Institute _____ **Energy and Mechanical engineering** _____

Department __ **Mechanical engineering** _____

EDUCATIONAL PROGRAM

7M07112 - Digitalization of engineering manufacturing

the name of educational program

Code and name field of education:
7M07-Engineering, manufacturing and civil engineering
Code and classification direction of personnel training:
7M071-Engineering and engineering trades
Group of educational programs:
M103-Mechanics and metal working
EP purpose: 7
EP type: 7
Period of study: 2 years
Volume of the credits: 120

Almaty 2024

Educational program 7M07112 - Digitalization of engineering
(the name of educational program)
manufacturing

was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Minutes 12 dated « 22 » 04 2024.

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

Minutes 6 dated « 19 » 04 2024.

Educational program 7M07112 - Digitalization of engineering
(the name of educational program)
manufacturing
developed by Academic committee in the direction of "7M071-Engineering and engineering trades"

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Yelemessov K.	Professor	Director of the Institute of Energy and Mechanical Engineering named after A.Burkitbayev	NAO KazNRTU named after K.I. Satpayev	
Teaching staff:				
Nugman E.Z.	Doctor PhD, Assoc. Prof.	Head of the Department of "Mechanical Engineering"	Institute of Energy and Mechanical Engineering named after A.Burkitbayev	
Uderbayeva A.E.	Doctor PhD	Assoc. Professor	Department of Mechanical Engineering	
Employers:				
Dyussebayev I.M.	Doctor PhD	Chief Engineer	LLP, Almaty plant "Electroshield"	
Students				
Baybatsha A.K.		1st year doctoral student	Department of "Mechanical Engineering"	

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List of abbreviations and designate

ECTS	European Credit Transfer and Accumulation System
BD	Basic disciplines
HEI	Higher education institution
SMSE	State mandatory standard of education
KazNRTU	K. I. Satpayev Kazakh National Research Technical University
MEP	Modular educational program
НАО	Некоммерческое акционерное общество
RWMS	Research work of a master's student
EP	Educational program
PD	Profile disciplines
WC	Working curriculum
IWMS	Independent work of a master's student
EMC	Educational and Methodological Council
AC	Academic council

1 Description of educational program

The professional activity of graduates of the educational program is aimed at digitalization of machine-building production, the use of innovative technologies in the field of mechanical engineering.

The direction of the educational program covers engineering and engineering.
The objects of professional activity of the master in EP 7M07112 - " Digitalization of engineering manufacturing" are:

-digitalization of machine-building production, including information-sensor, executive and control modules, their mathematical, algorithmic and software, methods and means of their design, modeling, experimental research and design;

- theoretical and experimental studies of digitalization of machine-building production for various purposes.

A master's degree in the field of training " Digitalization of engineering manufacturing" should be prepared to solve professional problems in accordance with the profile orientation of the master's program and types of professional activity:

research activities:

- analysis of scientific and technical information, domestic and foreign experience in the field of development and research of digitalization of machine-building production; study of new methods of control theory, artificial intelligence technologies and other scientific areas that make up the theoretical basis of digitalization of machine-building production, compilation and publication of reviews and abstracts;

- carrying out theoretical and experimental research in the field of development of new samples and improvement of existing digitalization of machine-building production, their modules and subsystems, search for new additive technologies;

- conducting patent research accompanying the development of new digitalization of machine-building production, in order to protect intellectual property objects, the results of research and development;

- development of experimental samples of digitalization of machine-building production, their modules and subsystems in order to verify and substantiate the main theoretical and technical solutions to be included in the terms of reference for the implementation of development work;

- organization and conduct of experiments on the existing digitalization of machine-building production, their subsystems and individual modules in order to determine their effectiveness and identify ways to improve, processing the results of experimental research using modern information technologies;

- preparation of reports, scientific publications and reports at scientific conferences and seminars, participation in the implementation of research and development results into practice;

design and engineering activities:

- preparation of a feasibility study of new digitalization projects of machine-

building production, their individual subsystems and modules;

- calculation and research of digitalization of machine-building production, control, information-sensor and executive subsystems using mathematical modeling methods, conducting mock-up and testing of existing systems, processing experimental data using modern information technologies;

- development of special software for solving design problems of digitalization of machine-building production, development of technical specifications and direct participation in the design of additive machines and equipment;

organizational and managerial activities:

- development of organizational and technical documentation (work schedules, instructions, plans, estimates) and established reporting on approved forms;

