



**Institute of Energy and Mechanical Engineering  
Department of "Technological machines and equipment"**

### **EDUCATIONAL PROGRAM**

#### **6B07132 – "Predictive technologies and diagnostics of machines"**

Code and classification of the field of education	6B07 – « Engineering, manufacturing and civil engineering»
Code and classification of training directions	6B071 – «Engineering and engineering trades»
Group of educational programs	B064 – «Mechanics and metal working»
Level based on NQF	Level 6 – Higher education and practical experience
Level based on IQF	Level 6 – a wide range of special (theoretical and practical) knowledge (including innovative ones). Independent search, analysis and evaluation
Study period	4 years
Amount of credits	240

**Almaty 2023**







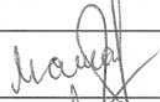
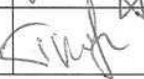
Educational program 6B07132 – "Predictive technologies and diagnostics of machines" was approved at the meeting of the Academic Council of K. Satpayev KazNRTU.

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Reviewed and recommended for approval at the meeting of the Educational and Methodological Council of K.Satpayev KazNRTU.

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Educational program 6B07132 – "Predictive technologies and diagnostics of machines" was developed by the Academic Committee in the direction of "Engineering and Engineering"

Full name	Academic degree / academic title	Position	Place of work	Signature
<b>Chairman of the Academic Committee:</b>				
Yelemessov Kassym	Candidate of Technical Sciences, Associate Professor	Director of the Institute of Energy and Mechanical Engineering	KazNRTU named after K.I. Satbayev	
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Eskulov Serik <i>Shan</i>	Candidate of Technical Sciences, Associate Professor	Head of the department "Technological machines and equipment"	KazNRTU named after K.I. Satbayev	
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Kaliev Bakhytzhana	Candidate of Technical Sciences, Associate Professor	Associate Professor	KazNRTU named after K.I. Satbayev	
<b>Employers:</b>				
Kanatbayev Maksat	Master MBA	CEO	JSC "Almaty plant of heavy engineering"	
<b>Students</b>				
Mashatayeva Gulzada	Master	Doctoral student 2 year of study	KazNRTU named after K.I. Satbayev	
Tleuova Kamshat		3rd year student	KazNRTU named after K.I. Satbayev	

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## List of abbreviations and symbols

**NAO "Kazakh National Research Technical University named after K. I. Satpayev"**

– NAO KazNRTU named after K. I. Satbayev;

**OP** – educational program.

**SRO** – independent work of the student (student, master's student, doctoral student);

**SROP** – independent work of a student with a teacher (independent work of a student (master's student, doctoral student) with a teacher);

**RUP** – working curriculum.

**QED**-catalog of elective subjects.

**VK** – university component.

**KV**-a component of your choice.

**NQF** – national qualifications framework.

**ORC**-industry qualifications framework.

**RO** – learning outcomes.

**CC** – key competencies

## 1. Description of the educational program

*The field of professional activity* of the bachelor of the educational program "Reliability and predictive maintenance of technological machines and equipment" includes:

- sections of science and technology that contain a set of tools, techniques, methods and methods of human activity aimed at creating competitive mechanical engineering products and based on the use of modern methods and tools for design, calculation, mathematical, physical and computer modeling;

- organization and execution of works on creation, installation, commissioning, maintenance, operation, diagnostics and repair of technological machines and equipment, development of technological processes for the production of parts and assemblies.

*The objects of professional activity* of the bachelor are:

- technological machines and equipment of various complexes;
- technological equipment and means of mechanization and automation of technological processes;
- production technological processes, their development and development of new technologies;
- installation and repair of technological machines and equipment;
- means of information, metrological, diagnostic and management support of technological systems to achieve the quality of manufactured products;
- means of testing and quality control of technological machines and equipment;
- technological processes of assembling metal structures;
- welding equipment and power supplies, assembly and welding devices;
- normative and technical documentation, systems of standardization and certification, methods and means of testing and quality control of products.

*Types of professional activity* are:

- experimental and research activities;
- calculation and design and analytical work;
- production and technological infrastructure;
- service and maintenance;
- installation and adjustment;
- organizational and managerial information.

*The bachelor's professional activity subjects* are:

- technological machines and equipment; power equipment;
- machine drive systems;
- traffic management systems;
- operator's life support systems;
- structural and operational materials;
- equipment for manufacturing, testing and recycling of technological machines;
- equipment for maintenance and repair of technological machines;
- control and measuring devices for the manufacture and operation of machines;
- equipment for automating machine work processes;
- machine design equipment

## **2. Goals and objectives of the educational program Цель и задачи образовательной программы**

**The purpose of the OP:** "Reliability and predictive maintenance of technological machines and equipment" is to provide comprehensive and high-quality training of competitive, highly qualified specialists who are ready to solve practical and theoretical problems on the reliability of professional activity in modern conditions based on the development of predictive maintenance systems, skills and abilities necessary for a future specialist.

### **OP tasks:**

- studying the cycle of general education disciplines to ensure social and humanitarian education based on the laws of socio-economic development of society, history, modern information technologies, the state language, foreign and Russian languages;

- study of the cycle of basic disciplines that provide knowledge of natural, general technical and economic disciplines as the basis of professional education;

- the cycle of basic disciplines is aimed at studying the main theoretical aspects of the reliability of technological machines, theoretical and practical methods, areas of human activity based on the creation of competitive technological machines and modern digital design methods and tools, predictive maintenance systems, mathematical, physical and computer modeling of technological processes;

- study of disciplines that form the skills of planning and organizing research work, designing reliable technologies and devices;

- familiarization with technologies and equipment of enterprises at different stages of practical training;

- mastering the skills and abilities of laboratory research, technological calculations, selection and design of equipment using modern computer technologies and programs

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

The scope of the bachelor's degree program is 240 credits, regardless of the form of study, the educational technologies used, the implementation of the bachelor's degree program using a network form, the implementation of the bachelor's degree program according to an individual curriculum, including accelerated learning.

Descriptors of the level and scope of knowledge, skills, and competencies

A – knowledge and understanding:

A1 - Ability to logically represent the acquired knowledge and understanding of systemic relationships within disciplines, as well as interdisciplinary relationships in modern science.

A2-Knowledge of approaches and methods of critical analysis, the ability to use them practically in relation to various forms and processes of production.

A3-perform basic calculations of the main parameters of technological machines, justify their choice depending on the production levels.

B-Applying knowledge and understanding

B1-Independent development and promotion of various options for solving professional problems using theoretical and practical knowledge

B2-put forward hypotheses for acquiring new knowledge necessary for daily professional activities and continuing education

B3 - on the basis of basic knowledge, be able to navigate adequately in various situations

C – forming judgments

C1 - on the basis of knowledge about economic patterns formation of hypotheses, forecasting and planning of economic activity of the enterprise.

C2 - be able to work in a team, correctly defend your point of view, and offer new solutions.

CC3 - skills of daily acquisition of new knowledge necessary for professional activity.

D – personal abilities

D1 - compliance with the standard of business ethics, possession of ethical and moral standards of behavior.

