Mining and Metallurgical Institute named after O.A. Baikonurov
Department «Metallurgy and mineral processing»

EDUCATIONAL PROGRAM

6B07218 – Technology of foundry production

Code and classification of the field of education:	6B07 - Engineering, manufacturing and construction industries
Code and classification of areas of study:	6B072 - Manufacturing and processing industries
Group of educational programs:	B069 - "Production of materials (glass,paper,plastic,wood)"
NQF level:	Level 6 - higher education and practical experience
ORC level:	Level 6 - a wide range of special (theoretical and practical) knowledge (including innovative). Independent search, analysis and evaluation of professional information
Training period:	4 years
Volume of loans:	240

Almaty 2024

The educational program «6B07218 – Technology of foundry production» was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Protocol No. 12 dated « 22 » 04 2024.

was reviewed and recommended for approval at the meeting of K.I. Satbayev KazNRTU Educational and Methodological Council

Protocol No. 6 dated « 19 » 04 2024.

Educational program «6B07218 – Technology of foundry production» was developed by Academic committee based on direction of «Manufacturing and processing industries»

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Barmenshinova M.B.	c.t.s., associate professor	Head of the Department of MaMP	KazNRTU named after K.I.Satpaeva	
Teaching staff:				
Baimbetov B.S.	c.t.s., docent	Associate professor of the Department of MPHEaTSM	KazNRTU named after K.I.Satpaeva	
Moldabayeva G.Zh.	c.t.s.	Associate professor of the Department of MaMP	KazNRTU named after K.I.Satpaeva	
Employers:				
Ospanov E.A.	Doctor of Technical Sciences	Head of department of complex processing of technogenic raw materials	«Kazakhmys» Corporation LLP	
Students:				

Table of contents

List of abbreviations and symbols

NJSC "Kazakh National Research Technical University named after K.I. Satpayev" - NJSC KazNRTU named after K.I. Satpayev;

SOSE - State obligatory standard of education of the Republic of Kazakhstan;

MSaHE RK - Ministry of Science and Higher Education of the Republic of Kazakhstan;

EP - educational program;

IWS - independent work of a student (student, undergraduate, doctoral student);

IWST - independent work of a student with a teacher (independent work of a student (undergraduate, doctoral student) with a teacher);

WC - working curriculum;

CED - catalog of elective disciplines;

UC - university component;

CC - component of choice;

NQF - National Qualifications Framework;

SQF - Sectoral Qualifications Framework;

LO - learning outcomes;

KC - key competencies.

SDG - Sustainable Development Goals

1. Description of the educational program

It is intended for the implementation of specialized bachelor's degree training in the educational program «6B07218 – Technology of foundry production» at Satbayev University and was developed within the framework of the direction «Manufacturing and processing industries».

This document meets the requirements of:

– Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2 "On approval of State mandatory standards of higher and postgraduate education". It was registered with the Ministry of Justice of the Republic of Kazakhstan on July 27, 2022, No. 28916.

– «National Qualifications Framework», approved by the Protocol dated 06.16.2016 of the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations; – Industry Qualifications Framework "Mining and Metallurgical Complex" dated 07.30.2019 No. 1.

Introduction to the educational program.

The educational program «6B07218 – Technology of foundry production» is the first level of qualification of a three-tier higher education system, which provides the basis for subsequent master's degree programs and then doctoral programs.

The program is aimed at training casting technologists. The necessary basic knowledge and skills in the field of engineering and technology will allow future specialists to easily integrate into the foundry industry workflow. The educational program provides scientific foundations in the field of materials science, foundry, heat treatment and surface hardening. Training of casting technologists for enterprises of Kazakhstan working in the field of foundry, metallurgy and mechanical engineering. The work of specialists consists in the creation, improvement, operation and repair of devices and devices, the creation and research of new materials, as well as their development and implementation of technologies by industry.

The educational program «6B07218 – Technology of foundry production» includes fundamental, natural science, general engineering and professional bachelor's degree training in foundry technology in accordance with the development of science and technology, as well as the changing needs of the mining and metallurgical industry. A distinctive feature of the program is that the program provides graduates with adaptability to the manufacturing sector, due to the content of 40% of general engineering disciplines in the educational program. The graduate receives a fundamental set of general engineering disciplines, as well as the maximum set of specialized disciplines. The program provides in-depth study of the following special disciplines: Technology of structural materials, Theory of mechanisms and machines, Resistance of materials, Physico-chemical fundamentals of foundry production, Quality assurance Tools, Physical Metal Science, Fundamentals of Machine design and parts, Theory of forming metal systems, Foundry alloys and melting, Core and molding mixtures, Methods of protection of metals and alloys corrosion protection, Resource protection- and

energy saving in foundry production, Design and equipment of foundries, Foundry technology, Mold manufacturing technology, Mobile hydraulics.

The field of professional activity of graduates who have completed the bachelor's degree program includes:

– processes for obtaining metals and alloys, metal products of the required quality;

– processing processes that change the chemical composition and structure of metals (alloys) to achieve certain properties;

– design and production of blanks;

– knowledge of CAE-system, CAD-system in foundry production;

– modeling of casting processes.

