Institute of Energy and Mechanical Engineering
Department of Mechanical Engineering

EDUCATIONAL PROGRAM

6B07130 -"Mechanical Engineering and Modeling"

Code and classification of the field of education: 6B07 - Engineering, manufacturing and construction industries
Code and classification of training areas: 6B071 - Engineering and Engineering
Group of educational programs: B064 - «Mechanics and metal working»
Level based on NQF: 6B
ORC Level:6
Study period: 4 years
Amount of credits: 240

Almaty 2025

Educational program 6B07130 - Mechanical Engineering and Modeling approved at the meeting of the Academic Council of Kazntu named after K.I.Satpayev.

Protocol No. 10 dated March 06, 2025.

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of Kazntu named after K.I.Satpayev.

Protocol No. 3 dated December 20, 2024.

Educational program 6B07130 - Mechanical Engineering and Modeling developed by the academic committee for the group of educational programs: B064 - Mechanics and metal working

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List of abbreviations and designations

EP - educational program,
LO – learning outcomes,
FM– Fluid Mechanics
AI - Artificial Intelligence
SDGs - Sustainable Development Goals

1. Description of the educational program

The educational program **"Mechanical Engineering and Modeling"** is aimed at preparing bachelors able to solve a wide range of engineering problems of mechanics based on fundamental knowledge in mathematics, mechanics, physics, chemistry and engineering principles using modern analytical, experimental and numerical methods mathematical and computer modeling and information technology. During preparing students, a broad systematic approach is followed, when graduates will make engineering decisions with a full understanding of the possibilities and limitations of research methods and advanced technologies used.

Thus, the mission of the educational program Mechanical Engineering and Modeling is to provide the market with highly qualified specialists with fundamental knowledge in the fields of natural sciences, engineering mechanics and computer modeling to work in the field of high-tech engineering.

The curriculum of the educational program “Mechanical Engineering and Modeling” is developed in accordance with the curricula of the educational program “Mechanical Engineering” of the world best research and engineering universities such as Massachusetts Institute of Technology – MIT, Stanford University, University of Cambridge, Georgia Institute of Technology, Technical University of Munich, Pennsylvania State University, Tokyo University, Nanyang Technological University (Singapore), and others, taking into account the current trends in technology development.

In the course of training, special attention is paid to the acquisition by graduates of in-depth knowledge in relevant areas of mathematics, the laws of physics and mechanics underlying modern engineering design, numerical and computer modeling methods and information technologies. The basic education received in these areas will allow future specialists to easily integrate into the workflow of almost any industry, it is easy enough to master a wide range of new technologies.

During the first two courses (in the first 4 semesters), students have the opportunity to receive fundamental education in mathematics (differential and integral calculus, vector analysis, algebra and geometry, differential equations, partial differential equations), physics (molecular physics, thermodynamics, electricity and magnetism, optics and atomic physics), mechanics (statics, strength of materials, dynamics), chemistry, information and digital technologies (information and communication technologies, numerical methods and programming), Kazakh and English languages. This knowledge is the basis of any technology and will allow students who have mastered them to easily master new technologies and retrain for other modern specialties.

At senior courses, students study in-depth special courses in mechanics and engineering (engineering thermodynamics, engineering materials, fluid mechanics, solid mechanics, theory and design of mechanisms and machines, design of machine elements, fundamentals of heat and mass transfer, numerical methods for solving engineering problems, fundamentals of robotics, design of mechanical systems and

elective courses) and gain skills at numerical and computer modeling, design of machine elements and structures, design of mechanisms and mechanical systems, numerical modeling and research of various mechanical processes and phenomena, development and creation of robots and manipulators. Primary attention is paid to the acquisition by graduates of skills in developing computer models of various engineering tasks and hydraulic systems, complex mechanical, thermal or mass transfer processes in various industries using modern computing and information technologies.

Students will practice in such companies as Kazatomprom JSC, Kazmunaygas JSC, at the Institute of Mechanics and Machine Science, at the Institute of Mathematics and Mathematical Modeling, etc. Students have the opportunity to undergo an internship at leading engineering universities in Europe and Russia could under the academic mobility program.

The educational program will make it possible to implement the principles of the Bologna process. Based on the students' choice and independent planning of the sequence of studying disciplines, they independently form an individual study plan for each semester according to the curriculum and the catalog of elective disciplines.

During the study teaching is conducted by highly qualified teaching staff, including graduates of USA, Europe, Russia and other countries universities.

Graduates can choose different career paths. They can either work in industry as practicing engineers or pursue master studies in mechanical engineering or applied sciences. Many graduates go on to careers in business or in public activities. The best graduates have studied or are studying in master's or doctoral studies at KazNU, NU, Purdue University, Georgia Institute of Technology, National University of Singapore, University of Pittsburgh, University of Lorraine and many other universities.

The Bachelor's degree program "Engineering Mechanics and Modeling" is the first level of qualification of a three-level system of higher education, it lays the foundation for subsequent master and later doctoral programs.

2. Purpose and objectives of educational program

The purpose of the educational program **" Mechanical Engineering and Modeling"** is to train highly qualified personnel: possessing fundamental knowledge of mechanics, mathematics, physics, chemistry, as well as methods and IT skills for modeling problems of engineering mechanics; able to apply knowledge and skills for the development and design of new mechanisms and mechanical devices, mechanical, thermal and hydraulic systems, heat- and mass transfer devices and installations, robots and manipulators; able to use knowledge to manage modern technological processes in mechanical engineering and energy.

Areas of professional activity of the graduate

profession	Labor function A scientific	Professional task A1: develop modern mechanical systems, mechanisms and mechanical devices, and robots	Knowledge Calculus I-III, ODE, Strength of materials, Solid Mechanics, Theory and Design of Mechanisms and Machines, Numerical Methods and Programming, Design of Machine Elements, Design of Mechanical Systems, Introduction to Robotics.
			Skills Ability to work with high-tech laboratory and research equipment. The ability to develop new mechanisms and devices, including robots.
			Standards of behavior: Self-learning and systemic thinking; IT competencies; creativity; cooperation with team members; ability to make decisions quickly, respond to changes in working conditions.
			Equipment and tools Computational systems, 3D printers, special materials and constructions, equipment for the study of mechanical properties of materials, electronic measuring systems, electrical equipment.
			Future trends The ability to develop effective mechanical structures and autonomous mechanical systems, and robots.
		Professional task A2: develop efficient	Knowledge Calculus I-III, Linear Algebra and Analytical Geometry, Physics I-II, General Chemistry, Statics, Dynamics, ODE, Partial Differential Equations, Engineering Thermodynamics, Fluid Mechanics, Computational Methods and Programming, Object Oriented Programming, Fundamentals of Heat Transfer, Computational fluid mechanics and modeling, Modeling and design of thermal systems.

			Skills Ability to work with high-performance computing systems, high-tech laboratory and research equipment. Ability to independently develop adequate physical and mathematical models of mechanical processes and phenomena. Ability to program in algorithmic languages, skills in modeling and research of complex mechanical and physical-chemical processes. Ability to use specialized software for independent study of a wide range of engineering problems in mechanics and design of various mechanical and energy systems.
			Standards of behavior: Self-learning and systemic thinking; IT competencies; creativity; cooperation with team members; ability to make decisions quickly, respond to changes in working conditions.
			Equipment and tools High-performance computing systems, specialized software and experimental installations for fluid mechanics, mass transfer devices and thermal systems, energy, research equipment.
			Future trends The ability to use machine learning methods to study stochastic problems of mechanics. The ability to use quantum computing systems to solve resource-intensive problems of fluid mechanics.
	Labor function B design and engineering	Professional task B1: design and create mechanisms and mechanical devices, mechanical systems and robots.	Knowledge Calculus I-III, ODE, Strength of Materials, Solid Mechanics, Numerical Methods and Programming, Theory and Design of mechanisms and machines, Design of Machine elements, Design of Mechanical Systems, Introduction to Robotics.
			Skills Ability to work with high-tech laboratory and research equipment. The ability to design and create new mechanisms and devices, including autonomous mechanisms and robots.
			Standards of behavior self-learning and systemis thinking; IT competencies; creativity; cooperation with team members; ability to make decisions quickly, respond to changes in working conditions.
			Equipment and tools 3D printers, computing systems, special materials and constructions, equipment for the study of mechanical properties of materials, electronic measuring systems, electrical equipment.
			Future trends

			The ability to design and create effective mechanical structures and autonomous mechanical systems, and robots.
		Professional task B2: develop mathematical models of physical and chemical processes in engines, heat exchangers and chemical reactors; design and build heat and mass transfer devices and reactors.	Knowledge Calculus I-III, Linear Algebra and Analytical Geometry, Physics I-II, General Chemistry, Statics, Dynamics, ODE, Partial Differential Equations, Engineering Thermodynamics, Fluid Mechanics, Numerical methods and programming, Object-oriented programming, Fundamentals of heat transfer, Computational fluid mechanics and modeling.
			Skills Ability to develop and create physical and mathematical models of mechanical and thermal phenomena and processes in engines, heat exchangers and chemical reactors. Ability to simulate and conduct experimental and numerical studies of fluid flow in pipes, channels of hydraulic systems, heat and mass transfer processes in thermal devices and reactors. Ability to design and build heat and mass transfer plants and reactors.
			Standards of conduct Self-learning and systemic thinking; IT competencies; creativity; cooperation with team members; ability to make decisions quickly, respond to changing working conditions.
			Equipment and tools High-performance computing systems and experimental installations for fluid mechanics, specialized software and experimental installations for fluid mechanics, mass transfer devices and thermal systems, energy, research equipment.
			Future trends Ability to design and create highly efficient heat and mass transfer installations and thermal energy storages
	Labor function C production, technological, organizational, managerial	Professional Task C1: manage of production and technological processes in mechanical	Knowledge Calculus I-III, ODE, Strength of Materials, Engineering Materials, General Chemistry, Fluid Mechanics, Solid Mechanics, Theory and Design of Mechanisms and Machines, Design of Machine Elements, Engineering Thermodynamics, Design of Mechanical Systems, Fundamentals of Heat Transfer.
			Skills Ability to model and program technological problems, skills in the study of complex physical and mechanical processes. Knowledge of methodology: systemic analysis;

		engineering and energy	design and decision-making in complex and professional situations; methods of communication and coordination of points of view; design and presentation of analytical and project documentation.
			Standards of conduct Self-learning and systemic thinking, technological literacy, entrepreneurship, customer orientation, the ability to make decisions quickly, respond to changes in working conditions, the ability to allocate resources and manage your time.
			Equipment and tools Equipment for mechanical engineering and energy.
			Future trends The ability to manage high-tech processes in mechanical engineering and energy.