D2-ability to find a compromise, correlate your opinion with the opinion of the team

D3-know social and ethical values based on public opinion, traditions, customs, and social norms and be able to navigate them in their professional activities.

*Completion competencies*

General Cultural competencies (CA)	
OK 1	Ability to communicate in oral and written forms in the state, Russian and foreign languages to solve problems of interpersonal and intercultural interaction
OK 2	Understanding and practical use of healthy lifestyle standards, including prevention issues, the ability to use physical culture to optimize performance
OK 3	Ability to analyze the main stages and patterns of historical development of society for the formation of civil
OK 4	Ability to use the basics of philosophical knowledge to form a worldview position
OK 5	Ability to critically use the methods of modern science in practical activities

OK 6	Awareness of the need and acquisition of the ability to independently learn and improve their skills throughout their working life
OK 7	Knowledge and understanding of professional ethical standards, proficiency in professional communication techniques
OK 8	Ability to work in a team tolerant perception of social, ethnic, confessional and cultural differences
OK 9	Ability to use the basics of economic knowledge in various fields of activity
<b>General Professional competencies (GIC)</b>	
OPK-1	Ability to acquire new knowledge with a high degree of independence using modern educational and information technologies
OPK-2	Possession of computer skills sufficient for professional activity with basic programming
OPK-3	Knowledge of the main methods, methods and means of obtaining, storing, processing information, the ability to use modern technical means and methods for solving communication problems. information technologies using traditional information carriers, distributed knowledge bases, as well as information in global computer networks
OPK-4	Understanding of the essence and significance of information in the development of modern society, the ability to receive and process information from various sources, the willingness to interpret, structure and formalize information in a form accessible to others
OPK-5	Ability to solve standard problems professional activity based on information and bibliographic culture with the use of information and communication technologies and taking into account the basic requirements of information security
<b>Professional competencies (PC)</b>	
PC 1	Ability to systematically study scientific and technical information, domestic and foreign experience in the relevant training profile
PC 2	Ability to take part in the preparation of scientific reports on the completed task and implement the results of research and development in the field of technological machines and equipment
PC 3	Ability to participate in work on innovative projects using basic research methods
PC 4	Ability to model technical objects and technological processes using standard packages and computer-aided design tools, willingness to conduct experiments using specified methods with processing and analysis
of PC 5 results	Possession of approaches and methods of critical analysis, the ability to use in practice with regard to various forms and processes of technological processes of
SC 6	the Ability to learn a new technique, technological and technical documentation make adjustments with respect to operating conditions
7 PC	the Ability to participate in work on the calculation and design of details and units of technological machines in accordance with the technical tasks and use the standard tools of design automation
PC 8	Ability to conduct patent research to ensure the novelty of the new design solutions and their patentability and the identification of indicators of technical level of engineered products
PC 9	Ability to explore and optimize the modes of operation of technological machines during their operation
PC 10	the Ability to pre-technical-economic justification of design solutions
PC 11	the Ability to design technical equipment jobs with accommodation of technological equipment, the ability to learn the input equipment
PC 12	the Ability to participate in work on fine-tuning and development of technological processes during the preparation of the production of a new product, to check the quality of the installation and commissioning testing and commissioning of new types of products, components and parts manufactured products
PC 13	the Ability to check the technical condition and residual life of process equipment, arrange a routine inspection and maintenance of technological machines and equipment
PC 14	the Ability to carry out activities for the prevention of occupational accidents and occupational diseases, to monitor compliance with environmental safety of the operations
PC 15	the Ability to choose the main and auxiliary materials, methods of implementation of technological processes, to apply advanced methods of operation of technological equipment
PC 16	to Wield the main methods of calculation of parameters of technological equipment, the method of their selection on the directories and catalogs.



## 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 civil engineering»
2	Code and classification of training	6B071 – «Engineering and engineering trades»
3	Group of educational programs	B064 – «Mechanics and metal working»
4	Name of the educational program	"Reliability and predictive maintenance of technological machines and equipment"
5	Brief description of the educational program programs	Educational program "Reliability and predictive maintenance of technological machines and equipment" in the following industries: - metallurgical machinery and equipment; - mining machinery and equipment; - machinery and equipment of the oil and gas industry;
6	Purpose of the educational program	The purpose of the educational program is to train highly qualified and competitive specialists competent in the field of digital monitoring, operation and predictive maintenance systems of technological equipment of the mining, metallurgical and oil and gas industries. Development of students' personal qualities, formation of general cultural and professional competencies
7	Type of OP	New
8	Level according to NRC	6
9	Level according to ORC	6
10	Distinctive features of OP	no
11	List of competencies of the educational program:	KK1.KK2 communication skills. Basic literacy in natural sciences KK3.General engineering competencies of the CC4.Professional competencies of KK5. KK6 Engineering and computer competencies .KK7 engineering and operational competencies . Socio-economic competencies KK8. Special-professional competencies
12	Learning outcomes of the educational program:	PO1: Ready to use ethical and legal norms that regulate the attitude of a person to a person, society, and the environment. He is able to practically apply the basic laws and forms of regulation of social behavior, human and civil rights and freedoms in the development of social projects, demonstrating respect for people, tolerance for other cultures, and readiness to maintain partnerships. PO2: Capable of purposeful application of basic knowledge in the field of mathematical, natural, humanitarian and economic sciences in professional activities. RO3: Is able to choose the main and auxiliary materials and methods of implementing the main technological processes and apply advanced reliability methods in the operation of technological equipment RO4: Knows the main methods, methods and means of

	<p>obtaining, storing, processing information, is able to use modern technical means and information technologies for solving communication problems using traditional information carriers, distributed knowledge bases as well as information in global computer networks.</p> <p>RO5: Able to participate in the installation and commissioning of new technological equipment during testing and commissioning. Can check the technical condition, reliability, and remaining life of the technological equipment., organize routine inspection and maintenance of equipment using predictive diagnostic systems and devices, and process measurement results.</p> <p>RO6: Is able to apply modern methods for developing low-waste, energy-saving technologies that ensure the reliability and safety of human life and their protection from possible consequences of accidents, catastrophes and natural disasters, is able to apply methods of rational use of raw materials, energy and other types of resources</p> <p>RO7: Is ready to perform work on standardization, technical preparation for certification of technical means and equipment, organize metrological support of technological processes using standard methods of quality control</p> <p>RO8: Is able to apply standard calculation methods in the design of parts and assemblies of technological machines and structures. Able to take part in reliability calculations надежности and design of parts and assemblies of technological equipment in accordance with technical specifications using digital design automation tools.</p> <p>RO9: Is able to develop working design and technical documentation, execute completed design and development works with verification of compliance of the developed projects and technical documentation with reliability standards, technical conditions and other regulatory documents.</p> <p>RO10: Can make requests for equipment and spare parts, prepare technical documentation for equipment repairs, analyze and monitor the technical condition of machines, and make management decisions based on their results.</p> <p>RO11: Has knowledge and skills in the field of dynamics, reliability and systems of predictive technical diagnostics of technological machines of the main and auxiliary production.</p> <p>RO12: Has knowledge in the field of operation and repair of machinery and equipment for integrated management and monitoring of industrial production.</p> <p>RO13: Has knowledge in the field of industrial enterprises. Knows how to manage divisions of industry-specific productions. Able to combine knowledge in the field of engineering and industrial production technologies.</p> <p>RO14 Performs strength calculations and calculations of machine structures, is able to design, adjust, repair various</p>
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		types of equipment, solve problems of efficient operation of mechanical equipment, as well as operate any set of equipment in technological processes in the mining, metallurgical and oil and gas industries
13	Form of training	full
14	Duration of training	4 years
15	Volume of credits	240
16	Languages of training	Russian
17	Academic degree awarded	Bachelor of Engineering and Technology
18	Developer(s) and authors:	<ol style="list-style-type: none"> <li>1. Director of the Institute of Energy and Mechanical Engineering, Yelemessov Kassym</li> <li>2. Head of the department "Technological machines and equipment", Eskulov Serik</li> <li>3. Professor, Myrzakhmetov Beibit</li> <li>4. Associate Professor, Bortebayev Saiyn</li> <li>5. Associate Professor, Kaliev Bakhytzhana</li> <li>6. Master MBA, Kanatbayev Maksat</li> <li>7. Master, Mashatayeva Gulzada</li> </ol>

