Institute of Energy and Mechanical Engineering named after A. Burkitbayev
Department of «Technological machines and equipment»

EDUCATIONAL PROGRAM
7M07111 «Digital Engineering of Machines and Equipment»

Code and classification of the field of education:	7M07 «Engineering, manufacturing and civil engineering»
Code and classification of training directions:	7M071 «Engineering and engineering trades»
Group of educational programs:	M103 Mechanics and metal working
Level based on NQF:	7
Level based on IQF:	7
Study period:	2 years
Amount of credits:	120

Almaty 2024

Educational program 7M07111 "Digital Engineering of Machines and Equipment" was approved at the meeting of K.I. Satbayev KazNRTU Academic Council
Minutes # 12 dated «22» April 2024

was reviewed and recommended for approval at the meeting of K.I. Satbayev KazNRTU Educational and Methodological Council
Minutes # 6 dated «19» April 2024

Educational program 7M07111 "Digital Engineering of Machines and Equipment" was developed by Academic committee based on direction 7M071 «Engineering and engineering trades»

Full name	Academic degree / academic title	Position	Place of work	Signature
Chairperson of Academic Committee:				
Yelemessov Kassym	Candidate of Technical Sciences, Professor	Director of the Institute of Energy and Mechanical Engineering	KazNRTU named after K.I. Satbayev	
Teaching staff:				
Kaliev Bakytzhan	Candidate of Technical Sciences, Associate Professor	Head of the department "Technological machines and equipment"	KazNRTU named after K.I. Satbayev	
Bortebayev Saiyn	Candidate of Technical Sciences,	Associate Professor	KazNRTU named after K.I. Satbayev	
Employers:				
Stvaev Nurzhan		Chairman of the Management Board of Alageum Group	Alageum Group LLP	
Students				
Moshanov Kanat		2nd year doctoral student	KazNRTU named after K.I. Satbayev	

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List of abbreviations and designations

NCJS KazNRTU named after K. I. Satbayev – NCJS «KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I. SATBAYEV»;
SOSE – State obligatory standard of education of the Republic of Kazakhstan;
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; S
QF – Sectoral Qualifications Framework;
LO – learning outcomes;
KC – key competencies

1. Description of educational program

The educational program (EP) of higher vocational education ensures the implementation of the state educational standard taking into account the type of higher education institution, the educational needs and requests of students, and includes a working curriculum, syllabuses (work programs of training courses), disciplines (modules) and other materials the quality of the training of students, as well as the program of scientific and pedagogical practice, the schedule of educational schedule and methodological materials to ensure the implementation of relevant educational technology.

The main idea of the educational program is to implement a continuous process of preparing the scientific and pedagogical and professional personnel of the new generation who are capable of working to transform the new scientific potential of Kazakhstan from raw materials to innovative through the development and implementation of sustainable trends in the field of digital service and operational services.

The uniqueness of the study program “Digital Engineering of Machinery and Equipment” is determined by the competencies that the master has, having completed his education in this program.

The Master's Program is designed to facilitate the effective training of future specialists in the field of technical services on a comprehensive and integrated foundation. It is aimed at a deep understanding of the role of digital monitoring in the operation of machines and equipment in the mining, metallurgical, and oil and gas industries and their timely service at a high level.

The program prepares masters for activities in areas such as digital engineering of machinery and equipment, as well as strategic planning, analytical and advisory activities.

At the master's level, training in the specialty 7M07111 – Digital Engineering of Machinery and Equipment is carried out along trajectories involving the implementation of educational programs for training personnel in the oil, mining and metallurgical sectors with advanced technical, analytical and prognostic training.

2. Purpose and objectives of educational program

Purpose of EP: The purpose of the educational program is to train scientific, technical and engineering personnel with world-class competencies in the field of digital technologies, based on the integration of fundamental physico-mechanical and experimental-oriented engineering and technical education with research and development for oil and gas, mining and metallurgical enterprises.

The objectives of the educational program are determined by the competencies acquired by graduates in the process of mastering the program at the university, and provide consumers with information about the areas of vocational training, the profile of the program and the types of professional activities for which graduates of this

magistracy educational program are preparing. It reflects the features of the goals of educational training of specialists in the field of technical services with scientific and innovative thinking, owning advanced technologies in the modern operational and service industry, able to integrate in the conditions of global digital engineering and solving socially important tasks of the Kazakhstan and regional service market.