3. Requirements for the evaluation of learning outcomes of the educational program

List of competencies
General competencies

- • Knowledge of Kazakh, Russian and English for free oral and written communication on professional topics and in a real-life situation, search and analysis of scientific and technical information, as well as work with literature on engineering mechanics, including issues of sustainable development and inclusive technologies.
- • Mastering critical and systemic thinking, transdisciplinary and cross-functionality to solve complex engineering problems, considering the principles of the Sustainable Development Goals.
- • Knowledge of ICT competencies and the ability to develop software for modeling and analyzing engineering systems aimed at energy efficiency, environmental safety and technological sustainability.
- • Mastering self-learning skills, deepening knowledge, openness to new information, systems thinking and self-judgment in the context of rapidly changing technological and social conditions.
- • The ability to be tolerant of representatives of different nationalities, races, religions and cultures; willingness to engage in intercultural and professional dialogue in an inclusive and multicultural environment.
- • Knowledge of communication skills, ability to cooperate and work effectively in a team, including in international and interdisciplinary teams.
- • Ability to work in conditions of high uncertainty and dynamic changes, consider the needs of consumers and the needs of sustainable socio-economic development.
- • Mastery of a broad social and professional outlook, the ability to use data from various sources, analyze and critically evaluate historical and modern trends in the context of sustainable development and social responsibility of the engineer.
- • Knowledge of the fundamentals of business and business economics, readiness for social mobility, innovation and the development of engineering solutions that are consistent with the SDGs and principles of inclusion.

Professional competencies

- Possession of fundamental knowledge in mathematics, mechanics, physics and scientific principles and the ability to use them in solving engineering problems.
- Ability to independently develop adequate physical and mathematical models of mechanical and thermal processes and phenomena.
- Ability to use mathematical and computer models of mechanical processes for independent research of a wide range of engineering problems of mechanics and design of various mechanical and energy systems.
- The ability to develop new mechanisms and devices, including autonomous mechanisms and robots.

- Ability to work with high-tech laboratory and research equipment.
- Knowledge of algorithmic languages and programming technology using object-oriented programming, computer modeling skills and research of complex physical processes and engineering problems.
- Proficiency in working as a designer in mechanical engineering, energy, transport, chemical production.
- Knowledge of methodology: system analysis; design and decision-making in complex and professional situations; methods of communication and coordination of points of view; design and presentation of analytical and project documentation.

Learning outcomes

LO1 – to search and study scientific and technical information on mechanical engineering in Kazakh (Russian) and English;
LO2 – be able to express their opinions in written and orally on the topic of mechanical engineering in Kazakh (Russian) and English;
LO3 – critically analyze historical resources, know alternative ways of posing and solving ideological issues, possess the skills of independent analysis of socio-political issues, have an idea about entrepreneurship;
LO4 – programming in modern algorithmic languages, including object-oriented programming; possess modern computer design tools;
LO5 – differentiate and integrate functions of one and many variables; apply integral theorems and elements of tensor analysis in problems of fluid and solid mechanics;
LO6– to understand the fundamental physical phenomena and laws of the universe in order to apply them in the study of engineering problems;
LO7 – perform calculations on the dynamics of bodies, the theory of mechanisms and machines and machine parts based on knowledge of the theories of differential and integral calculus, vector analysis;
LO8 – to conduct research and calculations on deformations of bodies, heat and mass transfer processes in thermal devices and reactors based on knowledge of mathematical analysis, differential equations, numerical methods of solid mechanics and fluid mechanics;
LO9 – have the skills to apply modern software to determine the behavior of solids, fluid flow in pipes, channels and devices and use them to solve engineering problems;
LO10 – to develop physical and mathematical models of mechanical systems and thermal phenomena and processes in engines, heat exchange plants and chemical reactors;
LO11 – develop and design various mechanisms and machine parts, mechanical systems and devices, autonomous mechanisms and robots;

Learning strategy

The strategy of the educational program **" Mechanical Engineering and Modeling"** is focused on training highly qualified specialists with fundamental knowledge in the fields of natural sciences, engineering mechanics and computer modeling to work in the field of high-tech engineering applying modern trends of mechanical engineering.

During the training, special attention will be paid to the development skills at students to apply the methods of mathematical, numerical and computer modeling of engineering problems, the use of software for solving and researching various problems of engineering mechanics. To achieve this goal, the classes of almost all specialized disciplines includes both laboratory and practical classes, i.e. the theoretical knowledge of students is firmly anchored by the skills of their practical application.

In the course of students' Diploma project on the educational program, the main attention is paid to instilling in graduates the skills independently or in a team to develop physical or virtual models of sufficiently complex mechanical and physical-chemical processes and phenomena, to develop computer codes or apply modern softwares and on their basis to design energy and/or heat and mass transfer devices, mechanical systems and machines, robots and manipulators.

Possession of fundamental knowledge in the fields of natural sciences, engineering mechanics and computer modeling skills will allow graduates to integrate relatively easily into the workflow of almost any industry, it is easy enough to master a wide range of new technologies.

4. Passport of the educational program

4.1. General information

№	Title	
1	Code and classification of the field of education	6B07 Engineering, manufacturing and construction industries
2	Code and classification of the direction of training	6B071 Engineering and Engineering business
3	Group of educational programs	B064 Mechanics and metal working
4	Name of the educational program	6B07130 - **Mechanical Engineering and Modelling**
5	Short description	The educational program "Mechanical Engineering and Modeling" is aimed at preparing bachelors able to solve a wide range of engineering problems of mechanics based on fundamental knowledge in mathematics, mechanics, physics, chemistry and engineering principles using modern analytical, experimental and numerical methods mathematical and computer modeling and information technology. During preparing students, a broad systematic approach is followed, when graduates will make engineering decisions with a full understanding of the possibilities and limitations of research methods and advanced technologies used. Thus, the mission of the educational program Mechanical Engineering and Modeling is to provide the market with highly qualified specialists with fundamental knowledge in the fields of natural sciences, engineering mechanics and computer modeling to work in the field of high-tech engineering. The curriculum of the educational program “Mechanical Engineering and Modeling” is developed in accordance with the curricula of the educational program “Mechanical Engineering” of the world best research and engineering universities such as Massachusetts Institute of Technology – MIT, Stanford University, University of Cambridge, Georgia Institute of Technology, Technical University of Munich, Pennsylvania State University, Tokyo University, Nanyang Technological University (Singapore), and others, taking into account the current trends in technology development. In the course of training, special attention is paid to the acquisition by graduates of in-depth knowledge in relevant areas of mathematics, the laws of physics and mechanics underlying modern engineering design, numerical and computer modeling methods and information technologies. The basic education received in these areas will allow future specialists to easily integrate into the workflow of almost any industry, it is easy enough to master a wide range of new technologies.

		During the first two courses (in the first 4 semesters), students have the opportunity to receive fundamental education in mathematics (differential and integral calculus, vector analysis, algebra and geometry, differential equations, partial differential equations), physics (molecular physics, thermodynamics, electricity and magnetism, optics and atomic physics), mechanics (statics, strength of materials, dynamics), chemistry, information and digital technologies (information and communication technologies, numerical methods and programming), Kazakh and English languages. This knowledge is the basis of any technology and will allow students who have mastered them to easily master new technologies and retrain for other modern specialties. At senior courses, students study in-depth special courses in mechanics and engineering (engineering thermodynamics, engineering materials, fluid mechanics, solid mechanics, theory and design of mechanisms and machines, design of machine elements, fundamentals of heat and mass transfer, numerical methods for solving engineering problems, fundamentals of robotics, design of mechanical systems and elective courses) and gain skills at numerical and computer modeling, design of machine elements and structures, design of mechanisms and mechanical systems, numerical modeling and research of various mechanical processes and phenomena, development and creation of robots and manipulators. Primary attention is paid to the acquisition by graduates of skills in developing computer models of various engineering tasks and hydraulic systems, complex mechanical, thermal or mass transfer processes in various industries using modern computing and information technologies. Students will practice in such companies as Kazatomprom JSC, Kazmunaygas JSC, at the Institute of Mechanics and Machine Science, at the Institute of Mathematics and Mathematical Modeling, etc. Students have the opportunity to undergo an internship at leading engineering universities in Europe and Russia could under the academic mobility program. The educational program will make it possible to implement the principles of the Bologna process. Based on the students' choice and independent planning of the sequence of studying disciplines, they independently form an individual study plan for each semester according to the curriculum and the catalog of elective disciplines. During the study teaching is conducted by highly qualified teaching staff, including graduates of USA, Europe, Russia and other countries universities. Graduates can choose different career paths. They can either work in industry as practicing engineers or pursue master studies in mechanical engineering or applied sciences. Many graduates go on to careers in business or in public activities.

		The best graduates have studied or are studying in master's or doctoral studies at KazNU, NU, Purdue University, Georgia Institute of Technology, National University of Singapore, University of Pittsburgh, University of Lorraine and many other universities. The Bachelor's degree program "Engineering Mechanics and Modeling" is the first level of qualification of a three-level system of higher education, it lays the foundation for subsequent master and later doctoral programs.
6	EP's Goal	to train highly qualified personnel: possessing fundamental knowledge of mechanics, mathematics, physics, chemistry, as well as methods and IT skills for modeling problems of engineering mechanics; able to apply knowledge and skills for the development and design of new mechanisms and mechanical devices, mechanical, thermal and hydraulic systems, heat- and mass transfer devices and installations, robots and manipulators; able to use knowledge to manage modern technological processes in mechanical engineering and energy.
7	Type of EP	Innovative
8	The level of the NRK	6
9	Sectoral Qualifications Framework Level	6
10	Distinctive features of the EP	No
11	List of EP competencies	**General competencies** • Knowledge of Kazakh, Russian and English languages for: free oral and written communication with a native speaker of a particular language on a professional topic and in a real-life situation; search for scientific and technical information in these languages; work with scientific and technical literature on engineering mechanics in these languages. • Mastery of critical systemic thinking, transdisciplinarity and cross-functionality. • Possession of IT competencies, the ability to develop software using algorithmic languages. • Mastery of skills: self-study; deepening of one's knowledge; being open to new information; systemic thinking and one's own judgment. • The ability to be tolerant of another nationality, race, religion, culture; the ability to conduct an intercultural dialogue. • Possession of communication skills, the ability to cooperate and work in a team. • Ability to work in cases of high uncertainty and rapid change of task conditions; to work with consumer requests. • Possession of a broad social, political and professional outlook; ability to use data from various sources and specialized literature, analyze and critically evaluate historical facts and events.

