Institute _____ **Energy and Mechanical engineering** _____

Department __ **Mechanical engineering** _____

EDUCATIONAL PROGRAM

6B07131- "Design and technology in mechanical engineering"

the name of educational program

Code and name field of education:
6B07-Engineering, manufacturing and civil engineering
Code and classification direction of personnel training:
6B071-Engineering and engineering trades
Group of educational programs:
B064-Mechanics and metal working
EP purpose: 6
EP type: 6
Period of study: 4 years
Volume of the credits: 240

Almaty 2023

NCJS «KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY
named after K.I.SATBAYEV»

Educational program 6B07131- "Design and technology in mechanical engineering"
(the name of educational program)

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

Minutes 5 dated « 24 » November 2022.

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

Minutes 3 dated «17 » November 2022.

Educational program 6B07131- "Design and technology in mechanical engineering
(the name of educational program)

developed by Academic committee in the direction of "6B071-Engineering and engineering trades"

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Nugman E.Z.	Doctor PhD	Head of the Department of "Mechanical Engineering"	NAO KazNRTU named after K.I. Satpayev, Institute of Energy and Mechanical Engineering	
Teaching staff:				
Kerimzhanova M.F.	Candidate of Technical Sciences, Associate Professor	Professor	Department of Mechanical Engineering	
Uderbayeva A.E.	Doctor PhD	Assoc. Professor	Department of Mechanical Engineering	
Employers:				
Dyusembayev I.M.		Chief Engineer	Almaty plant "Electroshield"	
Students				
Akan A.		4th year student	Department of "Mechanical Engineering"	

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List of abbreviations and designate

ECTS	European Credit Transfer and Accumulation System
BD	Basic disciplines
HEI	Higher education institution
SMSE	State mandatory standard of education
KazNRTU	K. I. Satpayev Kazakh National Research Technical University
MEP	Modular educational program
NJSC	Non-profit joint stock Company
GED	General education disciplines
EP	Educational program
PD	Profile disciplines
WC	Working curriculum
IWS	Independent work of a student
EMC	Educational and Methodological Council
AC	Academic council

1 Description of educational program

The professional activity of graduates of the program is aimed at the development of the machine-building complex, automation of the life cycle of machine-building products, development and implementation of information technologies in the production of machine-building products.

The direction of training in the educational program is Engineering and engineering.

The field of professional activity of bachelors includes sections of science and technology containing a set of tools, techniques, methods and methods of human activity aimed at creating competitive engineering products and based on the use of advanced methods and means of design, industrial design, digital technologies, computer modeling of technological processes of machine-building production.

The subjects of professional activity of graduates are: production equipment of machine-building enterprises; machine-building tools; technological equipment, design solutions, automated machine complexes and systems, tools, means of operation, renovation technologies, control and testing technologies of machine-building equipment; methods of reengineering and prototyping, technologies of 3D modeling and 3D scanning of machines and mechanisms.

Bachelors can perform the following types of professional activities using modern software:

- organizational and managerial;
-production and technological;
- design and engineering;
- settlement and design;
- experimental research.

Functions of professional activity of graduates:

- development and design of technological processes for the manufacture of various types of products, equipment, tooling, tools;
- standard control of regulatory and technical documentation;
- solving design, technological, organizational-technical and organizational-economic tasks;
- maintenance, organization and application of renovation methods and technologies of mechanical engineering, means of production, measurement, testing and control;
- development of engineering documentation, advanced technologies, methods of testing equipment and tooling for specific industries of the machine-building complex;
- analysis of the economic activity of production and assessment of the stability of product quality in order to further develop and improve the efficiency of the enterprise;
- conducting experiments, measurements, observations, implementation of research results and scientific developments.

Graduates are prepared to solve the following types of tasks according to the

type of professional activity:
- organization of the production process, organization of the work of performers; setting goals and forming management tasks related to the implementation of professional functions; organization of production maintenance; development of management algorithms; planning accounting and reporting, planning to improve production efficiency;
- development and implementation of innovative technologies for the production of machine-building products, creation of automated machine complexes and systems;
-organization of production maintenance management of the production process taking into account technical, financial and human factors;
- introduction of highly efficient means of technological equipment, ensuring environmental friendliness of machine-building production;
development of calculation schemes in the design of systems of machine-building equipment, tooling and tools;
- application of modern experimental methods for the study of machine-building production, research of new directions of digital engineering; scientific justification of methods for ensuring the quality of manufactured products and increasing labor productivity.