- organization of the work of small groups of performers involved in research, design work and experimental research;

- control over the implementation of measures for the prevention of occupational injuries, occupational diseases, prevention of environmental violations in the process of research and operation of digitalization of machine-building production;

installation and commissioning activities:

- participation in verification, adjustment, adjustment, assessment of equipment condition and setting up digitalization of machine-building production for various purposes, including both technical means and software control systems;

- participation in the coupling of software and hardware complexes with technical objects as part of the digitalization of machine-building production, in testing and commissioning of prototypes of such systems;

service and operational activities:

- participation in verification, adjustment, adjustment and assessment of the state of digitalization of machine-building production for various purposes, as well as their individual subsystems, in setting up control hardware and software complexes;

- preventive control of the technical condition and functional diagnostics of digitalization of machine-building production for various purposes, as well as their individual subsystems;

- preparation of operating instructions for digitalization of machine-building production and their hardware and software, development of routine testing programs;

- preparation of applications for equipment and components, preparation of technical documentation for equipment repair;

scientific and pedagogical activity:

- participation in the development of programs of academic disciplines and courses based on the study of pedagogical, scientific, technical and scientific-methodical literature, as well as the results of their own professional activities;

- preparation of applications for equipment and components, preparation of technical documentation for equipment repair;

scientific and pedagogical activity:

- participation in the development of programs of academic disciplines and courses based on the study of pedagogical, scientific, technical and scientific-

methodical literature, as well as the results of their own professional activities;

2 The purpose and objectives of additional educational program

EP purpose:
High-quality training of highly qualified and competitive specialists with creative thinking, ready for production, technological, scientific and pedagogical activities in the conditions of innovative digital engineering.

EP tasks:
- formation of knowledge of the basics of digital technologies in the field of mechanical engineering;
- acquisition of theoretical and practical knowledge on the organization, conduct of scientific and experimental research in the field of development of technological processes of machine-building products;
- formation of knowledge and skills in the analysis of scientific and technical information, new methods of control theory, scientific directions of digital engineering;
- formation of knowledge and practical skills of performing scientific and pedagogical activities, the use of computer and distance learning.

3 Requirements for evaluating the learning outcomes of an educational program

As a result of mastering the OP modules, students develop the knowledge, skills and abilities necessary to carry out all types of professional activities in the field of mechanical engineering, develop training skills to carry out further training with a high degree of independence, that is, the formation of professional, communication and key competencies that meet the requirements of employers.
The qualification assigned to the graduate is Master of Technical Sciences in OP 7M07112 - "_Digitalization of engineering manufacturing_".

4 Passport of the educational program

4.1 General information

№	Название поля	Примечание
1	Code and name field of education	7M07- Engineering, manufacturing and civil engineering
2	Code and classification direction of personnel training	7M071- Engineering and engineering trades
3	Group of educational programs	M103- Mechanics and metal working
4	Name of the educational program	7M07112 - "Digitalization of engineering manufacturing".
5	Short description of the educational program	The professional activity of graduates of the educational program is directed to the field of digitalization of

		machine-building production. In the educational program, students will receive professional knowledge of digital design and modeling of product structures, advanced materials and additive technologies; current problems of scientific research, the basics of research activities, lean digital production, scientific and pedagogical activities. They will acquire the skills of designing and developing business processes, technological processes of additive manufacturing, analysis of automated production technologies.
6	EP purpose	The purpose of EP 7M07112 - Digitalization of engineering manufacturing is the qualitative training of highly qualified and competitive specialists with creative thinking, ready for production, technological, scientific and pedagogical activities in the conditions of innovative digital engineering.
7	EP type	New EP
8	Level on NQF	7
9	Level on SQF	7
10	EP distinctive features	No
11	List of competencies of the educational program:	- Ability to follow ethical standards in professional activity; - The ability to plan and solve problems of their own professional and personal development. - Ability to critically analyze and evaluate modern scientific achievements, generate new ideas when solving research and practical tasks; - The ability to design and carry out comprehensive research based on a holistic systematic scientific worldview using knowledge in the field of history and philosophy of science; - Willingness to participate in the work of domestic and international research teams to solve scientific and scientific-educational tasks; - Willingness to use modern methods and technologies of scientific communication in the state and foreign languages;
12	Learning outcomes of the educational program:	ON1 Develops and improves the intellectual and general cultural level, expands and deepens the scientific worldview, uses new knowledge and skills in practical activities. ON2 Applies and observes the rights and duties of a citizen, ethical and legal norms in society and the collective. ON3 Demonstrates the ability to search for new scientific and technical information, based on the integration of knowledge in relation to the professional field, the use of a foreign language for business communication. ON4 Shows readiness for research and project work in the field of digital machine-building production, in related fields related to the selection and development of new research methods ON5 Demonstrates readiness for self-study and professional development and personal growth in