		• Knowledge of the basics of entrepreneurship and business economics, readiness for social mobility. **Professional competencies** • Possession of fundamental knowledge in mathematics, mechanics, physics and scientific principles and the ability to use them in solving engineering problems. • Ability to independently develop adequate physical and mathematical models of mechanical and thermal processes and phenomena. • Ability to use mathematical and computer models of mechanical processes for independent research of a wide range of engineering problems of mechanics and design of various mechanical and energy systems. • The ability to develop new mechanisms and devices, including autonomous mechanisms and robots. • Ability to work with high-tech laboratory and research equipment. • Knowledge of algorithmic languages and programming technology using object-oriented programming, computer modeling skills and research of complex physical processes and engineering problems. • Proficiency in working as a designer in mechanical engineering, energy, transport, chemical production. • Knowledge of methodology: system analysis; design and decision-making in complex and professional situations; methods of communication and coordination of points of view; design and presentation of analytical and project documentation.
12	Learning outcomes of the EP	LO1 – to search and study scientific and technical information on mechanical engineering in Kazakh (Russian) and English; LO2 – be able to express their opinions in written and orally on the topic of mechanical engineering in Kazakh (Russian) and English; LO3 – apply theories and methods of differential and integral calculus, integral theorems, and algebras to solve problems of fluid and solid mechanics; LO4 apply the fundamental physical laws of the universe in the development of models and the study of engineering problems; LO5 – to perform modeling and calculations of problems of dynamics of bodies, theory of mechanisms and machines and machine parts; LO6– to perform modeling and calculations of problems of deformation of bodies, heat and mass transfer processes in thermal devices and reactors; LO7 – apply modern application software to solve problems of solid mechanics and fluid mechanics; LO8 – develop and build physical and mathematical models of mechanical and thermal systems and phenomena, heat exchange plants and chemical reactors; LO9 – develop and design various mechanisms and machine

		parts, mechanical systems and devices, autonomous mechanisms and robots; LO10 – develop software, perform modeling and research of mechanical, hydraulic and heat and mass transfer problems in pipes, channels and devices; LO11 – conduct research on the creation of new mechanical devices, robots, mass transfer and/or thermal devices using artificial intelligence technologies; LO12 – to choose optimal numerical methods and develop, create software that allows to provide numerical calculations, modeling and research of mechanical, hydraulic and heat and mass transfer problems in pipes, channels and devices; LO13 – conduct independent research using analytical, experimental or numerical methods to develop and design of new mechanical devices, robots, mass transfer or thermal devices.
13	Form of training	Full - time
14	Duration of training	4 years
15	Volume of credits	242
16	Language	Kazakh, Russian, English
17	Academic degree awarded	"Bachelor of Engineering and Technology"
18	Developers and authors	Head of Department M.S. Tungatarova, Professor A. Kaltaev, Associate Professors: S.K. Djapaev, N.S. Imanbaeva, M.B. Izmambetov

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

№	Name of discipline	Short description of discipline The formed educational outcomes (codes)	Cycle	Compo nent	Credits											
						ON1	ON 2	ON3	ON4	ON5	ON6	ON7	ON8	ON9	ON10	ON11
1	Fundamentals of anti-corruption culture and law	_to form an informed understanding of the problem of corruption in society, to develop anti-corruption skills, as well as to educate civic responsibility and ethical principles. Contents_ basic theoretical and practical knowledge about corruption, analysis of corruption phenomena, strategies and methods of combating them, formation of adequate behavior and values aimed at creating an honest and open society_	GED	EC	5	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	Fundamentals of scientific research methods	Purpose: to form a systematic understanding of the methodology of scientific cognition	GED	EC	5	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

		among students; to develop scientific thinking skills; to form experience in organizing and conducting scientific research; to develop a competence-based approach to the use of methods and rules for conducting research in the field of mechanical engineering, related processes and their technologies. Contents: stages of scientific research, terms and concepts, methods of conducting an experiment, mathematical methods of processing research results. Concepts of engineering, laboratory and industrial experiment, bench research.														
3	Basics of Financial Literacy	Purpose: acquiring knowledge and skills in the field of personal finance management, including budget planning, use of financial instruments,	GED	EC	5	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

		taxation and investments to ensure effective management and increase of own funds. Contents: as part of the course, students will master the basics of financial management, learn how to create a budget, use various financial products, plan and pay taxes. They will also gain practical skills in analyzing financial information and choosing investment strategies.														
4	Fundamentals of economics and entrepreneurship	The purpose of studying the discipline is to familiarize students with the basic principles of economic theory and entrepreneurial activity. The course includes the study of basic economic concepts, market mechanisms, management tools and key aspects of entrepreneurship, such as starting and managing a business,	GED	EC	5	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

		analyzing the market environment, financial planning, assessing risks and developing development strategies.														
5	Ecology and life safety	The purpose of the discipline: to acquaint students with the tasks of ecology as a science, its sections and conclusions that find application in various fields of practical activity. Brief description: ecological terms, laws of functioning of natural systems are considered; environmental monitoring and management in the field of its security; sources of air, water, soil pollution and ways to solve environmental problems; emergency situations of natural and man-made nature.	GED	EC	5	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	Computational hydromechanics and modeling	Purpose: teaching methods of numerical solution of fluid flow problems arising in various engineering	BD	UC	5	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☑

		devices. Summary Fundamentals of finite difference methods. Finite-difference approximations of differential operators and equations. The concept of stability and convergence of the scheme. Methods for solving the vortex transfer equation. Methods for solving equations for the current function. Implementation of boundary conditions. Numerical methods for solving equations of fluid mechanics in variables "velocity-pressure".														
7	Dinamics	Purpose: to familiarize with the main types of motion of mechanical systems and to form the scientific foundations of dynamics related to the motion of material bodies under the action of forces. Summary The dynamics of a material point and the dynamics of a solid	BD	UC	5	☐	☐	☐	☐	☑	☑	☐	☑	☑	☐	☐

		body. The basic laws of motion and interaction of material bodies. The concept of oscillatory motion of various mechanical systems. Analysis of the conditions of stability of equilibrium and motion of material objects, methods for solving the corresponding equations.														
8	Engineering and computer graphics	Purpose: training in methods and means of machine graphics and graphical modeling of geometric objects. Summary Concepts of computer graphics, geometric modeling, graphic object, interactive graphic system for solving problems of automation of drawing and graphic works on the example of AutoCAD. Methods of obtaining certain graphical models of space based on orthogonal projection and the ability to solve	BD	UC	5	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☐

		problems related to spatial forms and relationships on these models.														
9	Engineering Thermodynamics	Purpose: familiarization with the basic laws and regulations of thermodynamics in relation to the tasks of power engineering and thermal power engineering. Summary Basic concepts of thermodynamics. The first law of thermodynamics. Application of the first law of thermodynamics to ideal gases. The second law of thermodynamics. Application of the second law of thermodynamics to analysis. Heat-power gas cycles. Thermodynamic potentials and differential equations of thermodynamics. Properties of real gases and vapors. Cycles of refrigerating machines and heat	BD	UC	5	☐	☐	☐	☑	☐	☑	☐	☑	☐	☐	☐

		pumps.														
10	Linear algebra and analytic geometry	Purpose: to give basic knowledge on the methods of solving algebraic equations and systems of linear equations, to introduce the methods of analytical geometry on the plane and in space. Summary Qualifiers. Algebraic Equations: General Theorems. Polynomials. Systems of Equations and Solution Methods. Matrices, matrix algebra. Analytic geometry on the plane. Analytical geometry in space.	BD	UC	5	☐	☐	☑	☐	☑	☑	☐	☐	☐	☐	☐
11	Mathematical Analysis I	Purpose: to introduce the basic ideas and concepts of mathematical analysis, to give basic knowledge of the differential calculus of a function of one variable. Summary Fundamentals of integral calculus of a function of one variable: definite integrals, indefinite	BD	UC	5	☐	☐	☑	☐	☑	☑	☐	☐	☐	☐	☐

		integrals, the main theorem of integral calculus, properties of integrals, integration methods. Application of integral calculus in mechanics and engineering.														
12	Mathematical Analysis II	Purpose: to give students basic knowledge of the integral calculus of a function of one variable. Summary Fundamentals of integral calculus of a function of one variable: definite integrals, indefinite integrals, the main theorem of integral calculus, properties of integrals, integration methods. Application of integral calculus in mechanics and engineering.	BD	UC	5	☐	☐	☑	☐	☑	☑	☐	☐	☐	☐	☐
13	Mathematical Analysis III	Purpose: to provide basic knowledge on differential and integral calculus of a function of many variables. Summary Differential and integral calculus of a function of many	BD	UC	5	☐	☐	☑	☐	☑	☑	☐	☐	☐	☐	☐

		variables. Curvilinear, double and multiple integrals; surface and volume integrals; mean value theorems; Fourier series and integrals. Applications of differential and integral calculus of functions of many variables in mechanics and engineering.														
14	Mathematical analysis IV	Purpose: to give students basic knowledge of vector analysis and elements of tensor analysis, mathematical statistics. Summary of the discipline. Fundamentals of vector analysis and elements of tensor analysis. Integral theorems. Applications of vector and tensor analysis in mechanics and engineering. Introduction to mathematical statistics.	BD	UC	5	☐	☐	☐	☐	☑	☑	☐	☑	☑	☐	☐
15	Fluid Mechanics	Purpose: formation of knowledge on fundamental issues of fluid mechanics and	BD	UC	5	☐	☐	☐	☐	☐	☑	☑	☑	☐	☑	☑

		acquisition of skills in applying the acquired knowledge and methods to solve practical engineering problems. Summary The continuity hypothesis; hydrostatics. Kinematics of the flow field. Conservation of mass. Equations of fluid motion, Bernoulli's theorem. Vortex-free and vortex-free flow of incompressible inviscid fluid. Flows of viscous incompressible fluid. Turbulent flow, calculation methods.														
16	Solid Mechanics	Purpose: formation of knowledge on the theoretical foundations of deformable solid mechanics, instilling skills in solving practical problems of mechanics and engineering. Summary Stress theory. Theory of deformations. The complete system of equations of the	BD	UC	5	☐	☐	☐	☐	☐	☑	☑	☑	☐	☑	☑

		theory of elasticity. Methods for solving problems of elasticity theory. The simplest inversely symmetric problems of elasticity theory (torsion of rods). Approximate methods for solving problems of elasticity theory. Axisymmetric problems and non-axisymmetric problems. Theory of bending of thin plates.														
17	Modeling and design of mechanical systems	Purpose: to gain knowledge in the field of engineering design of various types of mechanical systems using modern computer programs. Summary The latest computer modeling tools, finite element methods, optimization methods and methods of analysis of many-body systems. Design of mechanical systems using standard packages and computer-aided design tools Stress calculation, evaluation of deflections, static	BD	UC	5	☐	☐	☐	☐	☑	☐	☐	☑	☑	☑	☐