Requirements for the Bachelor's key competencies.

The bachelor must:
know the main production equipment, tools, equipment used in the machine-building complex; computer methods of calculation and design of machine structures and their parts; advanced technologies of procurement production; methods of design and development of technological processes of machine production; trends and prospects for the development of digital engineering; digital twins, reverse engineering, information technologies of organization and management of production, the main directions of engineering design of machines and mechanisms; methods of life support in mechanical engineering; modern forms and methods of project management.

2 The purpose and objectives of the educational program

EP purpose:

EP 6B07131- Design and technology in mechanical engineering
was developed in accordance with the National Qualification System, coordinated with the Dublin Descriptors and the European Qualification Framework. OP is focused on learning outcomes that form professional competencies in accordance with the requirements of the labor market.

The purpose of EP 6B07131 – Design and technology in mechanical engineering is to train qualified and in-demand specialists in the field of engineering design, calculation, design and organization of machine-building production, capable of using additive and information technologies.

EP tasks:

- formation of knowledge of modern information technologies;
- acquisition of theoretical and practical knowledge of engineering design of machine-building products;
- knowledge of methods and methods of 3D modeling and 3D scanning;
- acquisition of professional competencies in accordance with the requirements of industry professional standards;
- acquisition of knowledge of production engineering, technologies of procurement, processing and assembly production of machines;
- formation of knowledge about the main trends in the development of mechanical engineering, the introduction of innovative digital technologies.

3 Requirements for evaluating the learning outcomes of an educational program

Description of mandatory standard requirements for graduating from a university and conferring an academic bachelor's degree: mastering at least 240 academic credits of theoretical training and final thesis

4 Passport of the educational program

4.1 General information

№	Название поля	Примечание
1	Code and name field of education	6B07- Engineering, manufacturing and civil engineering
2	Code and classification direction of personnel training	6B071- Engineering and engineering trades
3	Group of educational programs	B064- Mechanics and metal working
4	Name of the educational program	6B07131- Design and technology in mechanical engineering
5	Short description of the educational program	The professional activity of graduates of the program is aimed at the application of modern technologies of digitalization of machine-building production. In the educational program, students will gain professional knowledge of industrial design of machines and mechanisms, acquire skills in computer-aided design of machine structures and their parts, design of technological processes for the production of machines using modern software products (CAD /CAM/CAE/PLM).
6	EP purpose	Training of qualified and in-demand specialists in the field of engineering design, calculation, design and organization of machine-building production, capable of applying

		additive and information technologies in the labor market
7	EP type	New
8	Level on NQF	6
9	Level on SQF	6
10	EP distinctive features	-
11	List of competencies of the educational program:	- Ability to apply general engineering knowledge, methods of mathematical analysis and modeling in professional activities; - Ability to analyze and evaluate production and technological processes; - Willingness to use engineering design technologies in modeling engineering processes; - Willingness to apply automated calculation methods in the design of machines and their parts; - Willingness to apply innovative, environmentally friendly and low-waste, additive technologies in mechanical engineering; - Readiness to use information technologies for project management, production, taking into account environmental requirements, emergency risks.
12	Learning outcomes of the educational program:	TR1 Develops communication skills, creativity, strategic thinking, ability to work in a team, leadership qualities TR2 Applies knowledge of state and foreign languages to solve professional tasks, taking into account economic, moral and ethical aspects of activity, culture of academic honesty TR3 Shows initiative and psychological readiness for professional activity, engineering ethics in making managerial decisions TR4 Applies fundamental knowledge in the field of mathematical, natural, humanitarian and economic sciences, digital technologies to solve engineering problems TR5 He is proficient in information methods of analysis, calculation and design of mechanisms and machine parts, fundamentals of structural materials and technical measurements, equipment and tooling design. TR6 Applies information technologies and automated systems of engineering design of structures of machines and equipment, modeling of tooling and tools. TR7 Carries out the design and modeling of tooling and cutting tools, processing

		methods and additive technologies, analysis and evaluation of economic indicators of production. TR8 Applies modern technologies of production engineering, production of blanks and manufacturing of parts, production of cutting tools, standardization and certification. TR9 Solves the problems of the development of machine-building production on the basis of knowledge of subtractive and additive technologies, the use of promising methods of project management, organization and planning of production. TR10 Demonstrates the skills of designing automated machine-building equipment, equipment drives, digitalization of technological processing processes TR11 Applies methods of research and design of technologies, digital twins, reverse engineering, 3D scanning technologies in mechanical engineering TR12 Solves problems related to life safety, emergency prevention and environmental safety, standardization and certification of production
13	Form of training	daytime
14	Period of study	4 years
15	Volume of the credits	240
16	Language of education	Kazakh, russian
17	The awarded academic degree	Bachelor of engineering and technology
18	Developer(s) and authors:	The educational program was developed by the academic committee in the direction "6B071-Engineering and engineering trades "