		professional activity. ON6 Possesses a set of personal qualities, scientific, pedagogical and professional competencies for production, pedagogical and research activities. ON7 Proficient in the principles of innovation management, business activities, quality and risk management in digital engineering. ON8 Demonstrates knowledge in the field of modern methods of organization and planning of scientific and experimental research, production and quality control of automated production. ON9 Demonstrates the ability to analyze, evaluate and synthesize modern innovative technologies, design methods and modeling of digital production processes. ON10 Demonstrates readiness to use computer and information technologies to solve practical and scientific problems in the field of digitalization of mechanical engineering. ON11 Applies sound design solutions to ensure the safety of life, environmental and industrial safety of digital machine-building production. ON12 It uses advanced materials for additive manufacturing, automated systems for ensuring the life cycle of products and advanced production automation technologies.
13	Form of training	daytime
14	Period of study	2 years
15	Volume of the credits	120
16	Language of education	russian
17	The awarded academic degree	Master of technical sciences
18	Developer(s) and authors:	The educational program was developed by the academic committee in the direction "7M071-Engineering and Engineering"

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

№	Name of discipline	Short description of discipline	Number of credits	The formed educational outcomes (codes)											
				ON1	ON 2	ON 3	ON 4	ON 5	ON 6	ON 7	ON 8	ON 9	ON 10	ON 11	ON 12
Cycle of basic disciplines University component															
1	English language (professional)	The course is designed for undergraduates of technical specialties to improve and develop foreign language communication skills in professional and academic fields. The course introduces students to the general principles of professional and academic intercultural oral and written communication using modern pedagogical technologies. The course ends with a final exam. Undergraduates also need to study independently (MIS).	5		v	v								v	
2	Psychology of management	The purpose of the discipline is to familiarize students with modern ideas about the role and multidimensional content of the psychological component of managerial activity; to increase the psychological culture of the future master for the successful implementation of professional activities and self-improvement. Studies the main stages, trends and trends in the development of Kazakh and foreign management psychology, the composition and structure of management activities. Special attention is paid to the psychological component of the managerial function, the individual characteristics of the manager, the ethical and cultural components of the manager, the basics of interaction.	3		v		v								

3	History and philosophy of science	The subject of philosophy of science, dynamics of science, specifics of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, engineering and technology, specifics of engineering sciences, ethics of science, social and moral responsibility of a scientist and engineer.	3				v					v			
4	Higher school pedagogy	The course is intended for undergraduates of the scientific and pedagogical magistracy of all specialties. Undergraduates will master the methodological and theoretical foundations of higher school pedagogy, plan and organize the processes of teaching and upbringing, master the communicative technologies of subject-subject interaction between a teacher and a master in the educational process of a university.	3				**v**					**v**			
Cycle of basic disciplines Elective component															
5	Lean Manufacturing Methodology	The purpose of the discipline is to form a systematic representation of the concept of lean production, knowledge of theoretical provisions and regulatory documents in the field of quality management. The discipline studies the basic concepts, the history of the Lean management system, lean production as a model for improving the efficiency of the enterprise; principles and essence of quality management systems - Kaizen and 6 sigma. The tools of quality management systems are considered; criteria for economic indicators characterizing changes in the activities of engineering enterprises.	5		v						v				

6	Advanced Materials for Additive Manufacturing	The discipline studies the place and role of additive technologies in the digital economy. Additive technologies using polymer and composite materials.The physical nature and technological possibilities of application in additive technologies of various materials. Methods of obtaining metal powders, nanomaterials and nanopowders for creating machine parts.	5	v						v					
7	Intellectual property and research	The purpose of this course is to provide undergraduates with the knowledge and skills necessary to understand, protect and manage intellectual property (IP) in the context of scientific research and innovation. The course is aimed at training specialists who can effectively work with IP, protect the results of scientific research and apply them in practice.	5		v		v					v			
8	Fundamentals of research activity	The purpose of the discipline is the formation of knowledge on the technical foundations of the creative process, conducting scientific research in the field of machine-building complex. The general methods and means of research of technological processes of machine-building production, parameters and their characteristics are studied. The methods of creating new patentable technical solutions, modern methods of conducting scientific research and processing their results are being studied. As a result, the skills of applying advanced research methods, identifying new properties and patterns in technological processes, identifying new technical solutions, formulating the novelty of inventions or utility models and their legal protection are acquired.	5		**v**		**v**								
9	Digitalization tools for machine-	The purpose of the discipline is to master knowledge on the tools of digitalization of	5	v						v					