OP is focused on professional social order through the formation of specific competencies (scientific-pedagogical, professional) related to the necessary types of research and practical activities, adjusted to the requirements of employers.

The goal (mission) of the MA in the field of preparation 7M07111 “Digital engineering of machinery and equipment” proclaims the training of a specialist with:

– a set of personal qualities, scientific, pedagogical and professional competencies sufficient to form modern digital technical engineering in the country (region) for the operational and service industry and advanced organization of production activities;

– the ability to reasonably combine the commercial principles of business activity, the satisfaction of social needs in the services of enterprises in the oil, mining and metallurgical industries with the humanitarian tasks of personnel development and social values of Kazakhstani society.

In forming the objectives of the study program in the direction of “7M07109 - Digital engineering of machines and equipment” for the preparation of masters, the following are taken into account

Tasks of EP:

Task 1: Willingness of specialists to research and design work in the field of digital services in the process of operating technological machines, including related areas, choosing the necessary research methods, modifying existing and developing new equipment repair methods based on specific research objectives .

Task 2: Specialists' readiness for industrial and technological activities ensuring the introduction and operation of new digital developments at the local level.

Task 3: Willingness of specialists to search for and obtain new information necessary to solve professional problems in the field of knowledge integration in relation to their field of activity, to actively participate in the activities of an enterprise or organization.

Task 4: Specialists' readiness for scientific informational, ideological and problem communication in a professional environment and in a non-expert audience with a clear and deep substantiation of their position, to engage in organizational, managerial and service activities, to realize the responsibility for making their professional decisions.

Task 5: Specialists' readiness for self-learning and continuous professional development throughout the entire period of scientific or professional activity.

3. Requirements for evaluating the educational program learning outcomes

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

- the ability to independently acquire, comprehend, structure and use in professional activities new knowledge and skills, develop their innovative abilities;
- the ability to independently formulate research goals, establish the sequence of solving professional tasks;
- the ability to put into practice the knowledge of fundamental and applied sections of the disciplines that determine the direction (profile) of the graduate program;
- the ability to professionally choose and creatively use modern scientific and technical equipment to solve scientific and practical problems;
- the ability to critically analyze, represent, protect, discuss and disseminate the results of their professional activities;
- Possession of skills for the preparation and execution of scientific and technical documentation, scientific reports, reviews, reports and articles;
- readiness to lead the team in their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences;
- readiness for communication in oral and written forms in a foreign language for solving problems of professional activity.

A graduate who has mastered the master's program must have professional competencies corresponding to the types of professional activity to which the master's program is oriented:

research activities:

- the ability to form diagnostic solutions to professional problems by integrating the fundamental sections of science and specialized knowledge gained in mastering the master's program;
- the ability to independently conduct scientific experiments and research in the professional field, summarize and analyze experimental information, draw conclusions, formulate conclusions and recommendations;
- the ability to create and explore models of the objects under study based on the use of in-depth theoretical and practical knowledge in the field of digital diagnostics of the state of equipment of mining, metallurgical and oil and gas production;
- research and production activities:
- the ability to independently carry out production and research and production of field, laboratory and interpretation work in solving practical problems;
- ability to professional exploitation of modern field and laboratory equipment and devices in the field of mastered master programs;
- the ability to use modern methods of processing and interpreting complex information to solve production problems;
- project activity:
- the ability to independently draw up and submit research and development projects;

- readiness to design complex research and production works in solving professional problems;
- organizational and management activities:
- readiness to use the practical skills of organizing and managing research and production works in solving professional problems;
- readiness for practical use of regulatory documents in the planning and organization of research and production work;
- scientific and educational activities:
- the ability to conduct seminars, laboratory and practical classes;
- ability to participate in the management of scientific and educational work of students in the field of digital technologies for diagnosing the state of the equipment of mining, metallurgical and oil and gas production.