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

№	Name of discipline	Short description of discipline	Number of credits	The formed educational outcomes (codes)											
				ON1	ON2	ON3	ON4	ON5	ON6	ON7	ON8	ON9	ON10	ON11	ON12
Cycle of general education disciplines Required component															
1	Foreign language	English is a compulsary subject. According to the results of placement test or IELTS score, students are placed into groups and disciplines. The name of the discipline corresponds to the level of English. When passing from level to level, prerequisites and postrequisites are respected.	10		v										
2	Kazakh (Russian) language	In this course author considers socio-political, socio-cultural spheres of communication and functional styles of the modern kazakh (russian) language. The course covers the specifics of the scientific style to develop and activate professional communication skills and abilities of students. Also it allows students to leavn the basics of scientific style practically and develop the ability of production structural and semantic text analysis.	10		v										
3	History of Kazakhstan	The purpose of the discipline is to provide objective historical knowledge about the main stages of the history of Kazakhstan from ancient times to the present day; introduce students to the problems of the formation and development of statehood and historical and cultural processes; contribute to the formation of humanistic values and patriotic feelings in the student; teach the student to use the acquired historical knowledge in educational, professional and everyday life; evaluate the role of Kazakhstan in world history.	5		v		v								
4	Philosophy	The purpose of the discipline is to teach students the theoretical foundations of philosophy as a way of knowing and spiritually mastering the world; developing their interest in fundamental knowledge, stimulating the need for philosophical assessments of historical events and facts of reality, assimilating the idea of the unity of the world historical and cultural process while recognizing the diversity of their skills in applying philosophical and general scientific methods in professional activities.	5			v	v								
5	Module of socio-political knowledge (sociology, political science)	The objectives of the disciplines are to provide students with explanations on the sociological analysis of society, about social communities and personality, factors and patterns of social development, forms of interaction, types and directions of social processes, forms of regulation of social behavior, as well as primary political knowledge that will serve as a theoretical basis for understanding social -political processes, for the formation of political culture, development of a personal position and a clearer understanding of the extent of one's	3	v		v									

		responsibility; help to master the political, legal, moral, ethical and socio-cultural norms necessary to act in the interests of society, form personal responsibility and achieve personal success.													
6	Module of socio-political knowledge (cultural studies, psychology)	The purpose of the disciplines is to study the real processes of cultural creative activity of people who create material and spiritual values, identify the main trends and patterns of cultural development, changes in cultural eras, methods and styles, their role in the formation of man and the development of society, as well as master psychological knowledge for the effective organization of interpersonal interaction, social adaptation in the field of their professional activities.	5		v	v									
7	Information and communication technology (in English)	Required component. The aim of the course is to gain theoretical knowledge in information processing, the latest information technologies, local and global networks, the methods of information protection; Getting the right use of text editor editors and tabulators; creation of base and different categories of applications.	5	v			v								
Cycle of general education disciplines Component of choice															
8	Fundamentals of anti-corruption culture and law	The course introduces students to the improvement of socio-economic relations of Kazakhstan society, psychological features of corrupt behavior. Special attention is paid to the formation of an anti-corruption culture, legal responsibility for acts of corruption in various spheres. The purpose of studying the discipline «Fundamentals of anti-corruption culture and law» is to increase public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Expected results: to realize the values of moral consciousness and follow moral norms in everyday practice; to work on improving the level of moral and legal culture; to use spiritual and moral mechanisms to prevent corruption.	5		v										
9	Fundamentals of economics and entrepreneurship	Discipline studies the foundations of economics and entrepreneurial activity from the point of view of science and law; features, problematic aspects and development prospects; the theory and practice of entrepreneurship as a system of economic and organizational relations of business structures; The readiness of entrepreneurs for innovative susceptibility. The discipline reveals the content of entrepreneurial activity, the stages of career, qualities, competencies and responsibility of the entrepreneur, theoretical and practical business planning and economic examination of business ideas, as well as the analysis of the risks of innovative development, the introduction of new technologies and technological solutions.	5		v										
10	Ecology and life safety	The discipline studies the tasks of ecology as a science, environmental terms, the laws of the functioning of natural systems and aspects of environmental safety in the conditions of labor activity. Monitoring of the environment and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to	5		v										v