Graduates of the program will be able to carry out professional activities in the mining and metallurgical complex in engineering and working positions, in metallurgical enterprises, in design organizations, in metallurgical research centers.

Line personnel include: a foundry worker; a design engineer; a technologist; an engineering researcher in design organizations, institutions, institutes, universities; a teaching staff member; a technical specialist, a technical consultant in the fields of activity; a technical engineer, a process engineer in the field of materials science (materials scientist, metallologist); a research engineer; electronic engineering engineer, etc.

Types and objectives of the graduate's professional activity

The list of types of professional activity and their corresponding professional tasks:

Types of professional activity	Professional tasks
scientific research activities	- conducting experimental research; - carrying out literary and patent search, preparation of technical reports, information reviews, publications; - study of scientific and technical information, domestic and foreign experience on the subject of research;
design and analytical activities	- carrying out a technical and economic analysis of the development of projects for new and reconstruction of existing workshops, industrial units and equipment; - analysis of designs and calculations of technological equipment; - analysis of design and working technical documentation; - development and analysis of mathematical models;
production and technological activities	- implementation of technological processes for the production and processing of metals and alloys, as well as products made from them; - implementation of measures to protect the environment from man-made impacts of production;

	- implementation of measures to ensure product quality; - organization of workplaces, their technical equipment, placement of technological equipment; - monitoring compliance with technological discipline; - organization of maintenance of technological equipment;
design and technological activities	- collecting information for a feasibility study and participating in the development of projects for new and reconstruction of existing workshops, industrial units and equipment; - calculation and construction of technological equipment elements; - development of design and working technical documentation;

2. Purpose and objectives of the educational program

The purpose of EP «6B07218 – Technology of foundry production» is:

– providing fundamental and practical training for students to successfully solve engineering problems in various fields of foundry, metallurgy and materials science, which are interdisciplinary in nature, taking into account the principles of sustainable development and the introduction of environmentally sound technologies.

The objectives of the EP «6B07218 – Technology of foundry production» are:

– knowledge and understanding of the scientific and mathematical principles underlying various specializations in foundry technology;

– the ability to apply the acquired knowledge to formulate, formulate and solve applied scientific problems in foundry technology using recognized methods;

– the ability to apply the acquired knowledge to the analysis of technical systems, processes and methods related to various specializations in foundry technology, including using modeling methods.;

– understanding of engineering systems design methodologies and the ability to apply them;

– the ability to analyze, plan and conduct the necessary research, interpret the data obtained and draw conclusions;

– the ability to select and use appropriate equipment, tools, and techniques;

– work effectively both individually and as a team member;

– to show awareness in the field of project management and business, knowledge and understanding of the impact of risks and changing conditions;

– be aware of the need and have the ability to independently study and improve their skills throughout their lives;

– understanding of health, safety, legal aspects and responsibility for engineering activities, understanding the impact of engineering solutions on the social context and the environment;

– follow the code of professional ethics and standards of engineering practice;

– formation of students' environmental responsibility and understanding of the principles of circular economy aimed at reducing production waste and rational use of natural resources in accordance with the SDGs.

3. Requirements for evaluating the learning outcomes of an educational program

As a result of mastering the bachelor's degree program 6B07218 – "Technology of foundry production", the graduate should have general cultural, general professional and professional competencies.

A graduate who has completed a bachelor's degree program must have the following competencies:

general cultural competencies:

– the ability to use the basics of philosophical knowledge, analyze the main stages and patterns of historical development to realize the social significance of their activities;

– ability to communicate orally and in writing in Russian and a foreign language to solve problems of interpersonal and intercultural interaction;

– ability to work in a team, tolerantly perceiving social, ethnic, religious and cultural differences;

– ability to self–organize and self–education;

- ability to use general legal knowledge in various fields of activity;

- ability to maintain proper the level of physical fitness to ensure full-fledged social and professional activities.

general professional competencies:

– willingness to use fundamental general engineering knowledge;

– willingness to critically reflect on accumulated experience, to change the profile of their professional activities, if necessary;

– ability to realize the social significance of their future profession;

– willingness to combine theory and practice to solve engineering problems;

– the ability to apply the principles of rational use of natural resources and environmental protection in practice;

– the ability to use regulatory legal documents in their professional activities;

– the willingness to choose measuring instruments in accordance with the required accuracy and operating conditions;

– the ability to follow metrological standards and regulations, meet the requirements of national and international standards in the field of professional activity;

– the ability to use the principles of the quality management system.

professional competencies corresponding to the type(s) of professional activity that the bachelor's degree program is focused on:

scientific and research activities:

– the ability to analyze and synthesize;

– the ability to choose research methods, plan and conduct necessary experiments, interpret results and draw conclusions;

– the willingness to use the physical and mathematical apparatus to solve problems arising in the course of professional activity;

- the willingness to use the basic concepts, laws and models of thermodynamics, chemical kinetics, heat and mass transfer;

– the ability to select and apply appropriate methods for modeling physical, chemical and technological processes.

design and analytical activity:

- ability to perform technical and economic analysis of projects;

– ability to use a process approach;