#### 4.2. The relationship between the achievability of the generated learning outcomes in the educational program and academic disciplines

№	Name of the discipline	Short description of the discipline	Number of credits	Generated learning outcomes (codes)													
				RO1	RO2	RO3	RO4	RO5	RO6	RO7	RO8	RO9	RO10	RO11	RO12	RO13	RO14
<b>Cycle of general education subjects Mandatory component</b>																	
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. When moving from one level to another, the prerequisites and post-prerequisites of the disciplines	5	/													
2	Kazakh (Russian) language	are observed. Socio-political, socio-cultural spheres of communication and functional styles of the modern Kazakh (Russian) language are considered. The course covers the specifics of the scientific style in order to develop and activate students' professional and communicative skills, allows students to practically master the basics of the scientific style and develops the ability to perform structural and semantic analysis of the text	5	/													
3	Information and communication technologies (in English)	Required component. The task of studying the discipline is to acquire theoretical knowledge about information processes, new information technologies, local and global computer networks, information security methods; gain skills in using text editors and table processors; create databases and various categories of application programs	5	/													
	Modern history of Kazakhstan	The course examines historical events, phenomena, facts, processes that took place in Kazakhstan. place on the territory of Kazakhstan from ancient times to the	5	/													

		present day. The sections of the discipline include: the steppe empire of the Turks; early feudal states on the territory of Kazakhstan; Kazakhstan during the Mongol conquest (XIII c), medieval states in the XIV-XV centuries. The epoch of the Kazakh Khanate of the XV-XVIII centuries. Kazakhstan as a part of the Russian Empire, Kazakhstan during the Great Patriotic War, during the formation of independence and at the present stage																
4	Philosophy	Philosophy forms and develops critical and creative thinking, worldview and culture, provides knowledge about the most general and fundamental problems of existence and gives them a methodology for solving various theoretical and practical issues. Philosophy expands the horizon of vision of the modern world, forms citizenship and patriotism, promotes self-esteem, awareness of the value of human existence. It teaches you to think and act correctly, develops practical and cognitive skills, helps you search for and find ways and means of living in harmony with yourself, society, and the world	around you 5	/														
5	M Modul socio-political knowledge (sociology, political science)	Studying the course contributes to the formation of students' theoretical knowledge about society as an integral system, provides the political aspect of training a highly qualified specialist on the basis of modern world and domestic political science. thoughts. The discipline is designed to improve the quality of both general humanitarian and professional training of students. Knowledge in the field of sociology and political science is necessary for understanding political processes, for forming a political culture, developing a personal position and a clearer understanding of the measure of	3	/														

		one's responsibility															
6	Module of socio-political knowledge (cultural studies, psychology)	The module of socio-political knowledge (cultural studies, psychology) is designed to acquaint students with the cultural achievements of humanity, to understand and assimilate the basic forms and universal laws of the formation and development of culture. During the course of cultural studies, general problems of the theory of culture, leading cultural concepts, universal laws and mechanisms of formation and development of culture, the main historical stages of formation and development of Kazakh culture are considered. It also studies the patterns of occurrence, development and functioning of mental processes, states, properties of a person engaged in a particular activity, patterns of development and functioning of the psyche as a special form of life	5	/													
<b>v Cycle of general education disciplines University component</b>																	
7	Fundamentals of anti-corruption culture	The discipline studies the essence, causes of occurrence, causes of sustainable development of corruption from both historical and modern points of view. Examines the prerequisites and impacts for the development of an anti-corruption culture. Studies the development of anti-corruption measures based on social, economic, legal, cultural, moral and ethical standards. Studies the problems of forming an anti-corruption culture based on the relationship with various types of public relations and various manifestations. Analysis of situations of conflict of interests and moral choice; improvement of anti-corruption culture; actions in situations of conflict of interests	5	/													
8	Fundamentals of	The discipline examines the basics of entrepreneurship and leadership from the	5	/													

	entrepreneurship and leadership	point of view of science and law; features, problematic aspects and development prospects; theory and practice of entrepreneurship as a system of economic, organizational and legal relations of business structures willingness of entrepreneurs to be innovative receptive. 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															
9	Ecology and life safety	The discipline studies the problems of ecology as a science, environmental terms, laws of functioning natural systems and aspects of environmental safety in the conditions of labor activity. Environmental monitoring and safety management. Sources pollution of atmospheric air, surface, underground water, soil and ways to solve environmental problems; safety of life in the technosphere; natural and man-made emergencies	5		/												
<b>v Cycle of basic disciplines University component</b>																	
10	Mathematics I	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 the graduate departments. The course sections include elements of linear algebra and analytic geometry, introduction to analysis, and differential calculus of functions of one and several variables. Methods of solving systems of equations, application of vector calculus to	5		/												

		solving problems of geometry, mechanics, and physics are considered. Analytical geometry on the plane and in space, differential calculus of functions of one variable, derivative and differentials, investigation of the behavior of functions, Direction derivative and gradient, extremum of a function of several variables.															
11	Physics	The course examines 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	/													
12	Математ Mathematics II	The discipline is a continuation of Mathematics 1. The course sections include elements of linear algebra and analytic geometry. The main questions of linear algebra are considered: linear and self-adjoint operators, quadratic forms, and linear programming. Differential calculus of functions of several variables and its applications. Multiple integrals. Theory of determinants and matrices, linear systems of equations, and elements of vector algebra. Elements of analytical geometry on a plane and in space are included	5	/													
13	Engineering and computer graphics	The discipline is aimed at studying methods for depicting objects and general drawing rules, using computer graphics; studying the basic principles and geometric	5						/		/						