		solve environmental problems; life safety in the technosphere; natural and man-made emergencies													
11	Fundamentals of scientific research methods	The purpose of the discipline is to form the skills of organizing and planning scientific research, methods of conducting experimental research, methods of information processing. The discipline introduces students to the goals, objectives and stages of scientific research. The terms and concepts, the methodology of the experiment, mathematical methods of processing research results are considered. The concept of engineering, laboratory and industrial experiment, bench research. The discipline introduces the basics of the theory of solving inventive problems, algorithmic methods of finding technical solutions and their optimization. Highlights the main mathematical methods of optimization, the use of artificial intelligence capabilities to solve optimization problems; issues of search, accumulation and processing of scientific information.	5	v											v
Cycle of basic disciplines University component															
12	Physics I	Objectives: to study the basic physical phenomena and laws of classical, modern physics; methods of physical research; the relationship of physics with other sciences. The following topics are considered: mechanics, dynamics of rotational motion of a solid body, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, transport phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell equations.	5				v								
13	Mathematics I	The course is based on the study of mathematical analysis in a volume that allows you to study elementary functions and solve the simplest geometric, physical and other applied problems. The main focus is on differential and integral calculus. The course sections include the differential calculus of functions of one variable, the derivative and differentials, the study of the behavior of functions, complex numbers, and polynomials. Indefinite integrals, their properties and methods of calculation. Certain integrals and their applications. Improper integrals.	5				v								
14	Physics II	The course studies the laws of physics and their practical application in professional activity. Solving theoretical and experimental-practical educational problems of physics for the formation of the foundations in solving professional problems. Assessment of the degree of accuracy of the results of experimental or theoretical research methods, modeling of physical condition using a computer, study of modern measuring equipment, development of skills for conducting test studies and processing their results, distribution of the physical content of applied tasks of the future specialty.	5	v			v								

15	Mathematics II	The discipline is a continuation of Mathematics 1. The course sections include elements of linear algebra and analytical geometry. The main issues of linear algebra are considered: linear and self-adjoint operators, quadratic forms, linear programming. Differential calculus of a function of several variables and its applications. Multiple integrals. The theory of determinants and matrices, linear systems of equations, as well as elements of vector algebra. The elements of analytical geometry on the plane and in space are included.	5	v			v									
16	Introduction to engineering design	General provisions of the engineering design methodology. Stages of creating machines. Project procedures. Principles of engineering design. Methods of engineering design. Manufacturability of machine designs. Economic aspects of engineering design. Problems of design, ergonomics and ecology in engineering design Environmental aspects of engineering design. Optimization of design solutions Methods for solving optimal engineering design problems. Basic concepts of reliability theory. Disadvantages of traditional engineering design. Goals and objectives of engineering design. Engineering design systems	5				v									
17	Classical mechanics	The purpose of the discipline is to form knowledge of the scientific foundations of mechanics related to the conditions of equilibrium of bodies, with the main types of motion of mechanical systems; knowledge of the basics of dynamics. The system of converging forces, the theory of moments, and the basic theorem of statics are considered. Dynamics of a material point and 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				v	v								
18	Mechanics of materials	The purpose of the discipline is to acquire theoretical knowledge of the fundamentals of the science of strength, rigidity and stability of materials and structures; practical skills in choosing calculation methods and designing various structures. The laws and theoretical propositions underlying the mechanics of a deformable solid are studied. Methods of calculation of structural elements for strength, rigidity and stability under various types of deformation of rods (stretching, compression, shear, torsion and bending), dynamic action of forces, calculation of structural elements beyond elasticity.	5				v	v								
19	Fundamentals of electrical engineering and industrial electronics	The purpose of the discipline is to study the basic definitions, parameters and methods of calculating DC and AC electrical circuits, the principles of operation of transformers, electrical machines, systems of electrical measuring devices, as well as components of industrial electronics. Main topics: Direct current. Electrical circuits. Complex and nonlinear electrical circuits. Magnetic field. Alternating current. Power. Three-phase current. Electrical measurements. Transformers. Electrical measuring devices. Electric machines. Electronic devices. Electronic	5				v						v			