– the ability to use information tools and technologies in solving problems that arise in the course of professional activity;

– the willingness to make calculations and draw conclusions when solving engineering problems.

production and technological activity:

- the ability to implement and adjust technological processes in metallurgy and material processing;

– willingness to identify facilities for improvement in engineering and technology;

– the ability to select materials for products for various purposes, taking into account operational requirements and environmental protection;

– the willingness to assess risks and determine measures to ensure the safety of technological processes.

design and technological activity:

– the ability to carry out project elements;

– the willingness to use standard software tools in design;

– the ability to justify the choice of equipment for technological processes.

additional competencies in the field of organizational and managerial activities, agreed with employers:

- the ability to apply methods of technical and economic analysis;

– willingness to use the principles of production management and personnel management;

- willingness to use the organizational and legal foundations of managerial and entrepreneurial activities;

– the ability to organize the work of a team to achieve a set goal.

additional general professional competencies focused on areas of knowledge: communication, individual and teamwork, lifelong education, additional engineering skills:

– the ability to acquire new, expand and deepen previously acquired knowledge, skills and competencies in various areas of life necessary for successful implementation in the field of professional activity, including at the junction of different fields of activity and fields of sciences.

Special requirements for graduation in this OP:

– The student should have a general understanding of the topic of the thesis/research plans, and contact potential academic supervisors one year before the expected completion of studies.;

– to get acquainted with potential scientific supervisors and accelerate students' choice of thesis topics (project), a review meeting is held one year before the expected completion of studies;

– to collect the necessary data and study current tasks, methods and procedures on the topic of the thesis, the student undergoes an internship;

– upon completion of the internship, the student contacts the supervisor in writing or verbally and reports on the results of the work, but no more than one week after the start of the 4th year of study;

– within 4 weeks after the start of studies, the student and the supervisor should discuss and decide on the type (research, project or independent study) and the topic of the thesis. This is an extremely important discussion and decision, as further changes in the topic and type of work are impossible.;

– the topic of the thesis (project) and the supervisor are assigned to the student or group of students no more than six weeks after the start of the final year of study and approved by the order of the rector of the higher educational institution.

Additionally, the ability of graduates to apply the principles of sustainable development in technological processes, including the rational use of resources, waste reduction and the introduction of environmentally sound production methods, is assessed, which is consistent with the SDGs.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	6B07 - Engineering, manufacturing and construction industries
2	Code and classification of areas of study	6B072 - Manufacturing and processing industries
3	Group of educational programs	B069 - "Production of materials (glass,paper,plastic,wood)"
4	Name of the educational program	Technology of foundry production
5	Brief description of the educational program	The program is aimed at training casting technologists. The educational program provides scientific foundations in the field of materials science, foundry, heat treatment and surface hardening.
6	Purpose of the EP	Providing fundamental and practical training for students to successfully solve engineering problems in various fields of foundry, metallurgy and materials science, which are interdisciplinary in nature.
7	EP type	New
8	NQF level	Level 6 - higher education and practical experience
9	ORC level	Level 6 - a wide range of special (theoretical and practical) knowledge (including innovative). Independent search, analysis and evaluation of professional information
10	Distinctive features of the EP	No
11	List of competencies of the educational program:	Professional competencies; Research competencies; Basic competencies and knowledge; Communication competencies; Universal competencies; Cognitive competencies; Creative competencies; Information and communication competencies.
12	Learning outcomes of the educational program:	LO1 - communicate successfully and at a high level in business circles in the state and other foreign languages; are able to use the physical and mathematical apparatus to solve problems arising in the course of professional activity; know traditions and culture, the basics of the legal system and legislation of the Republic of Kazakhstan; know the basics of the theory of fundamental sections of chemistry; are able to implement and adjust technological processes in metallurgy and enrichment. LO2 - use language skills in the professional sphere; use the basic laws of natural science disciplines in professional activity, apply methods of mathematical analysis and modeling, theoretical and experimental research. LO3 - have the skills to handle modern technology, are able to use information technology in the field of professional activity;

		possess the basic methods, methods and means of obtaining, storing, processing information; are able to apply in practice the principles of rational use of natural resources. LO4 - have basic knowledge in the field of natural sciences that contribute to the formation of a highly educated person with a broad outlook and culture; are able to combine theory and practice to solve engineering problems; are able to use basic concepts, laws and models of thermodynamics, chemical kinetics, heat and mass transfer. LO5 - applies knowledge of theoretical and experimental fundamentals in the field of professional activity, rational technology and design of technological equipment used in foundry production, relying on innovative casting methods, taking into account industrial and environmental safety, contributing to reducing negative environmental impacts and rational use of resources in accordance with the SDGs; LO6 - possess basic concepts and laws, laws and theories, as well as modern technologies for explaining and using knowledge in enrichment and metallurgical processes; apply experimental calculation methods to solve various practice-oriented tasks of a scientific, laboratory and educational nature. LO7 - possess knowledge in the field of scientific and technical innovation, skills and abilities of searching, evaluating, selecting information; possess methods of recording and processing experimental results; possess methods of selecting material for theoretical classes and laboratory work on enrichment and metallurgy. LO8 - are able to identify objects for improvement in engineering and technology; are able to use standard software tools in design; are able to choose and apply appropriate methods of modeling physical, chemical and technological processes in the field of enrichment and metallurgy.
13	Form of study	full-time
14	Training period	4 years
15	Volume of loans	240
16	Languages of instruction	Kazakh/Russian
17	Awarded Academic Degree	Bachelor of Engineering and Technology
18	Developer(s) and authors:	Barmenshinova M.B.