		failures, loss of stability of structural elements under combined loads.														
18	Modeling and design of thermal systems	Objective: to gain knowledge in the field of modeling and design of energy efficient thermal and ventilation systems. Summary Modeling and design of thermal systems. Optimization of thermal installations. Dynamic behavior of thermal systems. Heating systems based on renewable electricity.Solar heating and hot water supply. Economic calculations for engineering systems.	BD	UC	5	☐	☐	☐	☐	☐	☑	☐	☑	☐	☑	☑
19	Chemistry	Purpose: formation of knowledge on fundamental issues of general chemistry and skills of their application in professional activity. Summary Laws, theoretical propositions and conclusions that underlie chemical	BD	UC	5	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐	☐

		disciplines; properties and relationships of chemical elements based on the periodic law of D.I.Mendeleev and on modern ideas about the structure of matter; fundamentals of chemical thermodynamics and kinetics; processes in solutions; structure of complex compounds.														
20	Ordinary differential equations	Purpose: formation of basic knowledge on the sections of the theory of ordinary differential equations (ODES), formulation of problems and methods of solutions. Summary ODE of the 1st order. The Cauchy problem. An ODE of higher orders. ODE systems. Linear odes with variable coefficients. Numerical integration of ODES and ODE systems. Using Matlab for numerical solution of ordinary differential equations.	BD	UC	5	☐	☐	☐	☐	☑	☑	☐	☑	☑	☐	☐
21	Statistic and Kinematics	Purpose: familiarization with	BD	UC	5	☐	☐	☐	☐	☑	☑	☐	☐	☑	☐	☐

		various properties of forces and conditions of equilibrium, formation of scientific foundations of problems of mechanics related to the conditions of equilibrium of bodies. Summary A system of converging forces. The theory of moments. The main theorem of statics. Arbitrary plane system of forces. Friction. Arbitrary spatial system of forces. The center of gravity of the body. Kinematics of a point. The simplest movements of a rigid body. Plane-parallel motion of a rigid body. Complex point movement.														
22	Theory and Design of Mechanism and Machines	Purpose: familiarization with general methods of analysis and synthesis of mechanical systems, mastering general methods of studying the structure, geometry, kinematics	BD	UC	5	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐

		and dynamics of typical mechanisms and machines. Summary The basic concepts of machine elements and the main types of mechanisms. Structural analysis and synthesis of mechanisms. Kinematic analysis of mechanisms with lower pairs. Dynamics of machines and mechanisms. Synthesis of mechanisms. Designing mechanisms with the required properties.														
23	Equations of mathematical physics	Formation of basic knowledge on classical sections of equations of mathematical physics (UMF), statements of their tasks and methods of solutions. Parabolic equations, properties and methods of their solutions, Fourier method. Hyperbolic equations, some properties and methods of their	BD	UC	5	☐	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐

		solutions, the method of characteristics. Elliptic equations and some qualitative properties, classical solutions, Poincare-Perron method.														
24	Physics I: Mechanics. Molecular physics and thermodynamics	Purpose: formation of ideas about the fundamental laws of mechanics and thermodynamics, about the molecular structure of bodies. Summary Newton's laws of mechanics, applications in engineering. Molecular structures of bodies and their physical properties. Concepts and laws of thermodynamics.	BD	UC	5	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐	☐
25	Physics II: Electricity and magnetism.	Purpose: to provide basic knowledge on the laws of electromagnetism and their conscious application in science and technology. Summary Laws of electricity and magnetism, static electricity, electric currents, magnetic phenomena.	BD	UC	5	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐	☐

26	Numerical Methods and Programming	Purpose: introduction to the basics of programming, methods and algorithms of calculation, methods of numerical solution of algebraic and ordinary differential equations using computers. Summary Algorithms, search algorithms, data processing algorithms, arithmetic algorithms. Unstable algorithms and sensitivity of problems to initial conditions. Approximation of functions. Numerical differentiation and integration. Numerical solution of systems of algebraic equations. Numerical solution of ordinary differential equations.	BD	UC	5	☐	☐	☐	☐	☐	☑	☑	☐	☐	☑	☑
27	Fundamentals of Artificial Intelligence	The purpose of the course is to familiarize students with the basic concepts, methods and technologies in the field of artificial intelligence: machine	BD	EC	5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

		learning, computer vision, natural language processing, etc. As a result of studying this course, students will gain an understanding of the basic principles of artificial intelligence systems and their role in the modern world. The purpose of this course is to provide an introduction to the basic concepts, methods, and technologies of artificial intelligence, such as machine learning, computer vision, natural language processing, and others. Students will acquire knowledge of the key principles, algorithms and practical applications that underlie the development and use of artificial intelligence in various fields. Upon completion of the course, students achieve the following														

		learning outcomes: Know basic machine learning techniques, including supervised, unsupervised and reinforcement learning; be able to apply machine learning methods to solve various problems; have skills in working with various artificial intelligence tools and technologies.														
28	Fundamentals of sustainable development and ESG projects in Kazakhstan	Purpose: the goal is for students to master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Contents: introduces the principles of sustainable development and the implementation of ESG practices in	BD	EC	5	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

		Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.														
29	Legal regulation of intellectual property	Purpose: the goal is to form a holistic understanding of the system of legal regulation of intellectual property, including basic principles, mechanisms for protecting intellectual property rights and features of their implementation. Contents: The discipline covers the basics of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, and consider legal disputes and methods for resolving them.	BD	EC	5	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

30	ESG principles in inclusive culture	Purpose of the course: It focuses on studying ESG (Environmental, Social, Governance) principles and their interaction with the creation of an inclusive culture within an organization. Content: Students will gain knowledge on how implementing ESG principles contributes to corporate social responsibility, sustainable development, and equal opportunities for all employees, including those who may face various forms of discrimination. The course will help students understand the importance of an inclusive culture in achieving long-term business goals and ensuring sustainable organizational	BD	EC	5	☐	Hig h	☐		☐		☐		☐		☐

		development.														
31	The Strength and Relibility of Machines	Purpose: teaching the basics of the science of strength and reliability of materials, structures and machines, preparation for the correct choice of calculation and design methods. Summary The main provisions of the science of the strength of materials and structures, methods of calculation and design for the general case of the action of forces, calculation of statically indeterminate systems, dynamic action of forces, calculation of structural elements beyond the limits of elasticity, positions and dependences of reliability, reliability by basic criteria, calculations of reliability of machine parts of individual groups.	BD	EC	5	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐	☐

32	Statistical Mechanics	Purpose: to study the basics of statistical mechanics and reliability theory, practical methods of their application. Summary Determination of probabilistic characteristics of processes, mastering statistical methods for calculating systems, the main provisions of the theory of random processes, methods for analyzing random oscillations of mechanical systems, drawing up mathematical models for calculating machine elements, mechanisms and machine units under the action of random loads, carrying out calculations of reliability and trouble-free operation of systems.	BD	EC	5	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐	☐
33	Intro to Robots	Objective: to acquire skills in writing equations and programming kinematics, dynamics	PD	UC	5	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☑

		and sensing of robots, modeling, real-time control of robotic systems and manipulators. Summary Methods determination of the position and speeds of the robot links. Coordinate systems of the robot, recording the equations of forward and reverse kinematics of the robot. Recording of differential equations of robot motion, solution in Matlab. Control of the robot by trajectory and by force. Simulation of manipulators and robots.														
34	Finite Elements in Engineering	Purpose: to familiarize with the methodology of performing finite element analysis in the Structure3D automated control system environment. Mastering the creation of an object model in the ARM Strucmrc3D editor and using the three-dimensional ARM Studio editor.	PD	UC	5	☐	☐	☐	☐	☑	☑	☐	☑	☐	☐	☐

		Summary The basic concept of the FEM. Creation and calculation of models of structures containing rod, plate and volumetric finite elements in ARM Structure 3D. Using ARM Studio to create, load and generate a finite element grid of three-dimensional models. Modules for calculation, analysis and design of shafts and axles.														
35	Object-oriented programming	Purpose: to give students an idea of the basic principles of object-oriented programming (OOP) in C++ and C#. Summary Basic concepts. Classification of subspecies of OOP. Definition of OOP and its basic concepts. Implementation features. Program design in general. Various OOP methodologies. Component programming.	PD	UC	5	☐	☐	☐	☐	☐	☑	☑	☑	☐	☑	☑

		Prototype programming. Class-oriented programming.														
36	Basics of heat and mass transfer	Purpose: to form an idea about the physical nature of heat transfer processes, about theoretical, experimental and computational methods and methods of solving applied problems. Summary Basic concepts of heat transfer mechanisms. Fundamental principles and laws of heat transfer. The main types and models of heat transfer. Basic methods and techniques for calculating heat transfer in energy systems and applying them to solve engineering practice problems.	PD	UC	5	☐	☐	☐	☐	☑	☐	☑	☐	☑	☐	☑
37	Design of machine elements and parts	Purpose: formation of an initial knowledge base on the basics of theory, design calculation, design of parts and elements of	PD	UC	5	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐

		machines, development and design documentation. Summary The concept of parts and elements of machines, the main issues of ensuring their operability. Study of general principles of design and construction, construction of models and calculation algorithms for typical parts and elements of machines, taking into account the main performance criteria, development of design skills.														
38	Strength of materials	Purpose: to teach the basics of the science of strength, rigidity and stability of materials and structures and to the correct choice of methods of calculation and design of various structures. Summary The laws and theoretical propositions that underlie the mechanics of a deformable solid.	PD	UC	5	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐	☐

		Methods of calculation of structural elements for strength, rigidity and stability, methods of calculation and design in the general case of the action of forces, the dynamic action of forces, calculation of structural elements beyond elasticity.														
39	3D Printing of Machine Elements	When compiling the program for this course, the following goals were taken into account: to familiarize students with the classification of additive technologies, to give general information about the main types of AM technologies, manufacturers of AM machines, development trends and examples of practical use of AM technologies in industry. The study of terminology and classification, characteristics of the AM technology market. Additive	PD	EC	6	☐	☐	☐	☐	☐	☐	☑	☐	☑	☐	☑

		technologies and rapid prototyping, technologies and machines for growing metal products. Additive technologies and foundry, additive technologies and powder metallurgy, creation of machine elements.														
40	Interchangeability and technical measurements	The purpose of the discipline is to form theoretical and practical knowledge in the field of methods for ensuring interchangeability and technical measurements, technical standardization of various types of compounds in the field of engineering mechanics. Typical connections of machine-building products, methods and methods of rationing, accuracy standards and rules of designation in drawings are studied. Unified landing systems, bore system	PD	EC	5	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	

		and shaft system. Measuring instruments for geometric parameters and surface quality control. Normalization of cylindrical, conical, threaded connections, gears, rolling bearings.														
41	Computational Mechanics	Purpose: teach to build computer models of mechanical systems, numerical solution of continuum mechanics problems, conducting computer engineering calculations of mechanics problems.The finite difference method and its application to solving fluid mechanics and engineering problems. The finite element method and its application to solving problems of mechanics of a solid deformable body. Formulation and numerical implementation of boundary conditions.	PD	EC	5	☐	☑	☑	☐	☐	☐	☐	☐	☑	☐	☐