		amplifiers. Generators. Rectifiers. Digital control devices. Network and autonomous converters.														
20	Theory of mechanisms and machine parts	The purpose of the study of the discipline is to gain knowledge of the general methods of studying and designing the schemes of mechanisms necessary for the creation of machines, devices, automatic devices and complexes that meet modern requirements for efficiency, accuracy, reliability and economy. The main task of the discipline is to give knowledge about the kinematic and dynamic characteristics of mechanisms with rigid and elastic links and controlled kinematic chains, about methods for determining the parameters of mechanisms according to the required conditions, methods of vibration protection of a person and a machine, about controlling the movement of mechanisms and machines.	5				v	v								
21	Engineering Economics	The purpose of the discipline is to acquire theoretical knowledge and practical skills of economic assessment of the activities of a machine-building enterprise. The discipline studies the structure of a machine-building enterprise, fixed and current assets, production capacity of the enterprise, material and technical support of production, personnel, financial resources of production. The issues of forecasting and planning of production, calculation of production costs, production costs, economic efficiency, analysis and evaluation of the economic activity of the enterprise are studied. Practical skills of performing calculations of the main technical and economic parameters, evaluating the efficiency of the enterprise are acquired.	5		v					v						
22	Graphic design of machine parts (CAD)	The purpose of the discipline is to master the specifics of shaping an industrial product and methods of solving design problems. Formation of theoretical and practical knowledge of the main stages of design design and analysis of the design of an industrial product. Knowledge of the elements of engineering support for industrial design and the methodology of designing industrial products. As a result of the training, the skills of using computer-aided design technologies will be acquired when creating virtual models, drawings, text documents and files containing information necessary for the product life cycle.	5					v	v							
23	Interchangeability and basis of technical measurements	The purpose of the discipline is to acquire knowledge and practical skills on the basics of interchangeability, technical measurements, and machine manufacturing accuracy. Basic concepts of interchangeability. Principles of building a system of tolerances and landings. Calculation and selection of landings. The main provisions of the Unified System of tolerances and landings of smooth cylindrical joints. Normalization, methods and means of measuring and controlling deviations of shape, location, surface roughness. Tolerances and fitments of rolling bearings; spline, keyway and threaded connections, gears. Measuring instruments, metrological characteristics and their rationing.	6				v	v								
24	Modern construction materials	The purpose of the discipline is to form knowledge about modern materials used in mechanical engineering, progressive technological methods of their application. The classification of engineering materials,	5					v			v					

		the main properties of structural materials, methods of their heat treatment are considered. Properties and characteristics of metal alloys, ceramic and composite materials, powder and synthetic superhard materials, multifunctional coatings. Methods of studying the structure and composition of materials, diagram of iron-cementite. The skills of analyzing the composition and structure of materials, choosing the material for specific designs of machine parts are acquired.														
25	Engineering equipment of machine-building production	The purpose of the discipline is to acquire theoretical and practical knowledge of the main types of industrial equipment for the manufacture of parts, as well as information on the basics of design and operation of these types of equipment. The design of machines, machines and automatic machines, as well as their most important components, issues of kinematic analysis and synthesis of metal-cutting equipment are considered. Metal cutting machines for machining bodies of rotation, machining holes, prismatic parts. Equipment for finishing and finishing surfaces of machine parts. CNC machines, machining centers, advantages and technological capabilities.	5					v	v							
26	Design of automated machines and complexes	The purpose of the discipline is to study the basics of designing automatic machines and automatic lines, structures of automated equipment, automatic machines and automatic lines of sequential and parallel action, the choice of cutting modes for multi-tool processing, software control systems of metal-cutting machines, control processes of metal-cutting machines, control functions, their characteristics. Automated machine tools with numerical control, numerical control systems, coding and recording of information, flexible production systems, flexible production modules, the basics of designing automated machine systems are studied. The skills of designing automated machines and complexes, automated calculations of machine parts and assemblies are acquired.	5						v				v			
27	Technical design of machine-building equipment	The purpose of the discipline is the formation of knowledge of the equipment of modern machine-building industries for the successful solution of the tasks of professional activity and for the assimilation of subsequent disciplines of professional training. The issues related to the study and analysis of kinematic schemes of equipment; the methodology for selecting the required equipment for the technological process, equipment of procurement workshops are considered. Technical design of forging and pressing equipment, rolling and drawing mills, molds. Calculation, design and modeling of equipment for welding production..	5					v	v							
28	Design of foundry and forging technologies	The purpose of the discipline is theoretical and practical training in the main methods of designing and obtaining blanks, methods of ensuring the manufacturability and competitiveness of products in modern machine-building production, mastering the knowledge of technological design and modern calculation methodology in the design of forging and stamping workshops of machine-building production. Practical skills are acquired in the selection and design of blanks and the basic principles of	5					v			v					