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

№	Name of the discipline	Brief description of the discipline	Amount of credits	Formed learning outcomes (codes)							
				LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8
Cycle of general education disciplines Required component											
1	Foreign language	English is a discipline of the general education cycle. After determining the level (according to the results of diagnostic testing or IELTS results), students are divided into groups and disciplines. The name of the discipline corresponds to the level of English proficiency. During the transition from level to level, the prerequisites and post-prerequisites of disciplines are observed.	10	V							
2	Kazakh (Russian) language	Kazakh (Russian) language. The socio-political, socio-cultural spheres of communication and functional styles of the modern Kazakh (Russian) language are considered. The course highlights the specifics of the scientific style in order to develop and activate professional and communicative skills and abilities of students. The course allows students to practically master the basics of scientific style and develops the ability to perform structural and semantic analysis of the text.	10	V							
3	Physical Culture	The purpose of the discipline is to master the forms and methods of forming a healthy lifestyle within the framework of the vocational education system. Familiarization with the natural-scientific foundations of physical education, possession of modern health technologies, basic methods of independent physical education and sports. And also as part of the course, the student will master the rules of judging in all sports.	8	V							
4	Information and Communication Technologies (in English)	The task of studying the discipline is to acquire theoretical knowledge about information processes, about new information technologies, local and global computer networks, methods of information protection; to acquire skills in using text editors and tabular processors; to create databases and various categories of application programs.	5				V				
5	History of Kazakhstan	The purpose of the discipline is to provide objective historical knowledge about the main stages of the history of Kazakhstan from	5		V						

		ancient times to the present day; to acquaint students with the problems of the formation and development of statehood and historical and cultural processes; to promote the formation of humanistic values and patriotic feelings in the student; to teach the student to use the acquired historical knowledge in educational, professional and everyday life; to assess the role of Kazakhstan in world history.										
6	Philosophy	The purpose of the discipline is to teach students the theoretical foundations of philosophy as a way of cognition and spiritual development of the world; developing their interest in fundamental knowledge, stimulating the need for philosophical assessments of historical events and facts of reality, assimilating the idea of unity of the world historical and cultural process while recognizing the diversity of its skills of applying philosophical and general scientific methods in professional activity.	5				V					
7	Module of socio-political knowledge (sociology, political science)	The objectives of the disciplines are to provide students with explanations on the sociological analysis of society, about social communities and personality, factors and patterns of social development, forms of interaction, types and directions of social processes, forms of regulation of social behavior, as well as primary political knowledge that will serve as a theoretical basis for understanding socio-political processes, for the formation of political culture, the development of personal position and a clearer understanding of the measure of their responsibility; to help master the political-legal, moral-ethical and socio-cultural norms necessary for activities in the interests of society, the formation of personal responsibility and personal success.	3				V					
8	Module of socio-political knowledge (culturology, psychology)	The purpose of the disciplines is to study the real processes of cultural activity of people who create material and spiritual values, to identify the main trends and patterns of cultural development, the change of cultural epochs, methods and styles, their role in the formation of a person and the development of society, as well as to master psychological knowledge for the effective organization of interpersonal interaction, social adaptation in the field of their professional activities.	5			V						
Cycle of general education disciplines Selectable Component												
9	Fundamentals of anti-corruption culture and law	The course introduces students to the improvement of socio-economic relations of Kazakhstan society, psychological features of corrupt behavior. Special attention is paid to the formation of an	5			V						

		anti-corruption culture, legal responsibility for acts of corruption in various spheres. The purpose of studying the discipline "Fundamentals of anti-corruption culture and law" is to increase public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Expected results: to realize the values of moral consciousness and follow moral norms in everyday practice; to work on improving the level of moral and legal culture; to use spiritual and moral mechanisms to prevent corruption.									
10	Fundamentals of Economics and Entrepreneurship	The discipline studies the fundamentals of economics and entrepreneurship from the point of view of science and law; features, problematic aspects and prospects of development; theory and practice of entrepreneurship as a system of economic and organizational relations of business structures; readiness of entrepreneurs for innovative receptivity. The discipline reveals the content of entrepreneurial activity, career stages, qualities, competencies and responsibilities of an entrepreneur, theoretical and practical business planning and economic expertise of business ideas, as well as risk analysis of innovative development, introduction of new technologies and technological solutions.	5			V					
11	Fundamentals of scientific research methods	The purpose of the discipline Fundamentals of Scientific research methods is the formation of students' skills and abilities in the field of methodology of scientific cognition. A brief description of the discipline. Methodological foundations of scientific knowledge. The concept of scientific knowledge. Methods of theoretical and empirical research. Choosing the direction of scientific research. Stages of research work. Research topic and its relevance. Classification, types and tasks of the experiment. Metrological support of experimental studies. Computational experiment. Methods of processing the results of the experiment. Registration of the results of the study. Presentation of a research paper.	5			V					
12	Ecology and life safety	The discipline studies the problems of ecology as a science, ecological terms, the laws of the functioning of natural systems and aspects of environmental safety in working conditions. Environmental monitoring and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to solve environmental problems; life safety in the technosphere; natural and man-made emergencies									
Cycle of basic disciplines											