42	Dynamics of Machines and Computer Analysis	Purpose: formation of ideas about the dynamic processes that take place during the operation of machines and mechanisms and their consideration in the design. Summary Equivalent circuits and mechanical characteristics of machines and their drives. Laws of motion of machines with various mechanical characteristics. Questions of the theory of dynamics of machines with concentrated and distributed parameters. Ways to reduce dynamic loads. Computer analysis and synthesis of dynamic systems using the MATHCAD mathematical package.	PD	EC	4	☐	☐	☐	☐	☑	☐	☑	☐	☑	☐	☑
43	Laboratory: Heat Transfer	he course is based on the book “Fundamentals of Heat and Mass Transfer”, authors:	PD	EC	4	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑	☑

		FRANK P. INCROPERA, DAVID P. DEWITT, THEODORE L. BERGMAN, ADRIENNE S. LAVINE. Introduction to thermal conductivity. One-dimensional, stationary thermal conductivity. Two-dimensional, stationary thermal conductivity. Transient thermal conductivity. Introduction to convective heat transfer. External currents. Internal currents. Free convective flow. Boiling and condensation. Heat exchangers. Radiation heat transfer: processes and properties. Radiation heat transfer between surfaces. Diffusion mass transfer.														
44	Laboratory: Fluid Flowes	Laboratory: Fluid flow is aimed at consolidating the theoretical knowledge	PD	EC	4	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑	☑

		gained on fluid and gas mechanics and developing students' skills in conducting experimental research.														
45	Machine learning and data analysis in engineering	Purpose: to familiarize with the basics of machine learning and its application in stochastic engineering problems. Summary Linear classifier and stochastic gradient. Neural networks: gradient optimization methods. Metric methods of classification and regression. The method of support vectors. Multidimensional linear regression. Nonlinear regression. Model selection criteria and feature selection methods. Logical classification methods. Deep neural networks. Neural networks with unsupervised learning.	PD	EC	6	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑	☑
46	Finite volume method in fluid mechanics	Purpose: to familiarize with the methodology of performing finite element analysis in	PD	EC	4	☐	☐	☐	☐	☑	☑	☐	☑	☐	☐	☐

		the Structure3D automated control system environment. Mastering the creation of an object model in the ARM Strucmrc3D editor and using the three-dimensional ARM Studio editor. Summary The basic concept of the FEM. Creation and calculation of models of structures containing rod, plate and volumetric finite elements in ARM Structure 3D. Using ARM Studio to create, load and generate a finite element grid of three-dimensional models. Modules for calculation, analysis and design of shafts and axles. Equations of fluid motion, Bernoulli's theorem. Vortex-free and vortex-free flow of incompressible inviscid fluid.														
47	Biofluid Mechanics	Objective: to study the structure, function and movement of mechanical aspects of	PD	EC	6	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑	☑

		biological systems using methods of mechanics. Summary Rheological properties of blood and issues of its modeling, biomechanics of large blood vessels, anatomy and histology of vessels, mechanical properties of biological tissues, features of the functioning of the vascular system in a living organism. Research and modeling methods.														
48	Renewable Energy Systems	Renewable Energy Systems: The volume of reserves of traditional energy carriers. Nuclear energy and the greenhouse effect. Solar radiation. Wind energy. Water energy. Geothermy. Use of biomass. Hydrogen production, fuel cells and methanization.	PD	EC	6	☐	☐	☐	☑	☐	☐	☐	☑	☐	☑	☑
49	Filtration theory and applied problems	Purpose: to familiarize with the basics of filtration theory and its appli-cations in the technology of metal	PD	EC	4	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐

		extraction by underground borehole leaching. Summary Basic concepts and equations of filtration theory (TF). The laws of conservation of mass and momentum during filtration in a porous me-dium, Darcy's law. Derivation of differential filtration equations. Filtration of incompressible fluid in a non-deformable porous medium. Filtration considering the weak compressibility of the liquid and the porous skeleton. Applications of TF in the technology of metal extraction by under-ground borehole leaching.														
50	Control of Dynamic Systems	Control of Dynamic Systems: Theory of management of technical objects, challenges dictated by the nonlinear dynamics of management processes, priority	PD	EC	4	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☑

		tasks and approaches to their solution. The development of control theory in the context of three periods of its formation: the period of classical Newton mechanics, the modern period and in the direction of the future role of control theory as a component of the process of creating self-managed objects and technologies.														

4.4 Information about disciplines

№	Name of the discipline	Brief description of the discipline	Number of credits	Emerging competencies
Cycle of general education disciplines University component/Component of choice				
	Englishlanguage	**The purpose of the course** ”Beginner English" is learning from scratch- the foundation of learning English. This course is also suitable for those who have only general elementary knowledge of the language, to teach them to communicate on basic topics in English. **Course** “ElementaryEnglish” is aimed at developing students' receptive skills (reading and listening) and productive skills (writing and speaking), mastering pronunciation features and elementary vocabulary. **Summary of the discipline.** Basics of English grammar, to lay a certain foundation for the student, which will allow him to improve his skills at the next stage of learning English by analyzing basic knowledge, using and memorizing the main grammatical rules.	1	Mastering the peculiarities of pronunciation and elementary vocabulary. Ability to communicate verbally on basic topics in English. The ability to communicate in writing on basic and professional topics in English using a dictionary. Ability to work with sources and scientific and technical information on engineering mechanics in English
	Kazakh (Russian) language	**The purpose of the course is**to teach students to listen to statements on well-known topics related to home, study, free time; understand texts on personal and professional topics containing the most frequent words and expressions; be able to conduct a conversation on everyday topics; describe your experiences; express your opinion.**Summary of the discipline.** The course material is selected in such a way that the student, assimilating the lexical and grammatical minimum, had the opportunity to get acquainted with typical communicative situations and find himself in such situations, was able to correctly evaluate them and choose the appropriate model (strategy) of speech behavior. The main focus of learning is transferred from the process of knowledge transfer to learning the ability to use the language being studied, the ability to carry out various types of speech activity.	10	Acquisition of reading, writing and understanding skills of sounding speech on the basis of simultaneous mastering the basics of grammar (phonetics, morphology and syntax) and word usage. The ability to conduct a conversation on everyday topics; describing one's experiences; expressing one's opinion; retelling and evaluating the content of a book read, a movie seen. The ability to create simple texts on well-known topics, including those related to professional activity.
	Informationandcommunicationtechnologies	**The purpose of the** course is to teach the skills of using modern information technologies in the field of professional activity. **Summary of the discipline.** The basic concepts of the architecture of computer systems, information and communication technologies and subject terminology. Software interfaces of operating systems. Working with data in a different view. Basic principles of information security. Data formats and multimedia content.Modern social, cloud and email platforms and ways to work with them. Algorithmization and programming methods for solving engineering problems.	5	Ability: work with interfaces of modern operating systems; work with modern application software for working with data of various nature and purpose; apply modern social, cloud, and email platforms to organize business processes; programming in an algorithmic programming language.

	Modernhistoryo fKazakhstan	**The purpose of the** course is to familiarize students with the main achievements of the national historical science on the problems of the history of modern Kazakhstan, a comprehensive and systematic study of the main stages of the formation and development of Kazakhstan society. **Summary of the discipline.** The course covers the period from the beginning of the twentieth century to the present day. The modern history of Kazakhstan studies the national liberation movement of the Kazakh intelligentsia at the beginning of the XX century, the period of the creation of the Kazakh ASSR, as well as the process of formation of a multinational society.	5	Ability: work with all kinds of historical sources; writing essays and scientific articles on the history of the Fatherland; to operate with historical concepts; to conduct a discussion. Possession of skills of independent analysis of historical facts, events and phenomena; public speech.
	Sociology/ Political Science	**Purpose:** formation of systematic knowledge about the political sphere of public life, consistent and comprehensive study of the origins and evolution of the political thought of the Kazakh people at the stage of its historical development, political heritage and its most prominent representatives.		
	Cultural Studies/ Psychology	**Purpose:** to contribute to the formation of a holistic view of a person's personal characteristics as a factor of success in mastering and implementing their educational and professional activities. **Summary** Mental processes, properties and conditions of a person in various fields of human activity, interpersonal and social interactions, ways and forms of their organization and changes when exposed.		
	Fundamentals of anti-corruption culture, ecology and life safety	**Purpose:** The discipline "Fundamentals of anti-corruption culture" is an important component and belongs to the number of social and humanitarian disciplines. **Summary** This discipline reveals the general patterns of the emergence, development and functioning of the anti-corruption culture, and organically related other social phenomena and processes.		
	Philosophy	**The purpose of the** course is the formation of cognitive, operational, communicative, self-educational competencies to develop adequate ideological guidelines in the modern world; to distinguish between spiritual and material values, to determine one's attitude to life and to search for harmony with the surrounding world. **Summary of the discipline.** "Philosophy" is the basis for the formation of a holistic worldview. The main paradigms of philosophy and classical and postclassical traditions of philosophy. The connection of philosophy with the development of stable life orientations, the acquisition of the meaning of being as a special form of spiritual production.	5	Ability: analyze the history of the development of philosophical thought; to identify alternative ways of posing and solving ideological issues in the history of human development; to identify the main theoretical approaches in the relationship of a person with society.
Cycle of basic disciplines - University component				
	MathematicalanalysisI	**Purpose of the course:**to acquaint students with the basic ideas and concepts of mathematical analysis, to give basic knowledge of the differential calculus of a function of one variable. **Summary of the discipline.** Basic concepts of mathematical analysis: functions, variables, limits, series, derivatives.Basic concepts and rules of differential calculus of a function of one variable.Applications of differential calculationfunctions of one variable in mechanics and engineering.	5	**The ability** to find:the limits of continuous functions, the derivative of elementary functions of one variable, higher-order derivatives of a function of one variable; to investigate the functions of one variable using a derivative; to use for solving problems of **mechanics and engineering.**