		designing technological processes for the manufacture of blanks by casting and forging production methods.													
29	Subtractive technologies	The purpose of the discipline is to form a complex of knowledge, skills and skills in the field of physical and chemical processes of mechanical processing of materials, study the issues of development, manufacture of products using subtractive technologies, study the technology of production of functional metal, ceramic, composite powder materials, issues of urgent problems in subtractive production. We consider the prospects of hybrid technologies, the study of subtractive manufacturing technologies, the basics of reverse design and design, machining technologies on CNC machines, the study of routing and EDM, multi-axis CNC machining.	5				v					v			
Cycle of basic disciplines Component of choice															
30	Hydraulics and hydraulic pneumatic drive	The purpose of the discipline is the formation of knowledge in the field of hydraulics, hydraulic and pneumatic machines for processing, feeding and moving liquids and gases. The discipline deals with the issues of hydrostatics: basic physical properties of liquids and gases; hydrodynamics: motion of liquids and gases, Euler and Bernoulli equations, modeling of hydrodynamic phenomena; hydraulic machines and hydraulic drives. Fundamentals of pneumatic actuators, pneumatic motors, equipment of pneumatic systems. The basics of operation of combined hydraulic pneumatic drives are studied. The skills of designing and applying drives for machine-building equipment are acquired.	5				v						v		
31	Machine-building equipment drives	The purpose of the discipline is to study the components and mechanisms of metal-cutting machines, drives of metal-cutting machines and machine-building equipment, electric motors, transmission mechanisms, reversing, transformation of movement in machines. Classification and terminology of drives of machine-building equipment are studied, structures, principles of operation and methods of calculation of basic parameters of elements and devices of drives, methods of creation of models of drives for study of their dynamic characteristics using modern application programs, drives of machines with numerical program control (CNC) are considered.	5				v						v		
32	Cutting tool life cycle	The purpose of the discipline is to form knowledge of the basic fundamental approaches to the design of cutting tools, algorithms for the design and construction of components, design features of cutting tools, the life cycle of cutting tools, modern scientific approaches to the selection of geometric parameters of cutting tools. The methods of computer-aided design of cutting tools, questions of the theory of cutting materials, tool wear during various types of cutting, the quality of the surface layer, mechanisms of deformation and stress; features of the operation of cutting tools in various production conditions are studied.	5							v	v				
33	Cutting tool manufacturing technologies	The purpose of the discipline is to acquire theoretical and practical knowledge of the methodology of designing the cutting tool	5						v		v				

		manufacturing technology. The basics of designing technological processes for manufacturing cutting tools, technological properties of tool materials are described. The main features of procurement, shaping, thermal, grinding and sharpening operations are considered, as well as methods for further increasing the durability of cutting tools, the main directions for improving the technology of tool production. The skills of designing technological processes for manufacturing various types of cutting tools, computer-aided design of tools are acquired.														
34	Probabilistic models in industrial engineering	The purpose of the discipline is to acquire theoretical and practical knowledge of the reliability of technical systems (machines). The fundamentals of probability theory and the application of the laws of probability theory to the analysis of technological and technical systems, including in mechanical engineering, in procurement production, are studied. With the help of probabilistic and statistical models, the problems of designing, manufacturing and controlling products are solved. The use of such models in the calculations and research of the accuracy of equipment and technological processes, in the development and selection of statistical methods for quality control of machine-building products.	5				v	v								
35	Finite element method in engineering	The purpose of studying the discipline is to familiarize with the basics and methods of constructing mathematical models of design problems and technological processes of machine-building production, with methods of constructing and using mathematical models to determine the intensity of loading parts with various environmental factors. The discipline studies the tools for compiling mathematical models to determine the intensity of loading parts with various environmental factors. Skills of using standard packages and tools for computer-aided design of technical objects and technological processes, methodology of computational experiment are acquired.	5				v	v								
36	Reverse engineering	The purpose of the discipline is to master reverse engineering or reverse engineering, the process of creating a project of parts or products for which there are no working drawings or documentation. Various methods and technologies for creating 3D models of products and machine parts are being studied; creating digital CAD models using 3D scanning in order to change and optimize machine-building products, prolong their service life, and create new functions. The processes of measuring objects performed with the help of advanced three-dimensional measurement technologies are studied.	5						v					v		
37	3D Scanning techniques and technologies	The purpose of the discipline is the formation of knowledge about the methods and technologies of three-dimensional scanning of objects of machine-building production, optimization of the parameters of 3D scanners for high-quality measurements. The principles of 3D scanning, the structure of scanners, and the creation of a single model of the object to be scanned based on the results obtained are studied. Classification of 3D scanners, technologies and methods of 3D scanning: laser and optical, contact or contactless digitization. With different types of 3D	5						v					v		