		modeling approach and methodology for developing applications with a graphical interface; developing skills in using graphic systems for drawing development, using 2D methods															
14	Basics of the specialty	Course Discipline is one of the elective component disciplines that future representatives of the Technical Control Department of the Chief Mechanic's Service will study. The course content allows you to give future контролерам-mechanical supervisors an idea of such a technically and technologically complex industry. In the course of studying, students will be introduced to technological processes and basic equipment of the mining, metallurgical and oil and gas industries.	5							/				/			
15	Trebovani I to reliability of the equipment and their Assessment	The course provides for the study of basic methods related to repairs, conditions of repair and operation of technological equipment, requirements for the quality of repairs, the choice of necessary machines and equipment and materials. This discipline is an elective course for the training of mechanical engineers. As a result of mastering the discipline, students gain practical skills in maintenance and repair of components and parts of technological equipment and apply appropriate technical tools and tools	4														
16	Theoretical and applied Mechanics	Theoretical and applied mechanics includes courses such as theoretical mechanics, theory of mechanisms and machines. Theoretical mechanics deals with general laws of mechanical movements of material bodies and mechanical interactions between them. In the theory of mechanisms and machines, general methods of research, construction, and kinematics of mechanisms and	5														

		machines are studied. We also strive to engage students in developing and solving problems that help bridge the gap between scientific theory and engineering practice.															
17	Fundamentals of hydraulics and hydraulic drives of technological machines	The course is aimed at developing a complex of knowledge of the basic laws of hydraulics; skills to apply these laws to solve practical calculation problems; knowledge of standard hydraulic calculations and methods of experimental research of hydraulic systems. Application of knowledge in the field of technical fluid mechanics (hydraulics), for the calculation of hydraulic pressure systems, hydraulic machines, hydraulic and pneumatic drives, widely used in industry. Complete hydraulic calculation of various hydraulic systems, hydraulic and pneumatic equipment drives. Obtaining basic knowledge in the field of hydraulics-theoretical fluid mechanics in the field of hydraulic drives	6												/		/
18	Interchangeability, standardization and technical measurements	Study of the basic laws and concepts of standardization and interchangeability, methods and means of controlling shape deviations, roughness and undulation of the surfaces of parts, the role of standardization in improving the quality of machines. The course combines design, manufacturing technology, and product control into a single whole. Standardization and unification of parts and components help speed up and reduce the cost of designing and manufacturing products.	5						/								
19	Structural materials of technological machines and equipment	The solution of the most important technical problems associated with the creation and development of new most economical materials, improving the accuracy, reliability and operability of mechanisms and devices largely depends	5									/					/

		on the development of materials science and technology for obtaining and processing materials, concretizing knowledge about the relationship between the composition, structure and properties of materials used to control the structure and the properties of structural materials.															
20	Material resistance	Stretching and compression. Stresses in cross-sections and deformations of a straight rod. Mechanical properties of materials under tension and compression. Calculation of strength and stiffness under tension and compression. Geometric characteristics of plane sections. Shear and torsion. Calculation of torsional strength and stiffness. The bend. Normal and tangential bending stresses. Calculation of flexural strength. Theory of stressed and deformed states. The limit state hypothesis. Complex resistance. Stability of the equilibrium of deformable systems. Dynamic load.	5						/		/						
21	Thermodynamics, heat transfer and heat engineering equipment	Assimilation of methods for obtaining, converting, transmitting and using heat, which allows you to save fuel and energy resources, intensify technological processes, identify and use thermal energy resources during the operation of technological machines and equipment	5								/		/				
22	Industrial economics	The purpose of mastering the discipline is to form knowledge of complex solutions to economic problems of development acquisition of the ability to independently understand the changing market conditions in the context of economic activity of industrial enterprises. Economic aspects of product quality, investments, fixed and current assets of the enterprise, personnel, labor productivity, wages are studied. Basic technical and economic indicators of production, assessment and analysis of the	5				/									/	

		economic activity of the enterprise															
23	Fundamentals of machine design and parts	The purpose of the discipline: formation of knowledge of the basics of theory, calculation and design of machine parts and components. General principles of design and construction, construction of models and algorithms for calculating typical machine parts are considered, taking into account the performance criteria. Types of failures of machine parts, the concept of reliability and its main indicators, the basics of the theory and methodology for calculating typical machine parts, computer technologies for designing machine components and parts are studied. Basic requirements for machine parts and assemblies.	5							/							
24	Electrical engineering and microelectronics	Electrical and magnetic circuits. Basic definitions, parameters, and methods for calculating DC electrical circuits. Analysis and calculation of linear AC circuits. Analysis and calculation of electrical circuits with nonlinear elements. Analysis and calculation of magnetic circuits. Electromagnetic devices and electrical machines. Fundamentals of electronics and electrical measurements. Element base of modern electronic devices. Semiconductor elements. Power supply devices for electronic equipment. Electrical signal amplifiers. Electronic amplifiers and generators. Elements of pulse technology. Pulse and autogenerator devices. Fundamentals of digital and microelectronics. Microprocessor-based tools	5							/							
25	Labor protection in production	, the aim of the discipline is to develop knowledge of legislative acts and norms aimed at ensuring labor safety. In the discipline, students study legal and regulatory documents on labor protection(	5			/		/									

		OSH), occupational health and industrial sanitation. Dangerous and harmful production factors, safety measures during installation and operation of technological equipment, emergency situations and elimination of their consequences are considered. In the discipline, students learn the basics of OT management, rationing, methods for evaluating and predicting OT, methods for monitoring and auditing OT															
26	Dynamics and strength of technological machines	The course is designed to study the main methods for calculating the strength of parts and assemblies of technological machines and equipment. The main models of strength are considered in detail, in particular, methods of finite element modeling, methods for constructing stiffness matrices, displacements and deformations. A special place is occupied by the basics of calculating stresses and deformations in the assessment of strength, using various strength theories and methods for calculating the strength of simple and complex structures with the determination of internal forces in static calculation and access to the determination of geometric parameters	. 4											/			/
27	Надежность Reliability of technological machines	of the Course forms students ' knowledge and skills that provide a creative approach to solving reliability problems It is necessary to increase the level of automation, reduce the huge repair costs caused by machine downtime, and ensure safety during the operation of the equipment. When studying the disciplines, students master the issues of ensuring the reliability and durability of technological equipment; principles of rational use of technical parameters of technological machines.	5											/			