	building production	machine–building production - digital design and the tools used in it, new materials that are based on the concept of digital materials with specified properties, additive technologies, reverse engineering technologies, the Internet of things. A system of knowledge and skills is being formed on the creation of digital production technology, modern approaches and ways of implementing digital transformation in the field of high technologies, skills and abilities in using modern digital production tools to create and scale innovative projects and products													
10	Sustainable development strategies	Purpose: To train graduate students in sustainable development strategies to achieve a balance between economic growth, social responsibility, and environmental protection. Content: Graduate students will study the concepts and principles of sustainable development, the development and implementation of sustainable development strategies, the evaluation of their effectiveness, and international standards and best practices. Cases and examples of successful sustainable development strategies are included.	5	v	v										
Cycle of profile disciplines University component															
11	Virtual Factory and Augmented Reality	The goal is to form a knowledge system in the field of new business models, business processes and technologies in high–tech industries. The course covers industrial revolutions, Industry development programs 4.0; modern information technologies and marketing; the creation of factories of the future, their architecture. Digital transformation, principles and management of a digital company. The concept of a virtual factory and the	5		v				v						

		construction of logistics networks for a digital factory. "Digital double", technical and operational data.													
12	Digital design and modeling	The purpose of the discipline is to acquire knowledge of the basics of computer modeling and computer technologies used in mechanical engineering. The technologies of computer-aided design, rapid prototyping, a complex information model and an integrated information environment used in computer systems supporting the life cycle of mechanical engineering products are considered. Perspective directions of development of computer technologies and industrial systems, virtual engineering are considered. Practical application of computer modeling and design methods in the production of products.	5				v	v							
13	3D scanning methods and technologies	The purpose of the discipline is to form theoretical and practical knowledge in the field of digital 3D scanning of objects, methods for restoring 3D objects, 3D scanning technologies. The principles of operation of a 3D scanner, types of scanners according to the principle of use, scanning technologies and methods, advantages and disadvantages of three-dimensional scanners, and applications are studied. Practical skills are acquired in applying various methods of restoring machine-building products, working with manual 3D scanners, choosing scanning methods and technologies.	5							v	v				
14	Innovative Processes of Digitization for Industrial Manufacturing	The purpose of the discipline is the formation of knowledge in the field of innovation, innovation management, production of digital engineering. The course examines the role of science in innovative development, innovative business; classification and planning of	5	v							v				v

		innovations; methods of engineering creativity; theory of solving technical problems; technological approaches and their characteristics. The prospects for the development of high-tech industrial technologies; automation and robotization of machine-building production; digitalization of production are considered														
Cycle of profile disciplines Component of choice																
15	CAE/PLM for Industrial Manufacturing	The purpose of the discipline is to acquire knowledge and skills of working with CAE/PLM design and engineering analysis systems. The discipline studies the modern concept of CAD construction, the place of CAD in integrated systems of design, production and operation of engineering products. The features of CAE systems for solving problems of design, production and engineering calculations of machine-building products are considered; the effectiveness of CAD application in the development of new machine designs; software, information, linguistic and technical support of CAD. Computer-aided design of machine parts and assemblies; engineering equipment design.	5						v		v					
16	PLM technologies	The purpose of the discipline is to provide knowledge about PLM systems and their application in the development, development and improvement of technology, systems and means of machine-building production. Acquire knowledge, skills and abilities in the field of industrial CAD and product lifecycle management systems. The ability to participate in the preliminary technical and economic analysis of design calculations, the development of design, working and operational technical documentation of machine-building industries; in measures to control the compliance of the developed projects and technical documentation with the	5							v						v