		scanners, practical skills are acquired to create three-dimensional models of real machine-building objects													
Cycle of profile disciplines University component															
38	CAE/CAD tooling design and modeling	The purpose of the discipline is to give the future engineer theoretical and practical knowledge on the design of cast parts, as well as the design of technological equipment for casting into one-time molds, the formation of a unified design environment based on various CAD / CAM / CAE systems and the development of a methodology for computer-aided design of technological equipment. The issues of designing and calculating machine tools, the methodology of designing equipment and choosing the type of drives are considered. The skills of computer-aided design of technological equipment are acquired during the creation of blanks, their machining and assembly.	5					v	v						
39	Occupational health and industrial safety (by industry)	The purpose of studying the discipline is to form knowledge on the issues of industry-specific regulatory regulation of occupational safety and health in the Republic of Kazakhstan, the use of a systematic approach in occupational safety management, taking into account industry-specific industrial sanitation and occupational hygiene, protective equipment and their industry-specific application parameters, regulatory and technical regulation in the field of industrial safety, industry rules for industrial safety, declaration of industrial safety of a hazardous production facility, electrical safety and fire and explosion safety of production facilities.	5	v			v								v
40	Production engineering	The purpose of the discipline is to form knowledge and skills in the design of technological processes for assembling machines and manufacturing machine parts. The discipline deals with the basics of mechanical engineering technology: terminology, theory of manufacturing accuracy, basing theory, calculation of allowances, processing modes, equipment selection. The basics of designing typical technological processes for manufacturing parts of classes are studied: shafts and axles, body parts, discs (gears), bushings, levers and brackets, fasteners. The skills of designing technological processes for the production of machines are acquired.	5								v			v	
41	Computer-aided design systems and design of machine structures	The purpose of the discipline is to present the basic techniques on various aspects of CAD application in machine-building production. Also consideration of various types of CAD software such as: technical, software, informational, linguistic, organizational and legal, as well as issues related to the use of CAD in mechanical engineering, product modeling and its assembly process. As a result of the training, skills are acquired in the design and assembly of products and in computer engineering analysis	5					v	v						
Cycle of profile disciplines Component of choice															

42	Additive manufacturing design	The purpose of studying the discipline is the formation of professional skills in using the Solid Works program for additive manufacturing, the formation of students' basic concepts of modeling (structure, classification, application of models, requirements for models), familiarization with the theoretical foundations and ways to optimize the modeling of mechanical engineering processes, processing and extraction of information from various sources, the formation of cabling, analysis of the structure of the model, its applications, knowledge of model construction methods, the use of modern application programs in the design of components and mechanisms of machines.	6				v		v							
43	Additive manufacturing processes	The purpose of the discipline is to acquire knowledge of the history of the emergence and development of additive technologies, ZD–modeling as the basis of additive technologies. Additive manufacturing methods are studied: FDM, SLA, DLP, SLS/SLM, 3DP. Print type LOM, MJM, EVM. Optimization of additive manufacturing. Preparation of ZD models for printing. Engineering calculations in additive manufacturing. The concept of slicers. Variations and the ratio of printing parameters. Defects and their classification. Post-processing. Mechanical processing of products. Heat treatment. Chemical treatment. Optimization of printing taking into account post-processing.	6				v			v		v				
44	Digital twins in mechanical engineering	The purpose of the discipline is to form knowledge of the concept of digital twins of processes in mechanical engineering, about the methods of computer modeling to support technologies, the possibility of creating and repairing industrial products. Methods of building digital copies of processes of varying complexity are studied; methods of creating digital and vector copies of products, working tools and wear-out parts without using design documentation; skills of working with modern CAD systems for the development of 3D models of processes and objects are improved.	5				v				v			v	
45	Professional engineer ethics	The purpose of this course is to provide the future engineer with the means to answer the question "Should we continue (or continue this engineering project?" Engineers use their skills to make positive changes in the world. What is a solution in one area, in one culture, in one industry, can become a problem and even a disaster in another. The discipline "Professional Ethics of an engineer" will help engineering graduates "understand their ethical responsibilities", as well as "understand the impact of engineering solutions in a global and social context"	5		v	v	v								
46	Production organization, planning and management	The purpose of mastering the discipline is to study the basic principles of the organization and planning of production and the formation of knowledge and skills used in making engineering decisions, the importance of scientific, technical and organizational preparation of production. The system of forecasts and plans of the enterprise, forms and methods of planning, basic methods of production management are studied. The skills of organizing and planning production, calculating the main technical and economic indicators of the main and auxiliary	6				v					v				