Cycle of basic disciplines																
Software component Elective component																
28	construction of	equipment for drilling wells for the purpose of oil and gas production, design and main directions of further development of drilling machines and complexes in accordance with the trends of global technological progress. Evaluation of the efficiency of machines and equipment for choosing a rational method of their operation. Technical level, ways to improve the design, methods of operation of drilling machines and complexes.	5							/	/				/	
29	Technological lines and complexes of metallurgical production	The course provides students with the necessary knowledge about the scale of metallurgical production and the continuity of its constituent processes, the laws of construction and trends in the development of technological lines of metallurgical production, necessary for production, design and research activities. Students ' development of technologies for obtaining various metals, starting from enrichment and ending with metal processing by pressure, the structure of existing technological lines and complexes of metallurgical workshops and prospects for the development of metallurgical production, the principle of choosing machines and mechanisms, determining the necessary number of them for lines and complexes of metallurgical workshops	5						/		/					
30	Mining technology	Prospects for the development of underground mining of mineral deposits. Mining and geological characteristics of mineral deposits. Basic information about mining operations during underground development of the deposit. The order and methods of ore extraction and the sequence of block mining. Main indicators of ore	5							/	/				/	

		extraction. Loss and dilution of ore. Concepts of the mine field, mine. Stages of mine field development. Opening requirements															
31	Technological processes in the oil and gas industry	O Bachelor's degree training in well construction technology, downhole oil production, scientific understanding of the main technological processes and operations in the oil and gas industry. Methods of opening productive objects; calling the inflow and development of wells; selection of methods of impact on the productive formation; selection of methods of impact on the bottom-hole zone of the well; methods of well operation; calculation of operating modes of the "well-formation" system.	5							/	/					/	
32	Internal combustion engines	Thermodynamic cycles internal combustion engines. Internal combustion engine designs used in the oil and gas industry, working process theory, principles of their operation, basic concepts and definitions, technical and economic indicators, engine system designs, rules for their technical operation, maintenance and repair. Compression, combustion, and expansion processes. Calculation of the parameters of the working mixture in these processes	5							/	/					/	
33	Pumps, fans, compressors	Device of technologically important and large energy consumers in industry: pumps, fans and compressors of various types, parameters, effective modes of their operation. Design techniques and devices are practically mastered pumping stations, main ventilation fan installations. Pipeline networks, their design and installation, and auxiliary equipment that ensures efficient and safe operation of pumping, ventilating, and compressor units are studied.	5														/

34	. Transport and auxiliary equipment of metallurgical workshops	General information about mechanical and transport equipment of non-ferrous metallurgy plants. Equipment for warehouses of bulk charge materials. Structure and construction of car dump trucks. Bunkers and their closures. Feeder designs. Techniques for servicing equipment, depending on its type and purpose. Basic parameters of the mechanical mode. Purpose, design, operating principle and operation features of technological equipment for pyro-and hydrometallurgical industries	5							/							/	
	Gas pumping units	Main features and current state of natural gas pipeline transport. Modes and performance indicators of gas pumping units at compressor stations. Features of properties and aerodynamics of flows in gas-pumping units. Types of centrifugal pumps used in the gasindustry. Structures and characteristics of natural gas CBN. Methods for determining the technical condition and power consumption of gas-powered pumping units.	5							/							/	
35	. Calculation and design of technological machines and equipment	The concept of the essence and purpose of the mechanism. General principles of designing technological equipment. Kinematic schemes of technological machines and equipment, methods for obtaining new technical solutions in the design, construction of gearbox body parts; standard calculation of mechanical gears, design of the main elements of mechanical gears, including using computer-aided design methods	6							/		/						
36	Computer-aided design systems for technological machines	Organization of the design process for engineering objects, basic principles of construction and structure of computer-aided design systems computer-aided design, composition and types of support for computer-aided design systems,	6							/		/						



		analysis of working processes of technological machines using computers, elements of computer-aided design systems for technological machines. Structure and classification of computer-aided design systems, with various types of software for computer-aided design systems															
37	Computer technologies for calculation, modeling and design	The course is aimed at students studying the basics of modeling technological machines and equipment, getting practical skills in working with computer graphics in the process of designing parts and components, forming knowledge about trends in the development of computer graphics, the student's consciousness. When studying the discipline, students receive: practical skills in working with modern graphic computer programs.master the methods of applying computer graphics in the tasks of the discipline; knowledge of the theoretical foundations of the finite element method; obtaining skills in analyzing the results of computer modeling and design; fundamentals of system and computer-aided modeling and design of technical objects; classification, technical characteristics and capabilities of various computer-aided design systems and database management	systems 6				/					/					
<b>Cycle of specialized disciplines University component</b>																	
38	Repair of technological machines	Wear and aging of technological machines and equipment. Design of repair production. Organization and management of the electromechanical service. Basic information on methods of repair and improvement of technological equipment. Engineering support for repairs. Identify defects in the components of machines and aggregates, instill students with practical	5				/		/								

		skills necessary for the repair and operation of mining and metallurgical equipment. Technologies for the restoration of worn parts															
39	Control and measuring devices and automation of technological machines	Formation of a future specialist's knowledge of the design of devices, their purpose and principles of operation. As well as special training of engineering and technical personnel with scientific and practical knowledge in the field of operation, as it solves current engineering and scientific problems in the field of quality, operational properties and rational use of fuels, oils, lubricants and technical fluids.	5					/	/								
40	Installation and operation of technological machines	The course is aimed at familiarizing students with modern methods and forms of organizing installation work, technology for completing components during assembly, alignment of equipment during installation on the foundation, adjustment of standardized components, running-in, testing and operation of aggregates, lubricants, lubrication systems, lubrication fittings and regeneration of lubricants. The main task of studying the discipline is to gain knowledge on the organization and engineering support of high-quality operation and installation of metallurgical equipment, instilling students with practical skills necessary for the operation and installation of technological machines.	6					/	/								
41	Control of equipment	reliability requirements This discipline allows you to analyze the control sections контроля of the technical task and technical specifications with requirements for equipment reliability. Getting access to the use of system resources and information about equipment reliability. Formation of students ' skills in constructing queries to obtain the	4					/					/				

		necessary source data for selected segments and groups of equipment. Getting an assessment of the confirmed level of equipment reliability. Preparation of a report on the results of solving the problem of monitoring equipment reliability.															
<b>v v Cycle of profile disciplines Component Software component select</b>																	
42	Transport vehicles	General information about transport vehicles. Technological schemes of transport. Basics of calculating transport vehicles. Railway transport. Automated design system for electric locomotive transport. Self-propelled transport. Scraper installations. Conveyor installations. Pneumatic and hydraulic transport installations. Pipeline container pneumatic transport installations. Mechanization of loading and unloading and installation works. Transport on the surface of mines and mines. Technological complex of the surface. Construction of transport machines	5					/						/			/
43	Hydraulic machines and compressors in the oil and gas industry	Acquisition of solid theoretical and practical knowledge on the design and operation principles of hydraulic machines, compressors widely used in the transportation of oil, petroleum products and gas through pipelines. General diagrams of hydraulic machines and compressors. The principle of operation of volumetric, flow-through machines. Types of hydraulic and compressor machines. Theories of action and characteristics.	5							/				/			/
44	Ore treatment equipment	The course is aimed at training specialists in the field of operation of technological equipment for the preparation of ore raw materials, who have a system of theoretical and practical knowledge, techniques and technologies of the ore preparation	preparation 5					/						/			/