		current regulatory documents. Acquire practical design skills													
17	Computer-integrated production	The purpose of the discipline is to form knowledge of the basics of technical training of an automated machine-building complex using modern technological equipment and production management systems. The discipline studies the main characteristics of automated production: modern methods of production organization based on the widespread use of software-controlled technological equipment, microprocessor computing tools, robotic systems, automation tools for design, technological and planned production work. Design and organization of machine-building production based on multi-purpose machine tools with software control.	5					v				v			
18	Organizational and technical bases of flexible automated production	The purpose of teaching the discipline is to master the theoretical foundations of creating flexible automated production systems for the manufacture of parts and assembly of machines in modern machine-building production. The subject of the study is progressive technological systems created on the basis of the development of such fields of science and technology as mechanical engineering technology, electronics, computer science, economics, production organization, etc. The systems designed taking into account technical and economic factors are able to solve the tasks of increasing labor productivity, improving product quality, and reducing resource consumption.	5					v		v					
19	Actual problems of advanced scientific research	The purpose of the discipline is to acquire knowledge and practical skills in designing technological processes for manufacturing machine parts on automatic lines. The discipline considers the types, composition, principles of construction of automatic lines (AL); types of machine tools, transport and storage system of automatic lines; fixation	5								v			v	

		devices on AL operations; calculation of productivity and operating modes of AL; feasibility study of automated assembly of machines or processing of machine parts. Quality management of machine production at AL.													
20	Risk Management in Digital Manufacturing	The purpose of the discipline is to form knowledge of the basics of digital production management, diagnostics and risk modeling. The discipline examines the essence of risks as an economic category, criteria for risk classification. Development of risk management in practice: stages of the risk management process, methods of risk identification and analysis. The methodology of construction and application of economic and mathematical models of risk analysis and assessment, the basics of risk management in the evaluation activity of a machine-building enterprise using software are studied.	5	v									v		
21	Digital Systems of Industrial Manufacturing	The purpose of the discipline is to acquire knowledge of the design of digital machine-building industries, methods and means of construction based on information and production technologies. The discipline examines the concept of information support for the life cycle of products, the principles of building automated production, the methodology of end-to-end automated design of mechanical engineering products. As a result, students will be able to develop highly efficient technological processes and equipment using modern computer-aided design systems, create new technical solutions in the field of mechanical engineering technology, equipment and tools.	5						v					v	
22	Additive manufacturing technologies and equipment	The purpose of the discipline is to master professional knowledge on additive manufacturing technologies and their application in mechanical engineering; to form an idea of the procedure for preparing products	5					v				v			

		for reproduction using additive technologies; to study software tools used to prepare product models. The study of basic additive technologies; materials used in additive manufacturing; post-processing technologies of products. Skills of 3D printing of products, assessment of their quality, selection of equipment for various methods of additive manufacturing are acquired.													
23	Corrosion in mechanical engineering	The purpose of the discipline is to acquire knowledge in the field of corrosion of engineering products and methods of protection. Various methods of protecting mechanical engineering products from corrosion, ensuring the durability of products in various climatic regions, technical requirements, quality control of surface protection are studied. Requirements for the quality of products, their functional parameters, reliability, ease of maintenance, duration of operation. The choice of structural material and protection options that meet the requirements of moral and economic durability of the product, reducing labor costs.	4						**v**			**v**			
24	Wearproof and strengthening coverings	The purpose of the discipline is to form knowledge in the field of coating in mechanical engineering, a systematic approach to solving topical issues of increasing the life of machine parts and equipment. Progressive coating methods are considered that allow combining high strength characteristics of the substrate with increased values of corrosion wear resistance of the surface. A system of knowledge and skills on the creation of coatings on machine parts and tools is being formed. The main characteristics and methods of coating are studied.	4								**v**	**v**			
25	Occupational Health and Safety for Additive Manufacturing	The purpose of the discipline is to acquire knowledge on ensuring the safety of life in additive manufacturing. The discipline is based on the study of normative and technical	5								v		v		

		documents on labor protection, work safety in areas equipped with additive equipment. The main categories of work in additive manufacturing are considered: material extrusion, powder layer melting, photopolymerization in a bath, material jet processing, binder jet processing, sheet lamination. Classification of hazards arising during the operation of additive machines and equipment. Safety and security measures for work on additive equipment.													
26	Ergonomics of production	The purpose of studying the discipline is to form theoretical and practical knowledge in the field of industrial ergonomics, design of ergatic systems, types and basic functions of systems. The tasks of ergonomics, the essence of human labor activity, engineering psychology, the severity of work and its integral assessment are studied. The content and features of ergonomic design, methods of research of sensorimotor activity in work. Skills of designing and evaluating workplaces, ergodesign of professional equipment and personal protective equipment are acquired	5								v		v	v	

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 Kazntu named after K.Satpayev
M.M. Begentaev
«__» ____ 2024 y.