University component											
13	Mathematics I	The course is designed to study the basic concepts of higher mathematics and its applications. The main provisions of the discipline are used in the study of all general engineering and special disciplines taught by graduate departments. The course sections include elements of linear algebra and analytical geometry, an introduction to analysis, differential calculus of a function of one and several variables. The questions of methods for solving systems of equations, the application of vector calculus to solving problems of geometry, mechanics, physics are considered. Analytical geometry on the plane and in space, differential calculus of functions of one variable, derivative and differentials, study of the behavior of functions, Directional derivative and gradient, extremum of a function of several variables.	5	V							
14	Mathematics II	The discipline is a continuation of Mathematics I. The sections of the course include integral calculus of a function of one variable and several variables, series theory. Indefinite integrals, their properties and methods of their calculation. Definite integrals and their applications. Improper integrals. Theory of numerical series, theory of functional series, Taylor and Maclaurin series, application of series to approximate calculations.	5		V						
15	Physics	The course studies the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics as a science on the development of technology; the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. The course covers the following sections: mechanics, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, electrostatics, direct current, electromagnetism, geometric optics, wave properties of light, laws of thermal radiation, photoelectric effect.	5	V							
16	Engineering and computer graphics	The discipline is aimed at studying the methods of object image and general rules of drawing, using computer graphics; studying the basic principles and geometric modeling approach and methodology for developing applications with a graphical interface; developing skills in the use of graphic systems for the development of drawings, using 2D and 3D modeling methods	5	V							
17	General chemistry	Purpose: formation of knowledge on fundamental issues of general chemistry and skills of their application in professional activity. Summary of the laws, theoretical provisions and conclusions that	5		V						

		underlie chemical disciplines; properties and relationships of chemical elements based on the periodic law of D.I.Mendeleev and on modern ideas about the structure of matter; fundamentals of chemical thermodynamics and kinetics; processes in solutions; structure of complex compounds.									
18	Physical chemistry	The course physical chemistry allows students to form the ability to understand the physico-chemical essence of processes and use the basic laws of physical chemistry in complex production and technological activities. In the course of training, the student studies the laws of thermodynamics; basic equations of chemical thermodynamics; methods of thermodynamic description of chemical and phase equilibria in multicomponent systems; properties of solutions; fundamentals of electrochemistry; basic concepts, theories and laws of chemical kinetics and catalysis.	5				V				
19	Technology of structural materials	The purpose of the discipline is to formulate bachelor students' competencies in the field of functional interrelation of material and structure, which determines the choice and optimization of material properties, based on the purpose of durability and operating conditions of structures; the study of compositions, structures and technological bases for obtaining metal materials with specified functional properties, instrumental methods of material quality control The content of the discipline: Classification and properties of structural materials. Fundamentals of metallurgical production. Technologies of foundry production. Fundamentals of metalworking technology by pressure. Powder metallurgy. Technologies of material processing by cutting. Instrumental materials. Electrophysical, electrochemical and special methods of material processing. Welding and soldering technologies for metals and alloys. Composite materials and methods of their processing.	4								
20	The theory of mechanisms and machines	The purpose of studying the discipline is to form the scientific foundations of students' knowledge of general methods of research and design of mechanisms of machines and devices, to prepare a scientific and theoretical basis for the development of special disciplines and the basics of modern technology Contents: Introduction. The basic concepts of the theory of mechanisms and machines. The main types of mechanisms. Structural analysis and synthesis of mechanisms. Synthesis of mechanisms with lower pairs. Kinematic analysis of mechanisms. Dynamics. Basic concepts. Kinetostatic (force) analysis of	6								

		mechanisms. Dynamic analysis of mechanisms. Introduction to the theory of the highest kinematic pair. Mechanisms with higher kinematic pairs. Analysis and synthesis of gear mechanisms. Analysis and synthesis of cam mechanisms. Vibrations and vibrations in machines and mechanisms									
21	Strength of materials	To independently calculate structural elements, mechanisms and machine parts. Contents_ Stretching and compression. Stresses in cross sections and deformations of a straight rod. Mechanical properties of materials under tension and compression. Calculation of tensile and compressive strength and stiffness. Geometric characteristics of flat sections. Shear and torsion. Calculation of strength and torsional stiffness. The bend. Normal and tangential bending stresses_	5								
22	Physico-chemical fundamentals of foundry production	The purpose of the discipline: to study the theoretical foundations, as well as the main processes of foundry production of ferrous and non-ferrous metals, including equipment, tools and technology necessary for the implementation of these processes. The content of the discipline: acquisition of basic knowledge of the theoretical processes of forming cast blanks used to solve engineering problems of obtaining castings with specified service and technological properties; study of the main technological processes of foundry production of ferrous and non-ferrous metals; study of equipment, tools and technology necessary for the implementation of foundry processes.	5								
23	Quality assurance tools	The purpose of the discipline is to provide students with basic scientific and practical knowledge in the field of metrology, standardization and certification necessary to solve the problems of ensuring the uniformity of measurements and quality control of products (services); metrological and regulatory support for production, testing, operation and disposal of products; planning and execution of work on standardization and certification of products; metrological and regulatory expertise production activities. The content of the discipline: Theoretical foundations of metrology. Basic concepts related to measurement objects. Accuracy of measurement methods and results. The measurement system. Metrological support. State control and supervision in the field of standardization. Theoretical foundations of certification. Organizational and methodological foundations of certification in the Republic of Kazakhstan.	5								