		process, who have an idea of the purpose and role of preparatory processes in the processing of minerals, methods of calculation of technological equipment about the choice and technical and economic indicators of equipment, purpose, device, operation and operating conditions, as well as the basics of calculating machines and equipment for ore															
45	Systems and programs for ensuring equipment reliability software reliability	This course teaches students the organization of work on preserving and ensuring the reliability of equipment during its operation. Ensuring reliability plays a special role in the transition of enterprises to new conditions for maintaining the reliability of production with the use of software tools for monitoring the condition. High quality and, above all, reliability of the equipment, will affect the products and is an effective means of increasing profits and revenue generated by expanding customer demand for products.	4							/	/					/	
46	Technical diagnostics of technological equipment	The course is aimed at studying the theoretical foundations of technical diagnostics and obtaining practical skills in the use of non-destructive testing methods to assess the technical condition of technological machines and equipment; at familiarizing students with the basics of the theory of technical diagnostics, types of technical condition, controlled parameters, technical diagnostics systems; studying the physical foundations of non-destructive testing methods to detect and diagnose malfunctions of technological equipment; familiarization with equipment for non-destructive testing, test methods, acquisition of practical skills	4							/	/					/	
47	Friction and wear	Patterns of external friction and wear of	6		/											/	

		rough surfaces, modern friction theories, methods for determining friction coefficients, calculating and predicting wear intensity; types and mechanism of abrasive wear; значения lubricants and additives for friction and wear, methods for selecting materials for rubbing parts, methods for improving wear resistance, equipment used for friction and wear research, development directions.															
48	Fuel, oil and special fluids. Technologies with smears and technological machines	The course covers: operational properties of technological machines; operational properties of elements of technological machines exposed to temperature and corrosion; lubrication of technological equipment; lubricating oils; additives to lubricating oils; greases; selection, supply and methods for calculating the lubricant consumption. Types of organic fuels, lubricants and technical fluids, their purpose and main properties. As well as special training of engineering and technical personnel who possess scientific and practical knowledge in the field of chemmology, as it solves current engineering and scientific problems in the field of quality, operational properties and rational use of fuels, oils, lubricants and technical fluids.	6							/							
49	Analysis of the types of consequences and criticality of equipment failures	When studying this discipline, the student will gain knowledge on the signs of equipment failures that occur, their frequency of occurrence and identification of the causes of the malfunction. Analysis of failures that have occurred, their consequences and impact on functionally dependent mechanisms, and division of failures into criticality levels.	6					/						/			
50	Butmirovaniye of. Standardization of equipment reliability	discipline is aimed at training the requirements for standardization, ensuring and confirming reliability, which	5													/	

	requirements The of the equipment	<p>must be taken into account in the development, manufacture and controlled operation of technological equipment. General concepts and definitions of equipment reliability indicators used in production and applicable at the legislative level.</p> <p>Training students to work with passportsми, forms, instructionsми and other operational documentationrelated требованияto the m requirement. by reliability.</p>																
51	. Technology of operation and repair of compressor units and hydraulic	<p>machines Studying the discipline forms students ' ideas about the basics of installation of compressor units and hydraulic machines, about the organization of the operation system, factors affecting operational modes, as well as about modern technologies for improving operational reliability. When studying the discipline, the following are considered: general methods of installation of compressor stations; installation of technological equipment of a gas turbine shop; installation of equipment of gas engine shops; installation of auxiliary technological equipment</p>	5						/		/					/		
52	Smelting equipment	<p>Training of specialists for production, design and research activities in the field of creation, improvement and operation of mechanical equipment of the smelting process of the metallurgical cycle with knowledge of scientific principles of organization of technological design. As a result of studying the discipline, students master advanced methods of operation of mechanical equipment, the current state and prospects of development of metallurgical production; the main scientific and technical problems of operation of technological equipment of</p>	5						/		/							

		metallurgical enterprises.															
53	Oil and gas field machines and mechanisms	Construction of the wellbore completed by drilling. Well capital and routine maintenance units. Equipment and tools for capital and routine well repairs. Equipment of wells for various methods of influencing the formation in order to increase its oil recovery. Well production collection and preparation system. Equipment for maintaining reservoir pressure and displacing oil from productive formations	5								/		/				
54	Fundamentals of predictive maintenance systems	Фтmiefforming students ' knowledge systems in the field of theory and practice of using predictive technologies in the maintenance and repair of technological equipment and systems; - formation of skills in the use of information technologies in the design of technical management systems, in solving problems of system analysis of the state of equipment and its management; - formation of skills in the application of methods, system analysis, theory of knowledge to develop scientifically based solutions for solving technical problems in the operation and maintenance of technological equipment;	5				/										/
55	Drainage, fan and pneumatic installations	The design of technologically important and large-scale energy consumers in the mining industry: pumps, fans and compressors of various types, the main parameters and scope of these installations. Methodology of design and construction of pumping stations, main ventilation fan installations. Pipeline networks, their design and installation, auxiliary equipment that ensures efficient and safe operation of pumping, fan and compressor units	5				/										/

56	Dust and gas cleaning and recycled water supply of industrial enterprises	Studying the course gives students an idea of modern systems of dust and gas purification and recycled water supply of industrial enterprises. Contains basic information about the water supply features of industrial enterprises. Systems and schemes of industrial water supply, methods and technologies of water treatment are considered, and data on the design of installations for cooling recycled water and improving its quality, preventing suspension deposits and biological fouling, scale formation and corrosion in pipelines and equipment are provided.	5				/					/				
57	Equipment and installations for major well repairs	Principles of operation and arrangement; fundamentals of their theory of calculation, design and operation. Principles of economic operation of modern equipment for well capital repairs. Equipment used for major well repairs. Equipment for well repair work. Equipment for collecting and preparing oil and gas for transportation. Modern methods of environmental protection during major well repairs.	5					/					/			
58	Technique and technology of well capital repairs	of equipment and tools for well capital repairs; technology of well capital repairs of operating conditions and repairs; their principles of operation and device; fundamentals of their theory of calculation, design and operation. New technological techniques and technical means of repair. Principles of economic operation of modern equipment for well capital repairs; equipment used in various methods of oil and gas	production 5					/					/			
59	Metodik and reliability analysis and programs for ensuring the reliability of technological equipment	The course is aimed at acquiring students' theoretical knowledge and practical skills in analyzing models and methods for evaluating the reliability of technical and software tools. On new concepts of reliability and security methods for	5				/								/	



		systems and situations that lead to errors, defects, and failures. KClassification of reliability models: predictive, measurement, and evaluation types. Study of evaluationx modelseñthat are applied in practice. Getting acquainted with the resultsсами of applying reliability models to small, medium and large projects and thewritingие технологического technological modulea technological module assessment of reliability of technological equipment.															
60	Calculation and design of drilling equipment	The course is aimed at studying drilling machines and complexes that provide drilling of deep wells for the extraction of oil and gas from the earth's interior. The program is focused on the training of a mechanical engineer and is aimed at an in-depth study of the physical foundations of the operation of drilling machines and equipment, as well as the design of new drilling equipment based on existing ones developed by world firms. The objectives of the discipline are to acquire in-depth knowledge in the field of professional activity	5				/	/			/						
61	Calculation and design of oil and gas field equipment	Questions of the theory and practice of machine design and mechanisms, design features of typical types of oilfield equipment; optimization of equipment design using computer-aided design systems. Designing machines for the oil and gas industry is the basis for the development of this industry, contributes to the development of design skills. Basic design techniques for developing parametric series of equipment for oil and gas production	5				/	/			/						
62	Designing metallurgical machines	Training and training of specialists for production and research activities in the field of design and development and	5				/	/			/						