	Mathematical analysis II	**Purpose of the course:**to give students basic knowledge of integral calculus of a function of one variable. **Summary of the discipline.** Fundamentals of integral calculus of a function of one variable: definite integrals, indefinite integrals, the main theorem of integral calculus, properties of integrals, integration methods. Applicationofintegralcalculusinmechanicsandengineering.	5	**The ability** to calculate integrals from elementary functions of one variable; to find indefinite and definite integrals from elementary functions of one variable; to find the length of an arc, the area of a curved trapezoid; to use in solving problems of mechanics and engineering.
	Mathematical analysis III	**The purpose of the course:** to give students basic knowledge of differential and integral calculus of functions of many variables. **Summary of the discipline.** Differential and integral calculus of a function of many variables. Partial derivatives; full differential; differentiation of a function of many variables; curvilinear, double and multiple integrals; integrals over the surface and over the volume; mean value theorems; disclosure of uncertainties; Fourier series and Fourier integrals. Applications of differential and integral calculus of functions of many variables in mechanics and engineering.	5	**Ability to calculate:** differentials of a function of many variables; integral of a function of many variables; curvilinear, double and multiple integrals; surface areas and volumes of figures and masses of bodies. It can be used to solve problems of mechanics and engineering.
	Mathematical analysis IV	**The purpose of the course:** to give students basic knowledge of vector analysis and elements of tensor analysis, mathematical statistics. **Summary of the discipline.** Fundamentals of vector analysis and elements of tensor analysis. Integral theorems. Applications of vector and tensor analysis in mechanics and engineering. Introductiontomathematicalstatistics.	5	**Ability to operate** scalar and vector functions; calculate the gradient of a scalar function, divergence and rotor of vector functions; use knowledge of vector analysis and elements of tensor analysis to solve problems of mechanics and engineering.
	Linear algebra and analytic geometry	**The purpose of the course:** to give students basic knowledge of methods for solving algebraic equations and systems of linear equations, to introduce methods of analytical geometry on a plane in space. **Summary of the discipline.** Determinants. Algebraic equations: general theorems. Polynomials. Systems of equations and methods of their solution. Matrices, algebra of matrices. Analytical geometry on a plane. Analyticalgeometryinspace.	5	Knowledge ofmethods of solving: algebraic equations of 1-4 degrees, systems of linear equations; operate with matrices. The ability to use the methods of analytical geometry to describe and study the problems of engineering mechanics.
	PhysicsI: Molecular physics. Thermodynamics	**The purpose of the** course is to form students' ideas about the fundamental laws of mechanics and thermodynamics, about the molecular structure of bodies. **Summary of the discipline.** Newton's laws of mechanics, applications in engineering. Molecular structures of bodies and their physical properties. Concepts and laws of thermodynamics.	5	**Possession of a system** of knowledge about the fundamental physical foundations and laws of mechanics and its theories, molecular physics and thermodynamics. The ability to apply this knowledge in solving problems of engineering mechanics.
	PhysicsII: Electricity and	**Purpose of the course:**to give students basic knowledge of the laws of electromagnetism and their conscious application in science	5	**Understanding** of the physical essence of the

	magnetism.	and technology. **Summary of the discipline.** Laws of electricity and magnetism, static electricity, electric currents, magnetic phenomena.		laws of electromagnetism and the ability to apply them in engineering and engineering. The ability to use methods of physical research to solve problems of mechanics.
	Ordinarydifferentialequations	**The purpose of the** course is to form basic knowledge on the sections of the theory of ordinary differential equations (ODES), problem statements and solution methods. **Summary of the discipline.** ODE of the 1st order. The Cauchy problem. An ODE of higher orders. ODE systems. Linear odes with variable coefficients. Numerical integration of ODES and ODE systems. UsingMatlabfornumericalsolutionofordinarydifferentialequations.	5	**Knowledge** of the basics and methods of solving ODES; the ability to build mathematical models of mechanics and engineering problems described by the ODE; the ability to solve problems described by the ODE using both analytical and numerical methods using Matlab.
	Equationsofmathematicalphysics	**The purpose of the** course is the formation of basic knowledge on the classical sections of mathematical physics equations, their problem statements and solution methods. **Summary of the discipline.** Parabolic equations, properties and methods of their solutions, Fourier method. Hyperbolic equations, some properties and methods of their solutions, the method of characteristics. Elliptic equations and some qualitative properties, classical solutions, Poincare-Perron method.	5	**Knowledge** of the concepts and ideas of the UMF; the ability to build mathematical models of simple engineering problems described by the UMF; the ability to select methods sufficient for their research and obtain analytical or numerical results.
	Engineeringandcomputergraphics	**The purpose of the** course is to teach students the methods and means of machine graphics and graphical modeling of geometric objects. Mastering the knowledge of drawing construction, the ability to read and compose graphic and textual design documentation. **Summary of the discipline.** Concepts of computer graphics, geometric modeling, graphic object, interactive graphic system for solving problems of automation of drawing and graphic works on the example of AutoCAD.Methods of obtaining certain graphical models of space based on orthogonal projection and the ability to solve problems related to spatial forms and relationships on these models. Building a drawing, reading and drafting graphic and textual design documentation.		Ability to apply methods of graphical representation of objects of engineering mechanics, mechanical engineering; willingness to use modern means of computer graphics, in engineering mechanics; ability to participate in the development of design and working design documentation in accordance with regulatory documents.
	Staticsandkinematics	**The aim of the course** is to familiarize students with various properties of forces and conditions of equilibrium and to form the scientific foundations of students' knowledge of the laws of nature related to the conditions of equilibrium and motion of material bodies. **Summary of the discipline.** A system of converging forces. The theory of moments. The main theorem of statics. Arbitrary plane system of forces. Friction. Arbitrary spatial system of forces. The center of gravity of the body. Kinematics of a point. The simplest movements of a rigid body. Plane-parallel motion of a rigid body. Complexpointmovement.	5	The ability to apply fundamental laws of nature and basic physical laws in the field of mechanics to study static problems of engineering mechanics. Ability to build adequate mathematical models of static problems; Analyze the received decisions and draw

		Complexmotionof a rigidbody.		conclusions and develop appropriate recommendations.
	Dynamics	**The purpose of the** course is to familiarize students with the main types of movement of mechanical systems and to form the scientific foundations of students' knowledge of the laws of nature related to the movement of material bodies under the action of forces. **Summary of the discipline.** The dynamics of a material point and the dynamics of a solid body. The basic laws of motion and interaction of material bodies. The concept of oscillatory motion of various mechanical systems. Analysis of the conditions of stability of equilibrium and motion of material objects, methods for solving the corresponding equations.	5	The ability to apply fundamental laws of nature and basic physical laws in the field of mechanics for the study of dynamic problems of engineering mechanics. The ability to build adequate mathematical models of dynamics problems. Ability and readiness to solve problems of dynamics by analytical and numerical methods. Ability and willingness to analyze the results obtained and summarize them.
	Generalchemistry	**The aim of the** course is to form students' knowledge on fundamental issues of general chemistry and skills of their application in professional activities. **Summary of the discipline.** Laws, theoretical propositions and conclusions that underlie all chemical disciplines; properties and relationships of chemical elements based on the periodic law of D.I.Mendeleev and on modern ideas about the structure of matter; fundamentals of chemical thermodynamics and kinetics; processes in solutions; the structure of complex compounds.	5	**Ability:** to navigate the basic concepts of chemistry, properties of elements-nonmetals and metals of groups of the periodic system; to make chemical equations describing mass transfer processes; make calculations using basic chemical patterns.
	Theory and design of mechanisms and machines	**The purpose of the** course is to familiarize students with the initial knowledge base on general methods of analysis and synthesis of mechanical systems underlying technological equipment, their development of general methods of studying the structure, geometry, kinematics and dynamics of typical mechanisms and machines. **Summary of the discipline.** The basic concepts of machine elements and the main types of mechanisms. Structural analysis and synthesis of mechanisms. Kinematic analysis of mechanisms with lower pairs. Dynamics of machines and mechanisms. Synthesis of mechanisms. Designing mechanisms with the required properties.	5	The ability to independently compile structural and kinematic schemes of mechanisms. Possession of general (standard) methods and algorithms for the analysis and synthesis of mechanisms and systems formed on their basis. Willingness to participate in the collection and analysis of initial data for the design of equipment elements and objects of activity in general using regulatory documentation and modern methods of information retrieval and processing.
	Engineeringthermodynamics	**The purpose of the** course is to familiarize students with the basic laws and regulations of technical thermodynamics in relation to the tasks of power engineering and thermal power engineering. **Summary of the discipline.**	5	Skill and ability: to carry out thermodynamic calculations of heat exchange systems;

		Basic concepts of thermodynamics. The first law of thermodynamics. Application of the first law of thermodynamics to ideal gases. The second law of thermodynamics. Application of the second law of thermodynamics to analysis. Heat-power gas cycles. Thermodynamic potentials and differential equations of thermodynamics. Properties of real gases and vapors. Cycles of refrigerating machines and heat pumps.		design and select heat supply systems for buildings and structures; perform thermal calculations on licensed software.
	Numericalmethods andprogramming	**The purpose of the** course is to familiarize students with the basics of programming, methods and algorithms of calculation, numerical methods for solving algebraic and ordinary differential equations, to teach them to use them to solve problems of mechanics, physics and engineering using computers. **Summary of the discipline.** Algorithms, data construction, arrays, search algorithms, data processing algorithms, arithmetic algorithms. Representation of numbers in the machine. Examples of unstable algorithms and sensitivity of problems to initial conditions. Approximation of functions. Numerical differentiation and integration. Numerical solution of systems of algebraic equations. Search for the minimum of functions. Numerical solution of ordinary differential equations.	5 •	Skill: to develop algorithms and programs for solving computational problems; numerically differentiate and integrate analytical or tabular functions; numerically find the roots of equations, the minimum of functions; numerically solve algebraic and systems of algebraic equations; Numerically solve ordinary differential equations by Euler and Runge-Kutta methods.
	Fluidandgasmech anics	**The purpose of the** course is to form students' knowledge on fundamental issues of fluid mechanics and the acquisition of skills in applying the knowledge and methods obtained to solve practical problems of mechanics and engineering. **Summary of the discipline.** Physical properties of media; continuity hypothesis; hydrostatics. Kinematics of the flow field; conservation of mass, vorticity distribution. Equations of fluid motion, Bernoulli's theorem. Vortex-free and vortex flow of incompressible inviscid fluid, examples. Viscous incompressible fluid flows, examples. Turbulentflow, calculationmethods.	5	Ability: to apply the basic laws of statics, kinematics and dynamics of liquids and gases in solving engineering problems; to distinguish between the modes of fluid flow and to select methods of solution in applied problems for the calculation of the movement of liquids and gases; independently build the appropriate calculation scheme and find the optimal solution to the task.
	Solidstatemechan ics	**The aim of the** course is to form students' knowledge of the theoretical foundations of deformable solid mechanics (MDTT), instilling in them the skills to solve practical problems of mechanics and engineering. **Summary of the discipline.** Stress theory. Theory of deformations. Physical equations. The complete system of equations of the theory of elasticity. Methods for solving problems of elasticity theory. The simplest inversely symmetric problems of elasticity theory (torsion of rods). Approximate methods for solving problems of elasticity theory. The plane problem of elasticity theory, application to concrete examples. Elementary solutions using the stress function.Axisymmetric problems and non-axisymmetric problems. Theoryofbendingofthinplates.	5	Ability: to determine stresses, deformations and displacements in a solid elastic body; make calculation schemes; make basic equations and apply methods of elasticity theory to solve applied problems; analyze the stress state at dangerous points and correctly apply the basic hypotheses of the classical theory of elasticity;
	Computationalhydr omechanicsandmo deling	**Purpose:** teaching methods of numerical solution of fluid flow problems arising in various engineering devices. **Summary**	5	Skill: to choose a method of numerical solution of a