24	Physical metal science	The purpose of the discipline: the formation of students' knowledge in the field of properties of structural materials used in technological processes and industries, as well as the ability and willingness to assess the levels of threats and risks associated with their use. The content of the discipline: familiarization of students with the structure of materials, their mechanical, physico-chemical, operational and technological properties, classification of structural materials and alloys of ferrous and non–ferrous metals; study of technological methods, changes in the structure and properties of materials in a given direction; features of non-metallic materials - plastics, ceramics, composite materials and sealing materials used together with them materials; familiarization with the basics of the theory and technology of thermal and chemical-thermal treatment of steels and alloys	5								
25	Bases of designing and details of cars	Purpose: to acquire knowledge of calculations and design of machine parts and assemblies, taking into account the criteria of strength, reliability and stability.Contents_ general principles of design and construction, construction of models and calculation algorithms for standard machine parts taking into account performance criteria, fundamentals of theory and methodology for calculating standard machine parts, computer technologies for designing assemblies and machine parts. Basic requirements for machine parts and assemblies_	5								
26	Theory of formation of metal systems	The purpose of the discipline is to study the formation of metal systems, the structure of cast products, the physical essence of the processes occurring in the casting material and in the mold during solidification and cooling of the casting in and out of shape and their management techniques Content of the discipline: the essence of casting as a method of metalworking, its place and role in modern industrial production; processes of melt flow and mold filling; Formation of the crystal structure of cast products; processes of solidification and cooling of cast products; metal shrinkage processes during solidification of cast products; gas processes during the formation of cast products; shrinkage processes of cast products during cooling in solid state	5								
27	Foundry alloys and smelting	The purpose of the discipline is for students to acquire knowledge about the properties of foundry alloys, the theoretical foundations of their crystallization and melting, as well as practical skills to determine the technological (foundry) properties of the most common foundry alloys for the manufacture of machine-building	5								

		products. The content of the discipline: Fluidity of metals and alloys. Gas absorption and gas release in metals and alloys. Liquation properties of alloys are the basic concepts of shrinkage. Iron-carbon casting alloys. General characteristics of the structure and properties of cast iron. Foundry alloys of non-ferrous metals. Thermodynamics of the processes of phase interaction during melting. Kinetics of metallurgical processes in the melting of foundry alloys.									
28	Core and molding mixtures	The purpose of the discipline is for students to acquire knowledge about molding materials, molding and core mixtures, auxiliary compositions; to acquire skills in determining the properties of molding materials, molding and core mixtures, selecting the necessary compositions of molding mixtures for various casting processes Content of the discipline: initial molding materials: fillers, binders, special additives; molding quartz sands, non-quartz fillers; inorganic binders: molding clays, liquid glass, crystal hydrate binders; organic binders: oil binders, lignosulfonates, synthetic resins; properties, curing mechanisms; binder compositions based on liquid glass and synthetic resins; typical compositions and properties of molding and core mixtures.	5								
29	Methods of protection of metals and alloys from corrosion	The purpose of the discipline is to teach how to use knowledge of the basic patterns of chemical and electrochemical corrosion to predict the possible nature and type of destruction of ferrous and non-ferrous metals and alloys under the action of aggressive media. The content of the discipline: Corrosion and protection of metals in gaseous media. The mechanism of chemical corrosion and the theory of gas corrosion. Classification, properties and growth laws of oxide films. The kinetics of corrosion. The theory of high-temperature alloying. Electrochemical mechanism of corrosion. Electrochemical and diffusion kinetics. The influence of external and internal factors. Contact corrosion of metals. Types of corrosion effects on metal. Corrosion-resistant casting alloys. Protective coatings. Electrochemical corrosion protection. Principles of corrosion-resistant alloying.	4								
30	Resource and energy saving in foundry production	The purpose of the discipline is to study the processes and devices that ensure energy and resource conservation and environmental protection in the implementation of technological operations and the effective organization of foundry production of products of the required quality from ferrous and non–ferrous metal alloys.	5								