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

4. Passport of educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	7M07 «Engineering, manufacturing and civil engineering»
2	Code and classification of training directions	7M071 «Engineering and engineering trades»
3	Educational program group	M103 «Mechanics and metal working»
4	Educational program name	Digital Engineering of Machines and Equipment
5	Short description of educational program	The educational program "Digital engineering of machines and equipment" covers the specialty "Technological machines and equipment" in the following industries: - metallurgical machines and equipment; - mining machines and equipment; - machines and equipment of the oil and gas industry
6	Purpose of EP	The purpose of the educational program is to train scientific, technical and engineering personnel with world-class competencies in the field of digital technologies, based on the integration of fundamental physico-mechanical and experimental-oriented engineering and technical education with research and development for oil and gas, mining and metallurgical enterprises
7	Type of EP	new
8	The level based on NQF	7
9	The level based on IQF	7
10	Distinctive features of EP	no
11	List of competencies of educational program	Communication skills General engineering competencies Professional competencies Engineering and computer competencies Engineering and working competencies Socio-economic competencies Special professional competencies
12	Learning outcomes of educational program	**LO**1: To demonstrate high professional qualities when performing research and design work in the field of digital services during the operation of technological machines, including in related areas related to the selection of necessary research methods **LO**2: Apply knowledge to solve problems in the field of information and communication, organizational, managerial and service activities, be aware of the responsibility for making their professional decisions **LO**3: Possess a set of personal qualities, scientific, pedagogical and professional competencies sufficient for the formation of modern digital technical engineering in the country (region) for the operational and service industry and advanced organization of

		production activities **LO**4: Demonstrate knowledge in the field of production and technological activities that ensure the introduction and operation of new digital developments at the local level **LO**5: To choose methods of searching for new information necessary for solving professional tasks in the field of knowledge integration in relation to their field of activity **LO**6: Find time for self-study and continuous professional development during the entire period of scientific or professional activity **LO**7: To raise the intellectual and general cultural level, to improve the moral and physical development of one's personality in the competence of professional activity **LO**8: Speak a foreign language to the extent necessary to obtain professional information from scientific sources
13	Education form	full
14	Period of training	2 years
15	Amount of credits	120
16	Languages of instruction	Kazakh, Russian
17	Academic degree awarded	Master of Technical Sciences
18	Developer(s) and authors	Academic Affairs Committee

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

№	Name of the discipline	Short description of the discipline	Number of credits	Generated learning outcomes (codes)							
				LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8
Cycle of basic disciplines University component											
1	Foreign 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.public discussions; interpret and present the results of scientific research in a foreign language.	3								v
2	Psychology of management	The discipline studies the modern role and content of psychological aspects in managerial activity. The improvement of the psychological literacy of the student in the process of implementing professional activities is considered. Self-improvement in the field of psychology and studying the composition and structure of management activities, both at the local level and abroad. The psychological feature of modern managers is considered	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	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 Component of choice											
5	Intellectual Property Protection	Purpose of studying the discipline Formation of basic knowledge in the field of intellectual property of undergraduates, training graduates to solve professional problems related to the registration of intellectual property rights and their protection, obtaining theoretical knowledge in the field of patent science and the acquisition of practical skills in the application of	5					v		v	

		patent law as one of the components of intellectual property rights in Kazakhstan, the formation of a modern scientific outlook for undergraduates, an introduction to the methodology of scientific research vany. The main objectives of the discipline are: - The study of intellectual property and laws in the field of intellectual property protection; - Mastering ways to protect the rights of intellectual property, as well as the use of knowledge in the field of intellectual property in organizational, managerial, design and engineering activities									
6	Licensing and copyright	At discipline studying theoretical and practical preparation of the future masters concerning tehniko-legal bases of the copyright, protection "know-how" and licencing, a right protection of objects of the industrial property, drawing up and giving of patent demands and their examinations is carried out. Acquaintance to a role and value of objects and subjects of the copyright, conditions of patentability of the invention and industrial samples and possibilities of their licensing, gives the chance trained to master: sequence of registration of copyrights, maintenances of copyrights; ability to protect the right of authors and the patent of owners; ability to make registration of copyrights	5							v	v