		Fundamentals of finite difference methods and difference schemes. Methods for solving the vortex transport equation: explicit andimplicit schemes, a scheme with differences against the flow. Research on the stability of schemes. Setting boundary conditions. Numerical implementation of the solution of one- and two-dimensional vorticity transfer equation. Methods for solving equations for the current function. Difference schemes for elliptic type equations. Direct and iterative methods. The method of upper relaxation. Boundary conditions for the equation of the current function. Numerical implementation of the vorticity – current function equations. Finite–difference methods for solving the Navier–Stokes equations for physical variables.The MAC method and the projection method.Numerical implementation of boundary conditions.		specific problem of fluid mechanics, to set boundary conditions; build a numerical model of the problem; develop a computer program and perform calculations; analyze the results and validate the model, if necessary, make adjustments to the numerical and/or computer models.
	Modeling and design of mechanical systems	**The aim of the** course is to gain students' knowledge in the field of engineering design of various types of mechanical systems using modern computer programs. **Summary of the discipline.** The course combines a wide range of design tools necessary for a mechanical engineer. Classical engineering disciplines are combined with courses on the latest computer modeling tools, such as finite element methods, optimization methods and methods for analyzing systems of many bodies. The issues of using various kinds of computer programs in engineering design are considered. Stress calculation, evaluation of deflections, static failures, loss of stability of structural elements under combined loads are carried out.	5	Having the ability to solve standard problems of engineering mechanics. Ability to model technical objects and technological processes. Knowledge of the methodology for designing mechanical systems using standard packages and computer-aided design tools and the ability to apply them in practice. The ability to use new knowledge and skills in practical activities.
	Modeling and design of thermal systems	**The purpose of the** course is to provide students with knowledge in the field of thermal system design, to form their knowledge on the design and definition of energy efficient, environmentally friendly and economically cost-effective thermal installations. **Summary of the discipline.** Modeling of thermal systems. System modeling of thermal installations. Optimization of thermal installations. Mathematical modeling-thermodynamic parameters. Dynamic behavior of thermal systems. Modeling using methods of probability theory. Solar heating and hot water supply. Heatingsystemsbasedonrenewableelectricity.	5	Ability to apply mathematical methods in system modeling of thermal installations; apply modern computer technologies and programs for calculation and selection of thermal systems; apply TRNSYS and EES software in the calculation and selection of component equipment for thermal systems; designthermalsystems.
		Cycle of basic disciplines - Elective component		
	Statistical mechanis	**The aim of the** course is to form students' scientific foundations of a probabilistic approach to the calculation of structural elements for strength, reliability, stability. Study of the fundamentals of statistical mechanics and reliability theory and practical methods of their application. Preparation for the possible use of the described methods in the practice of designing and developing devices, machines and structures in various fields of industry. **Summary of the discipline.** Determination of probabilistic characteristics of processes, development of statistical methods for calculating systems, the main provisions of the theory of random processes, methods for analyzing random fluctuations of mechanical systems, compilation of	5	Ability to perform calculations of reliability and uptime of systems; determine the probability of failure-free operation of mechanical systems; formulate your own conclusions and justify them. Ability and willingness to apply practical methods of

		mathematical models for calculating machine elements, mechanisms and machine units under the action of random loads, calculations of reliability and trouble-free operation of systems, methods for calculating strength reliability and fatigue durability.		the fundamentals of statistical mechanics and reliability theory; use the studied material in your subject area; use information technology to solve problems of statistical mechanics; analyze the results obtained and summarize them.
	Strength and reliability of machines	**The purpose of the course:** to teach the future engineer the basics of the science of strength and reliability of materials, structures and machines, to prepare him for the correct choice of calculation and design methods. **Course Description:**the main provisions of the science of the strength of materials and structures, methods of calculation and design for the general case of the action of forces, calculation of statically indeterminate systems, dynamic action of forces, calculation of structural elements beyond the limits of elasticity, positions and dependences of reliability, reliability by basic criteria, calculations of reliability of machine parts of individual groups.		Ability to design structures of machines and mechanisms; to analyze the necessary information, technical data, indicators and results of work, their generalization and systematization; to carry out the necessary calculations using modern technical means when calculating the strength and reliability of machines.
Cycle of profile disciplines University component				
	Strengthofmaterials	**The purpose of the** course is to teach the future engineer the basics of the science of strength, rigidity and stability of materials and structures, to prepare him for the correct choice of calculation methods and design of various structures, to develop students' logical thinking, independent thinking skills necessary in further work when solving certain problems of natural science and technology. **Summary of the discipline.** The laws and theoretical propositions that underlie the mechanics of a deformable solid. Methods of calculation of structural elements for strength, rigidity and stability, methods of calculation and design in the general case of the action of forces, the dynamic action of forces, calculation of structural elements beyond elasticity.	5	Proficiency in the experimental study of the mechanical properties of materials, the stress-strain state of the simplest structural elements. Ability to handle modern testing machines and measuring equipment; accurately and thoroughly argue the course of reasoning, without cluttering it with unnecessary details; apply the studied material in various fields of engineering.
	The finite element method in engineering	**Purpose:** to familiarize with the methodology of performing finite element analysis in the Structure3D automated control system environment. Mastering the creation of an object model in the ARM Strucmrc3D editor and using the three-dimensional ARM Studio editor. **Summary** The basic concept of the FEM. Creation and calculation of models of structures containing rod, plate and volumetric finite elements in ARM Structure 3D. Using ARM Studio to create, load and generate a finite element grid of three-dimensional models. Modules for calculation, analysis and design of shafts and axles.		
	Design of machine elements and parts	**The purpose of the** course is to form the necessary initial knowledge base for students on the basics of theory, design calculation, design of parts and elements of machines, development and design documentation. Development of knowledge, skills and selection skills, analysis of joints,	5	Ability design elements of machines of the required purpose according to the specified output data;

		bearings, shafts, gears and other machine elements, as well as their design using computer technology. **Summary of the discipline.** The concept of parts and elements of machines, the main issues of ensuring their operability. Study of the general principles of design and construction, construction of models and calculation algorithms for typical parts and elements of machines, taking into account the main performance criteria, development of design skills.		choose the most suitable materials for machine elements and use them efficiently;perform calculations of machine parts and components using reference literature and GOST standards. The ability to collect and analyze raw data for the design of machine elements using regulatory documentation and methods of information retrieval and processing.
	Basics of heat and mass transfer	**The aim of the** course is to form students' understanding of the physical nature of heat transfer processes, theoretical, experimental and computational methods used in the study of these processes, methods for generalizing the results obtained, as well as skills for solving applied problems. **Summary of the discipline.** Basic concepts of heat transfer mechanisms. Fundamental principles and laws of heat transfer.The main types and models of heat transfer. The main methods and techniques for calculating heat transfer in energy systems and their application to solve problems of engineering practice.	5	Ability to carry out calculations of the thermal state of structural elements of thermal power devices; identify, formulate and solve problems related to heat transfer; perform calculations of heat transfer in energy systems; independently build a calculation scheme and find the right solution to the task.
	IntroductiontoRobotics	**The aim of the** course is to teach students the basic methods of robotics and automation, to acquire the skills of writing equations and programming in the Matlab kinematics, dynamics and robot sensing system, simulation, real-time control of real robotic systems and manipulators (in the Matlab system). **Summary of the discipline.** Study of different types of robots. Methods determination of the position and speeds of the robot links. Coordinate systems of the robot, writing equations of forward and reverse kinematics of the robot, solution in the Matlab system. Recording of differential equations of robot motion, solution in the Matlab system. Control when the robot moves along the trajectory. Management by force. The use of various sensors in robots. Simulation of manipulators and robots.		The ability to apply methods for determining the position and speed of robot links in the Matlab environment, for calculating and designing robots. Willingness and ability to use information technologies, including modern computer tools, in robotics. The ability to design new works in mechanical engineering.
	Cycle of profile disciplines Component of choice			
	Object-orientedprogramming	**Purpose:** to give students an idea of the basic principles of object-oriented programming (OOP) in C++ and C#. **Summary** Basic concepts. Classification of subspecies of OOP. Definition of OOP and its basic concepts. Implementation features. Program design in general. Various OOP methodologies. Component programming. Prototypeprogramming. Class-orientedprogramming.		
	Dynamics of machines and its computer analysis	**The purpose of the** course is to form ideas about the dynamic processes that take place during the operation of machines and mechanisms and take them into account when designing. **Summary of the discipline.** Equivalent circuits and mechanical characteristics of machines and their drives. Laws of motion of machines with various mechanical characteristics. Questions of the theory of dynamics of machines		The ability to apply theoretical, computational and experimental research methods, methods of mathematical and computer modeling in the process of professional