		The content of the discipline: technological schemes of foundries and consumers of their energy resources; methods of compiling energy balances and rationing energy costs; methods of reducing energy costs and the choice of resource- and energy-saving technologies for melting metals.									
Cycle of major disciplines University component											
31	Design and equipment of foundries	The purpose of the discipline: the study of working processes, design, operation features, the basics of calculating the structural and technological parameters of the main and auxiliary technological equipment of foundries. The content of the discipline: the study of equipment for the preparation of molding materials, molding and core mixtures, their regeneration and dosing; the study of the main methods of compaction of molding mixtures and design features of technological equipment for the manufacture of molds and rods; the study of technological equipment for melting and casting departments; the study of technological equipment for punching, cleaning castings, dust removal and waste transportation; the study of technological equipment equipment for special casting methods.	5								
32	Technology of foundry production	The purpose of the discipline is to study modern technological solutions in the production of castings of ferrous and non-ferrous metals and alloys by various casting methods with minimal labor and material costs with high quality. Content of the discipline: Basic concepts of technological processes for the production of castings in single-use detachable molds from sand-based mixtures. Design of the technological process of manufacturing castings. Principles of casting design. A typical technological process. The basic principles of choosing the position of the casting in the mold during molding, pouring, solidification. Production of molds and rods. Hardening of molds and rods. Assembly, casting, cooling of castings. Ways to correct defects in castings.	5								
33	Technology of casting molds manufacturing	The purpose of the discipline: students acquire theoretical knowledge on the physical processes of forming castings and manufacturing molds and the basic principles of calculation and design of mold elements Content of the discipline: manufacture of molds and rods; methods of mold manufacturing; technologically necessary degree of sealing; sealing by shaking, pressing, vibropressing; sandblasting,	5								

		sandblasting and sandblasting compaction of mixtures; sealing curves; gravitational, pulse, vacuum sealing; methods of extracting models; manufacture of molds for large castings; manufacture of molds in serial and mass production									
34	Mobile hydraulics	The purpose of the discipline: the acquisition by students of knowledge in the field of hydraulic drives of mobile machines and qualifications that allow them to read and draw up diagrams, carry out installation, commissioning of hydraulic systems of mobile machines The content of the discipline: the main provisions of statics and dynamics of metal melts; methods of theoretical calculations of hydraulic systems using modern applied techniques; classification of modes of movement of molten metal, their influence on the nature and conditions of metallurgical overflows; minimization of hydraulic losses and optimization of conditions of flow of liquid melt; physical and technical bases of calculation of hydraulic systems	5								
Cycle of major disciplines Selectable Component											

5 Curriculum of the educational program

NJSC "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATPAYEV"

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of KazNRTU named after K.Satpayev
M.M. Begentaev
_____ 2024 y.

CURRICULUM
of Educational Program on enrollment for 2024-2025 academic year

Educational program 6B07218 - "Technology of foundry production"
Group of educational programs B069 - "Production of materials (glass, paper, plastic, wood)"

Form of study: full-time Duration of study: 4 years Academic degree: Bachelor of Engineering and Technology

Discipline code	Name of disciplines	Cycle	Total amount in academic credits	Total hours	classroom volume of lek/lab/pr	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on courses and semesters							
								I course		II course		III course		IV course	
								1 semester	2 semester	3 semester	4 semester	5 semester	6 semester	7 semester	8 semester
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
M-1. Module of language training															
LNG108	English language	GED, RC	5	150	0/0/3	105	E	5							
LNG108	English language	GED, RC	5	150	0/0/3	105	E		5						
LNG104	Kazakh (Russian) language	GED, RC	5	150	0/0/3	105	E	5							
LNG104	Kazakh (Russian) language	GED, RC	5	150	0/0/3	105			5						
M-2. Module of physical training															
KFK101-104	Physical Culture	GED, RC	8	240	0/0/8	120	Difcredit	2	2	2	2				
M-3. Module of information technology															
CSE677	Information and communication technologies (in English)	GED, RC	5	150	2/1/0	105	E				5				
M-4. Module of socio-cultural development															
HUM137	History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE		5						
HUM132	Philosophy	GED, RC	5	150	1/0/2	105	E				5				
HUM120	Socio-political knowledge module (sociology, politology)	GED, RC	3	90	1/0/1	60	E				3				
HUM134	Socio-political knowledge module (culturology, psychology)		5	150	2/0/1	105	E			5					
M-5. Module of anti-corruption culture, ecology and life safety base															
HUM136	The base of anti-corruption culture and law	GED, CCH	5	150	2/0/1	105	E			5					
MNG489	Fundamentals of economics and entrepreneurship														
HPP128	Fundamentals of research methods														
CHE656	Ecology and life safety														
MNG564	Basics of Financial Literacy														
CYCLE OF BASIC DISCIPLINES (BD)															
M-6. Module of physical and mathematical training															
MAT101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5							
PHY468	Physics	BD, UC	5	150	1/1/1	105	E	5							
MAT102	Mathematics II	BD, UC	5	150	1/0/2	105	E		5						
M-7. Module of basic training															
GEN429	Engineering and computer graphics	BD, UC	5	150	1/0/2	105	E	5							
CHE495	Chemistry	BD, UC	5	150	1/1/1	105	E		5						
CHE127	Physical chemistry	BD, UC	5	150	1/1/1	105	E					5			
GEN412	The theoretical mechanics	BD, CCH	5	150	2/0/1	105	E		5						
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan				2/0/1										
MET800	Design and production of blanks	BD, CCH	5	150	2/0/1	105	E						5		
MET801	Quality control of castings				2/0/1										
MNG562	Legal regulation of intellectual property				2/0/1										