		obtaining practical skills in designing typical and specific elements and components of metallurgical machines using modern regulatory and technical documentation. This is due to the predominant use of specialists in industry as middle-level engineering and technical workers engaged in the creation, operation and repair of modern metallurgical machines and aggregates.															
63	Construction of mining and transport machines and stationary installations	Basic principles, methods of construction of mining machines and stationary installations manufacturability of the design. Indicators of design adaptability. Required documents and their registration. Establishment of rational design parameters of mining machines and stationary installations. Basic principles and methods of designing technological machines. Principles for calculating design parameters. Designing assembly units and machine parts.	5				/	/			/						
64	Fundamentals of industrial energy saving	To form an understanding of the general principles of developing an energy survey strategy, the current regulatory framework for energy efficiency, methods for determining regulatory and prospective indicators of energy efficiency, methods for confirming energy efficiency indicators and their compliance with regulatory values, modern and promising scientifically based technologies for energy conservation, quality control and improvement energy, including the use of renewable energy	sources 5						/	/		/					
65	Conversion equipment 3-5	Classification of working stands and rolling mills. Parameters of the rolling process. Calculation of the rolling force. Rolling moment and power. Determination of the electric drive power. Working stands. Rolling roller bearings and pads.	5				/				/						

		Mechanisms and devices for installing and balancing rolls. Frames of working stands. Drive of rolls of working stands. Gear boxes. Ingot carriers. Continuous hot and cold rolling mills															
66	Energy-saving equipment and technologies in the oil and gas industry	Basic terms and definitions of energy-saving. Energy saving in the oil and gas industry. The main directions of using VER. Prospects for the development of the use of non-traditional energy sources. Energy-saving measures in the technology of the oil and gas industry. Use of heat-carrying units in the gas and oil-producing industry. Utilization and use of VER gas turbine installations at compressor stations of main gas pipelines	5						/	/		/					
67	Lifting installations	Purpose and general arrangement of lifting installations for the transportation of people, cargo, minerals and waste rock. The purpose and design of lifting vessels of various types, their scope of application are studied. Information and methods of calculation and selection of ropes, lifting machines, copra. Calculation method for elements of kinematic and dynamic operation mode of a lifting installation, selection of electric	5							/							/
68	Digital monitoring of the condition of machines and equipment	Formation of students of basic knowledge among students on assessing the current technical condition of technological machines and equipment, choosing the most informative diagnostic signs of their condition, methods for collecting and processing diagnostic information, choosing tools and methods making decisions. Obtaining knowledge from: - practical use of devices for diagnosing the condition of machines by ultrasound, vibration, acoustic emission and other methods. - ability to detect and perform diagnostics,	5		/				/			/					

		analyze results and make decisions about the state of machines and mechanisms.															
69	Technique and modeling of a full-scale experiment	The purpose of the study: to give students the necessary knowledge for further production, activity about the essence and methodology of modeling and conducting full-scale experiments, hardware design of a full-scale experiment Expected results: The student will be able to independently prepare the equipment for conducting tests, research. Connect the assembled circuit and perform calibration using a calibration beam.	5	/					/				/				
70	Methods and tools for testing and production machines	, the Development of the discipline is aimed at the acquisition of knowledge and skills for the selection, creation, implementation and operation of the measuring systems, testing equipment; knowledge of methods and means of measurement; metrological characteristics of measuring instruments; the organization of the activities of testing and monitoring to assess the conformity of products and quality indicators	5	/					/				/				

## 5. Curriculum of the educational program

KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATBAYEV



**CURRICULUM**  
of Educational Program on enrollment for 2023-2024 academic year  
Educational program 6B07132 - "Predictive technologies and machine diagnostics"  
Group of educational programs B064 - "Mechanics and metal working"

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 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						
<b>CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)</b>																					
<b>M-1. Module of language training</b>																					
LNG 108	English language	GED, RC	10	300	0/0/6	210	E	5	5												
LNG 104	Kazakh (Russian) language	GED, RC	10	300	0/0/6	210	E	5	5												
<b>M-2. Module of physical training</b>																					
KFK 101-104	Physical Culture	GED, RC	8	240	0/0/8	120	Difference	2	2	2	2										
<b>M-3. Information technology module</b>																					
CSE 677	Information and Communication Technologies (in English)	GED, RC	5	150	2/1/0	105	E				5										
<b>M-4. Module of socio-cultural development</b>																					
HUM137	History of Kazakhstan	GED, RC	5	150	1/0/2	105	GE		5												
HUM132	Philosophy	GED, RC	5	150	1/0/2	105	E				5										
HUM120	Module of socio-political knowledge (sociology, political science)	GED, RC	3	90	1/0/1	60	E				3										
HUM134	Module of socio-political knowledge (culturology, psychology)	GED, RC	5	150	2/0/1	105	E				5										
<b>M-5. Module of anti-corruption culture, ecology and life safety base</b>																					
HUM136	Fundamentals of anti-corruption culture and law	GED, CCH	5	150	2/0/1	105	E				5										
MNG489	Fundamentals of Economics and Entrepreneurship																				
MSM500	Scientific research methods																				
CH 656	Ecology and life safety																				
<b>CYCLE OF BASIC DISCIPLINES (BD)</b>																					
<b>M-6. Module of physical and mathematical training</b>																					
MAT 101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5													
PHY 468	Physics	BD, UC	5	150	1/1/1	105	E	5													
MAT 102	Mathematics II	BD, UC	5	150	1/0/2	105	E		5												
<b>M-7. Basic training module</b>																					
GEN 429	Engineering and computer graphics	BD, UC	5	150	1/0/2	105	E	5													
TEC606	Basics of the specialty	BD, UC	4	120	2/0/1	75	E	4													
TEC577	Thermodynamics, heat transfer and thermal engineering installations	BD, UC	5	150	2/0/1	105	E				5										
GEN411	Theoretical and applied mechanics	BD, UC	5	150	2/1/0	105	E				5										
TEC563	Fundamentals of hydraulics and hydraulic drives of technological machines	BD, UC	5	150	2/0/1	105	E							5							
GEN408	Strength of materials	BD, UC	5	150	1/1/1	105	E				5										
PED413	Interchangeability, standardization and technical measurements	BD, UC	6	180	2/0/1	120	E				6										
TEC460	Structural materials of technological machines and equipment	BD, UC	5	150	2/1/0	105	E		5												
NSE143	Economics of industry	BD, UC	5	150	2/0/1	105	E												5		
GEN125	Basics of design and machine parts	BD, UC	5	150	1/1/1	105	E				5										
ELC103	Electrical engineering and microelectronics	BD, UC	5	150	2/1/0	105	E							5							
TEC578	Industrial Safety	BD, UC	5	150	2/0/1	105	E												5		
CSE554	Algorithmization and Programming	BD, UC	4	120	1/1/1	75	E							4							
3217	elective	BD, CCH	5	150	2/0/1	105	E							5							
TEC555	Dynamics and strength of technological machines	BD, UC	4	120	2/0/1	75	E							4							
PED189	Manufacturing technology of technological machines	BD, UC	5	150	2/0/1	105	E				5										
TEC607	Technical diagnostics of technological machines	BD, UC	4	120	2/0/1	75	E												4		
AUT184	Программирование микроконтроллеров	BD, UC	5	150	2/1/0	105	E												5		
3220	elective	BD, CCH	5	150	2/0/1	105	E												5		
AAP179	Educational practice	BD, UC	2								2										