		with concentrated and distributed parameters**.** Ways to reduce dynamic loads. Computer analysis and synthesis of dynamic systems using the MATHCAD mathematical package.		activity. Knowledge of modern methods and means of conducting experimental research on dynamics and strength, stability, reliability, friction and wear of machines and devices.
	Engineeringmaterials	**The purpose of the** course is to familiarize students with the structure and mechanical properties of metallic and non-metallic materials. **Summary of the discipline.** The structure of materials. Crystallization and structure of metals and alloys. Mechanical properties of materials. Diagram of the state of alloys. Structure, properties of heat treatment of iron-carbon alloys. Structural and tool steels are alloys. Non-ferrousmetalsandnon-metallicmaterials.		Knowledge of methods: determination of optimal and rational modes of heat treatment and hardening of materials; analysis of the causes of defects in materials; determination of the quality and condition of alloys based on the analysis of their structures.
	Machine learning and data analysis	**Purpose:** to familiarize with the basics of machine learning and its application in stochastic engineering problems. **Summary** Linear classifier and stochastic gradient. Neural networks: gradient optimization methods. Metric methods of classification and regression. The method of support vectors. Multidimensional linear regression. Nonlinear regression. Model selection criteria and feature selection methods. Logical classification methods. Deep neural networks. Neural networks with unsupervised learning.		
	3D printing of machine parts and elements	**Purpose:** to familiarize students with the basics of additive technology and the main types of AI technologies. **Summary** The study of terminology and classification, characteristics of the AM technology market. Additive technologies and rapid prototyping, technologies and machines for growing metal products. Additive technologies and foundry, additive technologies and powder metallurgy, creation of machine elements.		
	Fundamentalsofmechatronics	**Purpose of the course:**to acquaint bachelors with the basics of microcontrollers, analog and digital electronics, sensors, actuators and their application in modern mechatronic systems, with mathematical methods and algorithms used in planning and controlling movement under the influence of force, as well as to instill some skills in the use of these methods. **Summary of the discipline.** Fundamentals of mechatronics: 16-bit microprocessor, embedded computers, analog and digital devices, sensors, actuators.Modeling and control of electromechanical systems, modeling of various mechatronic systems.		The ability and ability to design, model and manage modern mechatronic systems.
	Renewableenergy systems	**Purpose:** formation of knowledge in the field of renewable energy sources and training in the skills of their use. **Summary** The volume of reserves of traditional energy carriers. Nuclear energy and the greenhouse effect. Solar radiation. Wind energy. Water energy. Geothermy. Use of biomass. Hydrogenproduction, fuelcellsandmethanization.		

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 06.03.2025 Minutes № 10

WORKING CURRICULUM

Academic year	**2025-2026 (Autumn, Spring)**
Group of educational programs	**B064 - "Mechanics and metal working"**
Educational program	**6B07130 - "Mechanical engineering and modeling"**
The awarded academic degree	**Bachelor of engineering and technology**
Form and duration of study	**full time - 4 years**

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters								Prerequisites
									1 course		2 course		3 course		4 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	7 sem	8 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																	
M-1. Language Training module																	
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E	5								
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E	5								
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E		5							
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E		5							
M-2. Physical training module																	
KFK101	Physical culture I		GED, RC	2	60	0/0/30	30	E	2								
KFK102	Physical culture II		GED, RC	2	60	0/0/30	30	E		2							
KFK103	Physical culture III		GED, RC	2	60	0/0/30	30	E			2						
KFK104	Physical culture IV		GED, RC	2	60	0/0/30	30	E				2					
M-3. Information Technology module																	
CSE677	Information and communication technology		GED, RC	5	150	30/15/0	105	E				5					
M-4. Module of socio-cultural development																	
HUM137	History of Kazakhstan		GED, RC	5	150	15/0/30	105	GE	5								
HUM132	Philosophy		GED, RC	5	150	15/0/30	105	E			5						
HUM120	Module of socio-political knowledge (sociology, political science)		GED, RC	3	90	15/0/15	60	E			3						
HUM134	Module of socio-political knowledge (cultural studies, psychology)		GED, RC	5	150	30/0/15	105	E				5					
M-5. Module fundamentals of anti-corruption culture, ecology and life safety																	
HUM136	Fundamentals of anti-corruption culture and law	1	GED, CCH	5	150	30/0/15	105	E			5						
MNG489	Fundamentals of economics and entrepreneurship	1	GED, CCH	5	150	30/0/15	105	E			5						
MSM500	Fundamentals of scientific research methods	1	GED, CCH	5	150	30/0/15	105	E			5						
CHE656	Ecology and life safety	1	GED, CCH	5	150	30/0/15	105	E			5						
MNG564	Basics of Financial Literacy	1	GED, CCH	5	150	30/0/15	105	E			5						
CYCLE OF BASIC DISCIPLINES (BD)																	
M-7. Module of basic training in engineering mechanics and Modeling																	
GEN177	Engineering and computer graphics		BD,	5	150	15/15/15	105	E		5							

AAP196	Educational practice		BD, UC	2				R		2							
GEN409	Statistic and Kinematics		BD, UC	5	150	15/0/30	105	E			5						
GEN198	Dinamics		BD, UC	5	150	15/0/30	105	E				5					PHY111, MAT126
CHE495	Chemistry		BD, UC	5	150	15/30/0	105	E					5				
GEN413	Theory and Design of Mechanism and Machines		BD, UC	5	150	15/15/15	105	E					5				
GEN199	Engineering Thermodynamics		BD, UC	5	150	15/0/30	105	E					5				
GEN414	Numerical Methods and Programming		BD, UC	5	150	15/15/15	105	E					5				
GEN185	Statistical Mechanics	1	BD, CCH	5	150	15/15/15	105	E					5				
GEN407	The Strength and Relibility of Machines	1	BD, CCH	5	150	15/15/15	105	E					5				
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan	1	BD, CCH	5	150	30/0/15	105	E					5				
MNG562	Legal regulation of intellectual property	1	BD, CCH	5	150	30/0/15	105	E					5				
CSE831	Fundamentals of Artificial Intelligence	1	BD, CCH	5	150	15/0/30	105	E					5				
CHE950	ESG principles in inclusive culture	1	BD, CCH	5	150	30/0/15	105	E					5				
GEN404	Fluid Mechanics		BD, UC	5	150	15/15/15	105	E						5			
GEN405	Solid Mechanics		BD, UC	5	150	15/0/30	105	E						5			
GEN504	Computational hydromechanics and modeling		BD, UC	5	150	15/0/30	105	E						5			
GEN447	Modeling and design of mechanical systems		BD, UC	5	150	15/15/15	105	E							5		
GEN448	Modeling and design of thermal systems		BD, UC	5	150	15/15/15	105	E								5	
M-8. Module of professional training in engineering mechanics and Modeling																	
AAP182	Industrial internship I		BD, UC	3	90	0/0/45	45	R				3					
M-6. Module of physical and mathematical training																	
MAT189	Linear algebra and analytic geometry		BD, UC	5	150	15/0/30	105	E	5								
MAT169	Mathematical Analysis I		BD, UC	5	150	15/0/30	105	E	5								
PHY469	Physics I: Mechanics. Molecular physics and thermodynamics		BD, UC	5	150	15/15/15	105	E	5								
MAT170	Mathematical Analysis II		BD, UC	5	150	15/0/30	105	E		5							MAT169
PHY471	Physics II: Electricity and magnetism.		BD, UC	5	150	15/15/15	105	E		5							
MAT171	Mathematical Analysis III		BD, UC	5	150	15/0/30	105	E			5						MAT170
MAT110	Ordinary differential equations		BD, UC	5	150	15/0/30	105	E			5						MAT170
MAT172	Mathematical analysis IV		BD, UC	5	150	15/0/30	105	E				5					MAT171
MAT448	Equations of mathematical physics		BD, UC	5	150	15/0/30	105	E					5				
CYCLE OF PROFILE DISCIPLINES (PD)																	
M-8. Module of professional training in engineering mechanics and Modeling																	
GEN426	Strength of materials		PD, UC	5	150	15/15/15	105	E				5					
AAP504	Industrial internship II		PD, UC	3	90	0/0/45	45	R						3			
GEN449	Design of machine elements and parts		PD, UC	5	150	15/15/15	105	E						5			
GEN508	Dynamics of Machines and Computer Analysis	1	PD, CCH	4	120	15/15/15	75	E						4			
GEN509	Control of Dynamic Systems	1	PD, CCH	4	120	15/15/15	75	E						4			
GEN512	Filtration theory and applied problems	2	PD,	4	120	15/30/0	75	E						4			

GEN511	Finite volume method in fluid mechanics	2	PD, CCH	4	120	15/30/0	75	E						4			
GEN505	Object-oriented programming		PD, UC	5	150	15/15/15	105	E							5		
GEN510	Basics of heat and mass transfer		PD, UC	5	150	15/0/30	105	E							5		
GEN421	Intro to Robots		PD, UC	5	150	15/15/15	105	E							5		
GEN160	Finite Elements in Engineering		PD, UC	5	150	15/15/15	105	E							5		MAT101, MAT102, GEN170, GEN153
GEN425	Computational Mechanics	1	PD, CCH	5	150	15/15/15	105	E							5		
MSM468	Interchangeability and technical measurements	1	PD, CCH	5	150	15/15/15	105	E							5		
AAP128	Производственная практика III(преддипломная практика)		PD, UC	2	60	0/0/15	45	R								2	
GEN462	Machine learning and data analysis in engineering	1	PD, CCH	6	180	30/15/15	120	E								6	
GEN446	Renewable Energy Systems	1	PD, CCH	6	180	30/15/15	120	E								6	
GEN438	3D Printing of Machine Elements	2	PD, CCH	6	180	30/15/15	120	E								6	
GEN442	Biofluid Mechanics	2	PD, CCH	6	180	30/15/15	120	E								6	
GEN506	Laboratory: Fluid Flowes	3	PD, CCH	4	120	0/45/0	75	E								4	
GEN507	Laboratory: Heat Transfer	3	PD, CCH	4	120	0/45/0	75	E								4	
M-9. Module of final certification																	
ECA103	Final examination		FA	8												8	
Additional type of training (ATT)																	
AAP500	Military training																
Total based on UNIVERSITY:									32	29	30	30	30	31	30	31	
									61		**60**		**61**		**61**		

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	University component (UC)	Component of choice (CCH)	Total
GED	Cycle of general education disciplines	51	0	5	56
BD	Cycle of basic disciplines	0	110	5	115
PD	Cycle of profile disciplines	0	35	29	64
Total for theoretical training:		**51**	**145**	**39**	**235**
FA	Final attestation				8
TOTAL:					**243**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024

Decision of the Academic Council of the Institute. Minutes № 3 dated 19.12.2024

Signed:

Governing Board member - Vice-Rector for Academic Affairs — Uskenbayeva R. K.

Approved:

Vice Provost on academic development — Kalpeyeva Z. Б.

Head of Department - Department of Educational Program Management and Academic-Methodological Work — Zhumagaliyeva A. S.

Director of the Institute - A.Burkitbaev Institute of Energy and Mechanical Engineering — Yelemesov K. .

Department Chair - Engineering Mechanics — Tungatarova M. .

Representative of the Academic Committee from Employers ____Acknowledged____ — Tuleshov A.