		abroad; bases of a right protection and "know-how" protection									
7	Intellectual Property and Research	Purpose: the goal is to train specialists who can effectively manage rights to the results of intellectual activity in the field of science, as well as ensure their legal protection and commercialization. Contents: analysis of legal protection of research and development results, methods of commercialization of scientific inventions, ethical and legal aspects of scientific activity in the context of IP	5							v	v
8	Innovative installation and commissioning methods for machines and equipment	Advanced methods of installation, adjustment, diagnostics of technological equipment, innovative methods of testing, methods and types of diagnostics, installation work using modern methods and monitoring of the technical condition (welding, rolling, basic plumbing work, adjustment and adjustment work)	5		v		v				
9	The system of full maintenance Technological machines and equipment	To get acquainted with promising innovative technologies and techniques in technological engineering. Expected results: Awareness of the need for professional development during their working life. The ability to formulate problems and use heuristic methods to solve them. The ability to critically use the methods of modern science in practice. The ability to assess the quality of advanced technologies and equipment in an expert manner. Ability to make a	5		v		v				

		technical and economic comparison of various modifications of technological machines and equipment									
10	Innovative drives of machinery and equipment	Formation of a system of knowledge, skills and abilities among undergraduates in the field of design, operation, maintenance and evaluation of the technical condition of industrial machine drives. Study of the features of innovative designs, layout and operating modes of mechanical, hydraulic and pneumatic drives of mining, metallurgical and oil and gas machines. Formation of skills and abilities to assess the technical condition and residual life of machine drives, apply methods for calculating design and operating parameters of innovative drives of technological machines	5		v						
11	Innovative technologies for monitoring and diagnosing the state of technological machines	The course provides: concepts, terms and definitions of technical diagnostics, structure and formulation of technical diagnostics tasks, statistical methods of fault recognition, non-destructive types and methods of control, prediction of the residual life of equipment, assimilation of basic concepts, terms and definitions in the field of technical diagnostics	5			v		v			
12	Sustainable development strategies	The goal is to develop deep knowledge and competencies in the development and implementation of sustainable development strategies at various levels. The content covers a wide range of topics, ranging from global	5						v	v	

		environmental challenges such as climate change, biodiversity loss and natural resource depletion, to socio-economic aspects including inequality, health and education.									
Cycle of profile disciplines University component											
13	Methods and means of scientific research	The course is aimed at familiarizing students with theoretical and experimental research methods, building their knowledge, skills and abilities in the use of scientific research tools, methods of searching and analyzing scientific information. In the course of training, undergraduates choose methods of planning and organizing scientific research. They will study and master the mechanism of scientific search, analysis, conducting experiments, organizing surveys, compiling questionnaires, setting up and standards for the implementation of research results. They receive results in the development and preparation of documents for scientific projects, reports, publications for seminars and conferences	5	v				v			v
14	Digital methods and means of measuring the parameters of technological machines	Instruments and digital methods for measuring temperature, pressure, flow of liquids and gases, linear and angular quantities, measurement of forces and moments, non-destructive testing of materials and substances, motion parameters and composition, composition of gases, chemical liquids,	5		v	v					

		fuel quality and oils. The choice of modern technical means of measuring and monitoring the parameters of technological machines, depending on their design and operating conditions. Assessment of the reliability of measuring instruments. Rules of installation and operation of technical measuring instruments. Types of tests of technological machines - control, research, parametric, delivery, diagnostic, resource, etc. Test benches and equipment. Assessment of the technical condition of technological equipment based on the test results									
15	Predictive maintenance systems for process equipment	Formation of master students ' knowledge and skills in the application of digital methods for predicting the technical condition and reliability of objects, studying the basics of the theory of diagnostics, studying the basic concepts, techniques and innovative methods for diagnosing the technical condition of parts, mechanisms and products. Course objectives graduate students are determined by the requirements of the qualification characteristics of the specialty and is aimed to teach undergraduates to apply for digital computer technology and forms of organization of diagnostics in the maintenance and repair of production machinery and equipment, as well as use in the practice of critical assessment of	5				v	v			

		the technical condition of machinery and equipment obtained with the use of digital diagnostic equipment and indirectly									
16	Energy-saving technologies in the operation of technological machines	Formation of knowledge, skills and abilities in energy efficiency and energy saving in the mining, metallurgical and oil and gas industries based on equipment and technologies for automation and control, mastering knowledge in the field of energy saving, mastering the principles and methods of energy saving as a set of measures or actions taken to ensure efficient use of energy resources and technological equipment during their operation	5	v			v				
Cycle of profile disciplines Component of choice											
17	Intelligent management of technological equipment complexes	The discipline provides studying of questions of the organization and operation of the enterprises on service of production complexes of the technological equipment in system of branch appointment. The purpose of teaching - the development of the methodology of management of complex technological equipment of industrial enterprises of mining, metallurgical and oil industries and methods of calculation of their production capacity, as well as the study of optimal control algorithms of production systems in the maintenance of production facilities	5		v					v	