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

Educational program 7M07112 - "Digitalization of engineering manufacturing"
Group of educational programs M103 - "Mechanics and metalworking"

Form of study: full-time **Duration of study: 2 year** **Academic degree: Master of technical sciences**

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount lec/lab/pr	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on courses and semesters			
								I course		2 course	
								1 semester	2 semester	3 semester	4 semester
CYCLE OF BASIC DISCIPLINES (BD)											
M-1. Engineering training module (university component)											
LNG213	Foreign language (professional)	BD UC	5	150	0/0/3	105	E	3			
HUM214	Management psychology	BD UC	3	90	1/0/1	60	E	3			
HUM212	History and philosophy of science	BD UC	3	90	1/0/1	60	E		3		
HUM213	Higher school pedagogy	BD UC	3	90	1/0/1	60	E		3		
component of choice											
MSM231	Lean manufacturing methodology	BD CCH	5	150	2/0/1	105	E	5			
MSM222	Advanced additive manufacturing materials										
IND251	Fundamentals of research activity	BD CCH	5	150	2/0/1	105	E	5			
MNG781	Intellectual Property and Research										
MSM232	Digitalization tools for machine-building production	BD CCH	5	150	2/0/1	105	E			5	
MNG782	Sustainable development strategies										
CYCLE OF PROFILE DISCIPLINES (PD)											
M-2. Production digitalization module (university component, component of choice)											
MSM201	Virtual factory and Augmented reality production	PD UC	5	150	2/0/1	105	E	5			
MSM218	Digital design and modeling	PD UC	5	150	2/0/1	105	E	5			
MSM238	3D scanning methods and technologies	PD UC	5	150	2/0/1	105	E		5		
MSM206	Innovative processes of digitalization of machine-building production	PD UC	5	150	2/0/1	105	E		5		
MSM210	CAE/PLM of machine-building production	PD CCH	5	150	2/0/1	105	E			5	
MSM237	PLM technologies										
MSM219	Computer-integrated production	PD CCH	5	150	2/0/1	105	E		5		
MSM234	Organizational and technical bases of flexible automated production										
IND249	Actual problems of advanced scientific research	PD CCH	5	150	2/0/1	105	E		5		
IND210	Risk management in digital production										
MSM211	Digital systems of machine-building production	PD CCH	5	150	2/0/1	105	E			5	
MSM236	Additive manufacturing technologies and equipment										
MSM224	Wear-resistant and hardening coatings	PD CCH	4	120	2/0/1	75	E				4
MSM223	Corrosion in mechanical engineering										
MSM235	Ergonomics of production	PD CCH	5	150	2/0/1	105	E			5	
UND225	Occupational health and safety of digital engineering production										
M-3. Practice-oriented module											
AAP273	Pedagogical practice	BD UC	8							8	
AAP256	Research practice	PD UC	4								4

M-4. Experimental research module											
AAP268	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	4					4			
AAP268	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	4						4		
AAP251	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	2							2	
AAP255	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	14								14
M-5. Module of final attestation											
ECA212	Preparation and defense of a master's thesis	FA	8								8
	Total based on UNIVERSITY:							30	30	30	30
								60		60	

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
			university component (UC)	component of choice (CCH)	Total
BD	Cycle of basic disciplines		20	15	35
PD	Cycle of profile disciplines		24	29	53
	Total for theoretical training:	**0**	**44**	**44**	**88**
	RWMS				*24*
FA	Final attestation	12			8
	TOTAL:	**12**	**44**	**44**	**120**

Decision of the Academic Council of Kaznu named after K.Satpayev. Protocol № 12 от "22" 04 2024 y.

Decision of the Educational and Methodological Council of Kaznu named after K.Satpayev. Protocol № 6 от "19" 04 2024 y.

Decision of the Academic Council of the Institute E&ME. Protocol № 4 от "19" 01 2024 y.

Board Member -Vice-Rector for Academic Affairs **R.Uskenbaeva**

E&ME Institute Director **K.Yelemessov**

ME Department Head **E.Nugman**

Representative of the Council for EP from Employers **I. Dyusebaev**