MET699	Theory of casting processes	BD, CCH	5	150	2/0/1	105	E						5		
MET802	Theory of casting formation				2/0/1										
CSE831	Fundamentals of Artificial Intelligence				1/0/2										
MET803	Economics and management in foundry production	BD, CCH	6	180	2/0/2	120	E							6	
MET804	Entrepreneurial activity in the foundry				2/0/2										
AAP167	Educational practice	BD, UC	1		0/0/1				1						
M-8. Basic training module in metallurgy															
MET805	Technology of structural materials	BD, UC	4	120	2/0/1	75	E			4					
GEN147	The theory of mechanisms and machines	BD, UC	5	150	1/1/1	105	E			5					
GEN408	Strength of materials	BD, UC	5	150	1/1/1	105	E			5					
MET806	Physico-chemical fundamentals of foundry production	BD, UC	5	150	2/1/0	105	E			5					
MET832	Quality assurance tools	BD, UC	5	150	2/0/1	105	E				5				
MET149	Physical metal science	BD, UC	5	150	2/0/1	105	E					5			
GEN125	Bases of designing and details of cars	BD, UC	5	150	1/1/1	105	E					5			
MET807	Theory of formation of metal systems	BD, UC	5	150	2/0/1	105	E					5			
MET808	Foundry alloys and smelting	BD, UC	5	150	2/1/0	105	E					5			
MET809	Core and molding mixtures	BD, UC	5	150	2/1/0	105	E					5			
MET810	Methods of protection of metals and alloys from corrosion	BD, UC	4	120	2/0/1	75	E					4			
MET811	Resource and energy saving in foundry production	BD, UC	5	150	2/0/1	105	E						5		
CYCLE OF PROFILE DISCIPLINES (PD)															
M-9. Module of professional activity in metallurgy															
MET812	Design and equipment of foundries	PD, UC	4	120	2/0/1	75	E						4		
MET813	Technology of foundry production	PD, UC	5	150	2/1/0	105	E							5	
MET814	Technology of casting molds manufacturing	PD, UC	5	150	2/1/0	105	E							5	
MET815	Mobile hydraulics	PD, UC	6	180	2/0/2	120	E							6	
M-10. Professional activity module															
MET830	CAE systems in foundry production	PD, CCH	5	150	2/1/0	105	E						5		
MET831	CAD systems in foundry production				2/1/0										
MET816	Production of castings from non-ferrous metals and alloys	PD, CCH	4	120	2/0/1	75	E						4		
MET819	Metallurgical alloys of foundry production				2/0/1										
MET817	Production of castings from steel and cast iron	PD, CCH	6	180	2/1/1	120	E							6	
MET818	Production of castings from composite materials				2/1/1										
MET820	Foundry metallurgy	PD, CCH	5	150	2/1/0	105	E							5	
MET821	Planning an industrial experiment				2/0/1										
MET822	Automation of production processes in the foundry	PD, CCH	5	150	2/0/1	105	E								5
MET823	Computer-aided design systems				2/0/1										
MET824	Modeling of foundry processes	PD, CCH	5	150	2/1/0	105	E								5
MET825	Fundamentals of metallurgical process modeling				2/0/1										
MET826	Technology of special types of casting	PD, CCH	4	120	2/0/1	75	E								4
MET827	Advanced technologies in foundry production				2/1/0										
AAP141	Production practice I	BD, UC	4		0/0/4						4				
AAP183	Production practice II	PD, UC	3		0/0/3								3		

M-11. Module of "R&D"															
MET828	Methodology of scientific research in foundry production	PD, CCH	5	150	2/0/1	105	E								5
MET829	Theory and practice of structural heredity				2/0/1										
M-12. Module of final attestation															
ECA109	Writing and defense of the thesis / project	FA	8												8
M-13. Module of additional types of training															
AAP500	Military affairs	ATT	0												
	Total based on UNIVERSITY:							27	33	31	29	29	31	33	27
								60		60		60		60	

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
		required component (RC)	university component (UC)	component of choice (CCH)	Total
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of basic disciplines		89	21	176
PD	Cycle of profile disciplines		27	39	
	Total for theoretical training:	*51*	*116*	*65*	*232*
FA	Final attestation	8			8
	TOTAL:	59	116	65	240

Decision of the Academic Council of KazNRTU named after K.Satpayev. Protocol № 12, 22.04.2024

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Protocol № 6, 19.04.2024

Decision of the Academic Council of MaMI named after O. Baikonurov. Protocol № 7, 27.03.2024

Vice-Rector for Academic Affairs — **R.K. Uskenbaeva**

Director of the Mining and Metallurgical Institute named after O. — **K.B. Rysbekov**

Head of department "Metallurgy and mineral processing" — **M.B. Barmenshinova**

Representative of the employers' council of the LLP "KazFerroStals" — **R.R. Protsenko**