18	Heattechnical equipment and power plants	The ability to integrate knowledge from different disciplines within and use them to solve production problems, to develop terms of reference for the design and manufacture of electrical equipment	5	v			v				
19	Instrumentation and equipment technology machines and equipment	The course gives an idea of modern instrumentation and instrumentation of technological machines and equipment and covers the following topics: means of measuring and controlling weight, geometric, mechanical, electrical and magnetic quantities; temperature control; measurement of optical radiation; measurement of acoustic quantities; measurement and control of pressure, flow and quantity of gases and liquids; means liquid level measurements and alarms; gas and liquid analyzers; analyzers of the composition and physico-chemical properties of ore raw materials; selection of measurement and control tools	5		v		v				
20	Innovative technologies in the practice of maintenance and repair of technological machines	To get acquainted with promising innovative technologies and techniques in technological engineering. Awareness of the need for professional development during their working life. The ability to formulate problems and use heuristic methods to solve them. The ability to critically use the methods of modern science in practice. The ability to assess the quality of advanced technologies and equipment in an expert manner. Ability to make a technical and economic	5			v	v				

		comparison of various modifications of technological machines and equipment									
21	Project Management	The discipline studies the components of project management based on modern behavioral models of project-oriented business development management. The program is based on the international standards PMI PMBOK, IPMA ICB and the standards of the Republic of Kazakhstan in the field of project management. The features of organizational management of business development through the interaction of strategic, project and operational management are studied	5						v	v	
22	The use of digital technology in the design and construction of technological machines	To acquaint undergraduates with the use of digital systems for designing technological machines and equipment, modern digital developments and the main directions of development of digital designing and designing technological machines, as well as with the technological preparation of their production. To give undergraduates knowledge in the field of digital systems for designing technological machines and equipment for mining, metallurgical and oil and gas production, to acquaint with modern developments and main directions of development of digital design of technological machines and production preparation	5			v	v				
23	Digital monitoring of machines and equipment	Study of methods of digital diagnostics, rules and conditions of work in the field	5				v	v			

		of determining the technical condition of equipment; obtaining practical skills in the use of non-destructive testing methods to assess the technical condition and determine the residual life of technological machines and equipment of the mining and metallurgical and oil and gas industries; the ability to calculate the reliability of technological equipment and individual components and mechanisms, drives of technological equipment and special devices; to monitor the current parameters and actual performance of technological equipment in accordance with the requirements of regulatory and technical documentation to identify possible deviations; skills in diagnosing the causes of possible malfunctions and system failures to select methods and ways to eliminate them; organization of work on troubleshooting, equipment failures and repair of technological equipment within their competence									
24	Innovative methods for repairing machine parts	The course is aimed at studying specialists with modern knowledge on the technology of restoring specific parts of mining, metallurgical and oil and gas production equipment. In the process of mastering this discipline, students become familiar with the principles of choosing a rational technological process for restoring and strengthening parts of mining, metallurgical and oil and gas	5		v	v					

		production, depending on the type of wear									
25	Theory and practice of operation and repair of hydro machines and compressors	On the basis of studying of the given course the master will receive representation about forms and methods of operation and repair of the oil and gas equipment, features of their service and repair in field conditions and bases of industrial service. Will master the basic receptions of operation and equipment repair; rules of formation of industrial divisions, their structure and acquisition by brigades. The organisation of productions of structural divisions. Forms and rules of interaction with the foreign enterprises, specialisation and cooperation in industrial activity. Knowledge of these features will help fast adaptation of the expert with practical activities, to carrying out of the analysis of efficiency of activity of various divisions	5	v			v				
26	Innovative construction materials of technological machines	A historical overview of the use of materials, the basic concepts of materials: classification of modern materials (metallic and non-metallic materials, ferrous and non-ferrous metals and their alloys), areas of application of materials; The main properties of materials: physical, chemical, mechanical and technological, structure of materials: crystallization process, types of crystal lattices, phases in alloys; Alloy state diagrams: state diagrams of	5				v		v		

