professional research thinking of undergraduates, formation of a clear idea of the main professional tasks and ways to solve them;
- formation of the ability to independently set professional tasks, plan experimental research work and perform Computational Research in solving professional problems using modern research methods and computing tools;
- formation of the ability to correctly use modern technologies for collecting information, processing and interpreting the obtained experimental data;
- conducting bibliographic work on the topic of the master's thesis with the involvement of modern information technologies;
- processing and analyzing the data obtained, comparing the results of their own research with the data available in the literature;
- ensuring the ability to take a critical approach to the results of their own research, readiness for professional self-improvement and development of creative potential and professional skills.

BRIEF DESCRIPTION OF THE COURSE
EIRM helps to systematize, consolidate and expand theoretical knowledge, develop statistical methods in management, master the elements of independent research work.
The results of experimental research work of a master's student are determined on the basis of Dublin descriptors of the corresponding level of education and are expressed in terms of competencies.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
Should have an idea: about current trends in the development of scientific knowledge; about the contradictions and socio-economic consequences of globalization processes; about the organization of strategic enterprise management, innovation management, leadership theories; about the main financial and economic problems of the functioning of enterprises.
Must know: the methodology of scientific knowledge; at least one foreign language at a professional level that allows you to conduct scientific research and practical activities.
Must be able to: apply scientific methods of knowledge in professional activities; critically analyze existing concepts, theories and approaches to the study of processes and phenomena; integrate knowledge gained in different disciplines, use them to solve analytical and managerial problems in new unfamiliar conditions; conduct microeconomic analysis of the economic activity of the enterprise and use its results in enterprise management; apply in practice new approaches to the organization of marketing and management; to make decisions in difficult and unusual situations in the field of organization and management of economic activities of the enterprise (company); to apply norms of the legislation of the Republic of Kazakhstan in the field of regulation of economic relations; creative thinking and creative approach to solving new problems and situations; to conduct information-analytical and information-bibliographic work with attraction of modern information technologies; summarize the results of experimental research and analytical work in the form of a master's thesis,

article, report, analytical note, etc.
must have the following skills: solving standard scientific and professional tasks; scientific analysis and solving 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 obtained to improve enterprise management methods; expand and deepen the knowledge necessary for daily professional activities and continuing education in doctoral studies; use information and computer technologies in the field of professional activity.
Must be competent: in the field of research methodology in the specialty; in the organization and management of the enterprise; 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.

Production practice
CODE – AAP246
CREDIT – 9
PRE-REQUISIT –

PURPOSE AND OBJECTIVES OF THE COURSE
the purpose of practical training is to gain professional skills and experience in professional activities in accordance with the direction of master's training and specific types of professional activities provided for by the master's degree program. the practice is aimed at consolidating and concretizing the results of theoretical training, the formation of competencies necessary for further professional activity. practice provides continuity and consistency in the study of theoretical and practical material, provides a comprehensive approach to the subject of study.

BRIEF DESCRIPTION OF THE COURSE
The results of certification in practice are taken into account when summing up the overall performance of students. During the internship period, undergraduates must perform all types of work provided for in the internship program in a timely manner and submit a report on the practice. Undergraduates who have not completed the internship program without a valid reason are considered to have academic debt.
The form of control is differentiated credit. The principle of organizing knowledge and competencies for all types of activities - in accordance with the selected types according to the passport of competencies. 10 days before the start of the internship, the head of the master's program provides information to the Institute of Magistracy about the place of internship for undergraduates with the application of letters of guarantee or an individual task form, with signatures and seals.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE
Production practice types, according to the directions of master's training to the professional activities of students and is part of the training program, selected undergraduates, is based on the knowledge and skills in the disciplines we have studied to practical training.
practice options:
- analysis of the activities of the organization, departments and divisions;
- performance of tasks in accordance with the competencies of training masters of OOP under the guidance of the person responsible for the practice of the enterprise (organization);
- participation in the processing of data on the activities of the enterprise (organization) –
- participation in the preparation of reports on the activities of the enterprise (organization), etc.
The content of the production practice is agreed with the scientific director of the practice, and approved by the scientific director of the master's program.

Registration and defense of the master's project (RaDMT)
CODE – ECA206
CREDIT – 12
PRE-REQUISIT –

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of the master's thesis is to
demonstrate the level of scientific/research qualification of the master's student, the ability to independently conduct scientific research, test the ability to solve specific scientific and practical problems, knowledge of the most general methods and techniques for solving them.

BRIEF DESCRIPTION OF THE COURSE
Master thesis – graduation qualification scientific work, which is a generalization of the results of independent studies undergraduates one of the pressing problems of a particular specialty relevant branch of science that has internal unity and reflects the progress and results of the development of the chosen topic.
Master's thesis – the result of research /experimental research work of a master's student, conducted during the entire period of study of a master's student.
The defense of the master's thesis is the final stage of the master's training. The Master's thesis must meet the following requirements –
- the work must conduct research or solve current problems in the field of metallurgy and mineral processing;
- the work should be based on identifying important scientific problems and solving them;
- decisions must be scientifically sound and reliable, have internal unity;
- the dissertation work must be written individually.

Content