CYCLE OF PROFILE DISCIPLINES (PD)																	
M-8. Module of professional activity																	
TEC586	Installation and repair of technological machines	PD, UC	5	150	2/0/1	105	E						5				
PED193	Instrumentation and automation of technological machines	PD, UC	5	150	2/0/1	105	E			5							
TEC587	Fundamentals of Reliability of Technological Machines	PD, UC	5	150	2/0/1	105	E				5						
TEC588	Geomonitoring of the technical condition of technological machines	PD, UC	5	150	2/0/1	105	E						5				
3303	elective	PD, CCH	5	150	2/0/1	105	E				5						
3304	elective	PD, CCH	5	150	2/0/1	105	E				5						
4306	elective	PD, CCH	5	150	2/0/1	105	E					5					
4307	elective	PD, CCH	5	150	2/0/1	105	E					5					
4308	elective	PD, CCH	6	180	2/0/2	120	E					6					
4310	elective	PD, CCH	5	150	2/0/1	105	E						5				
4311	elective	PD, CCH	5	150	2/0/1	105	E						5				
4312	elective	PD, CCH	6	180	2/0/2	120	E						6				
AAP143	Production practice I	PD, UC	2							2							
AAP183	Production practice II	PD, UC	3								3						
M-9. Module of final attestation																	
ECA108	final examination	IA	8										8				
M-10. Module of additional types of training																	
AAP500	Military training	DVO	0														
<b>Total for UNIVERSITY:</b>										31	29	28	32	28	32	31	29
										60	60	60	60	60	60	60	60

Number of credits for the entire period of study						
Cycle code	Cycles of disciplines	Credits				Total
		required component (BC)	university component (UC)	component of choice (CCH)		
GED	Cycle of general education disciplines	51		5	56	
BD	Cycle of basic disciplines		99	10	109	
PD	Cycle of profile disciplines		25	42	67	
	<i>Total for theoretical training:</i>	<i>51</i>	<i>124</i>	<i>57</i>	<i>232</i>	
FA	Final attestation	8			8	
	<b>TOTAL:</b>	<b>59</b>	<b>124</b>	<b>57</b>	<b>240</b>	

Decision of the Academic Council of Kazntu named after K.Satpayev. Protocol № 13 or "90" 03 2023y.

Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № 6 or "04" 02 2023y.

Decision of the Academic Council of the Institute E&ME. Protocol № 3 or "24" 11 2022y.

Vice-Rector for Academic Affairs

Director of Institute of E&ME

Head of department TM&T

Representative of the Council from employers

B.A. Zhautikov

K.K. Yelemessov

S.A. Bortebayev

M.A. Kanatbayev





MAJOR ELECTIVE DISCIPLINES educational program for the 2022-2023 academic year admission  
 Educational program 6B07132 - "Predictive technologies and machine diagnostics"  
 Group of Educational programs B064 - "Mechanics and metal working"

Full-time study Study duration : 4 years Academic degree: Bachelor of Engineering and Technology

Year of study	Code of elective	Code of discipline	Name of discipline	Semestr	Cycle	Credits	Total hours	lec/lab/pr	SIWT (including SIWT) in
<b>M-7. Module of basic training</b>									
<b>General technical training module</b>									
3	3220	TEC485	Drilling machines and complexes	6	BD	5	150	2/0/1	105
		PED137	Technological lines and complexes of metallurgical production					2/0/1	
		MIN173	Mining technology					2/0/1	
<b>M-8. Module of professional activity</b>									
<b>Technology and Operations Module</b>									
3	3303	TEC479	Oil and gas field machines and mechanisms	6	PD	5	150	2/0/1	105
		TEC429	Mining and transport machines					2/0/1	
		PED149	Equipment for metallurgical plants					2/0/1	
	3304	TEC590	Design and construction of oil and gas machines	6	PD	5	150	2/0/1	105
		TEC591	Design and construction of mining machines					2/0/1	
		PED176	Construction of metallurgical machines					2/0/1	
4	4306	TEC127	Hydraulic machines and compressors in the oil and gas industry	7	PD	5	150	2/0/1	105
		PED431	Dewatering, fan and pneumatic plants					2/0/1	
		PED118	Dust-gas cleaning and recycling water supply of industrial enterprises					2/1/0	
	4307	TEC592	Energy-saving technologies in the oil and gas industry	7	PD	5	150	2/0/1	105
		TEC593	Energy-saving technologies in the mining industry					2/0/1	
		TEC453	Energy-saving technologies in the metallurgical industry					2/0/1	
	4308	TEC594	Predictive technologies in the oil and gas industry	7	PD	5	180	2/0/2	120
		TEC595	Predictive technologies in mining					2/0/2	
		TEC596	Predictive technologies in metallurgical production					2/0/2	
4	4310	TEC597	Operation, repair and maintenance of oil and gas machines and equipmen	8	PD	5	150	2/0/1	105
		TEC598	Operation, repair and maintenance of mining machines and equipment					2/0/1	
		TEC599	Operation, repair and maintenance of metallurgical machines and equipment					2/0/1	
	4311	TEC600	Organization, planning and management of the repair of oil and gas machines	8	PD	5	150	2/0/1	105
		TEC601	Organization, planning and management of the repair of mining machines					2/0/1	
		TEC602	Organization, planning and management of the repair of metallurgical machines					2/0/1	
	4312	TEC603	Digitalization of production processes in oil and gas production	8	PD	5	180	2/0/2	120
		TEC604	Digitalization of mining production processes					2/0/2	
		TEC605	Digitalization of production processes in metallurgical production					2/0/2	
<b>Module "R&amp;D"</b>									
3	3217	TEC583	Oil and gas production technologies	5	BD	5	150	2/0/1	105
		TEC584	Mining technologies					2/0/1	
		TEC585	Technologies of metallurgical production					2/0/1	

Credits numbers of elective disciplines over the entire period of study	
Cycle of disciplines	Credits
Cycle of basic disciplines (B)	10
Cycle of special disciplines (S)	42
<b>Overall:</b>	<b>52</b>

Decision of the Academic Council of the Institute E&ME. Protocol № 3 or "24" 11 2022.

Head of the department TM&T

S.A. Bortebayev

Representative of the Council from employers

M.A. Kanatbayev