		double alloys, state diagram of iron-carbon alloys; Heat treatment of metals and alloys: the main types of heat treatment, chemical-thermal and thermomechanical treatment									
27	Lubricants and lubrication system for technological machines and equipment	The course is aimed at studying the hydrodynamic theory of lubrication, where the viscous flow for a Newtonian fluid, the basic equations of hydrodynamics, the continuity equation, the equation of motion (the Navier-Stokes equation) and the energy equation will be considered. Issues related to modern lubricants used in technology, their distinctive qualitative properties, means and devices for carrying out lubricating operations will also be considered. During the practical classes, calculations of the friction features in the hydrodynamic lubrication mode, the presence of a lubricating film between the rubbing surfaces, friction problems in the hydrodynamic lubrication mode according to Couette's law will be carried out.	5		v		v				

5. Curriculum of educational program

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
«25» 04 2024.

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

Educational program 7M07111 - "Digital Engineering of Machines and Equipment"
Group of educational programs M103 - "Mechanics and metal working"

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. Module of basic training (university component)											
LNG213	English (professional)	BD UC	3	90	0/0/2	60	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		
Professional Engineering Training Module											
Component of choice											
TEC701	Intellectual Property Protection	BD CCH	5	150	2/0/1	105	E	5			
TEC702	Licensing and copyright		5	150	2/0/1	105	E				
MNG781	Intellectual Property and Research		5	150	2/0/1	105	E				
TEC297	Innovative installation and commissioning methods for machines and equipment	BD CCH	5	150	2/0/1	105	E	5			
TEC700	The system of full maintenance Technological machines and equipment		5	150	2/0/1	105	E				
TEC706	Innovative drives of machinery and equipment	BD CCH	5	150	2/0/1	105	E			5	
TEC707	Innovative technologies for monitoring and diagnosing the state of technological machines		5	150	2/0/1	105	E				
MNG782	Sustainable development strategies		5	150	2/0/1	105	E				
CYCLE OF PROFILE DISCIPLINES (PD)											
M-2. Module of professional activity (university component, component of choice)											
The module of innovative technologies											
TEC200	Methods and means of scientific research	PD UC	5	150	2/0/1	105	E	5			
TEC703	Digital methods and means of measuring the parameters of technological machines	PD UC	5	150	2/0/1	105	E	5			
TEC710	Predictive maintenance systems for process equipment	PD UC	5	150	2/0/1	105	E		5		
TEC709	Energy-saving technologies in the operation of technological machines	PD UC	5	150	2/0/1	105	E		5		
Component of choice											
TEC715	Intelligent management of technological equipment complexes	PD CCH	5	150	2/0/1	105	E		5		
TEC716	Heattechnical equipment and power plants		5	150	2/0/1	105	E				
TEC723	Instrumentation and equipment technology machines and equipment	PD CCH	5	150	2/0/1	105	E		5		
TEC719	Innovative technologies in the practice of maintenance and repair of technological machines		5	150	2/0/1	105	E				
MNG705	Project Management		5	150	2/0/1	105	E				
TEC711	The use of digital technology in the design and construction of technological machines	PD CCH	5	150	2/0/1	105	E			5	
TEC705	Digital monitoring of machines and equipment		5	150	2/0/1	105	E				
TEC713	Innovative methods for repairing machine parts	PD CCH	5	150	2/0/1	105	E			5	
TEC714	Theory and practice of operation and repair of hydro machines and compressors		5	150	2/0/1	105	E				
TEC718	Innovative construction materials of technological machines	PD CCH	5	150	2/0/1	105	E			5	
TEC717	Lubricants and lubrication system for		5	150	2/0/1	105	E				
M-3. Practice-oriented module											
AAP229	Pedagogical practice	BD UC	8							8	
AAP274	Research practice	PD UC	8								8
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		28	25	53
	Total for theoretical training:	***0***	***48***	***40***	***88***
	RWMS				***24***
FA	Final attestation	8			8
	TOTAL:	**8**	**48**	**40**	**120**

Decision of the Academic Council of Kaznu named after K.Satpayev. Protocol № 12 "24" 04 2024.

Decision of the Educational and Methodological Council of Kaznu named after K.Satpayev. Protocol № 5 "19" 04 2024.

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

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

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

Head of department TM&E — **K.K. Yelemessov**

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