		production of an industrial enterprise, methods of planning, ensuring, evaluating and managing quality at all stages of the product life cycle are acquired.														
47	Enterprise management information technology (CASE)	The purpose of the discipline is to form a qualified specialist in the field of information technologies of machine-building production based on the use of the universal modeling language UML. Integrated production systems, integrated enterprise management, structural modeling of production systems, introduction to the UML language, principles of modeling, entities and general mechanisms of UML, ideal object-oriented CASE-tool, object-oriented techniques, identification of needs for CASE-tools, criteria for choosing CASE-tools, issues of transition to the practical use of CASE funds, local funds (ERwin, BPwin, S-Designor, CASE. Analyst), object-oriented CASE-tools (Rational Rose).	6					v				v			
48	Digitalization of machining processes	The purpose of the discipline is the formation of theoretical and practical knowledge on the design of digital technological processes for the production of machine-building products. The discipline studies the classification of metal-cutting machines, the structure of CNC machines, CNC systems, preparation and development of control programs. Design of technological operations on turning, grinding, milling, combined CNC machines. The features of designing technological processes in the conditions of flexible automated production, programming automation systems are considered. The skills of computer-aided design of technologies for the production of parts and assembly of machines are acquired.	6				v						v		
49	Programming of processing on CNC machines	The purpose of the discipline is theoretical and practical knowledge on the development of control programs for processing on CNC machines. The issues of preparation for the development of control programs, technological documentation, calculation of elements of the trajectory of the cutting tool, recording, control and editing of the control program are considered. Basic principles of automation of the process of preparation of control programs. The study of the automated workplace of a programmer technologist, a CNC machine operator. Various software products of SolidWorks, Autodesk are considered.	6										v	v	
50	Economics of quality, standardization and certification	This discipline is designed to consider the main provisions for assessing the economic efficiency of the quality of standardization and certification. The course is aimed at determining the economic effect of standardization, calculating the prevention of damage and the cost of certification work, determining the cost of certification work	5		v					v					
51	Sustainable development through standardization tools	A holistic system of quality of life standards. Methods of quality of life management. Development of unified approaches to the adoption of regulatory measures in the fields of economic and social policy	5		v					v					
52	Advanced processing methods	The purpose of the discipline is to acquire theoretical and practical knowledge of promising methods of surface treatment of machine parts in order to increase their strength, resource and wear resistance. The fundamental and applied aspects of the development and application of	5							v		v			

		vacuum and ion-plasma technology, laser, plasma and gas-dynamic methods of processing materials, methods for obtaining diamond-like coatings are considered. Skills of practical application of progressive methods of processing machine parts, application of methods of strengthening technological processes based on the use of various types of coatings are acquired.														
53	Precision processing methods	The purpose of the discipline is theoretical and practical knowledge of technical means of implementing processes (machines, tools, components, mechanisms and other technological equipment), at the stages of their creation and operation, processing of parts of high-precision dimensions using specialized tools and devices, ultra-precise measuring instruments. The issues of obtaining high-precision dimensions of parts, developing a graphical model of a part, software for computer-aided design (CAD), converting CAD to CAM are considered. The skills of designing and optimizing the parameters of tools and equipment, technological processes of mechanical and physico-technical processing are acquired.	5							v	v					
54	Theory and practice of project management	The purpose of mastering the discipline is to expand and deepen knowledge about modern project management technology and study the principles of using project management in practical tasks. Mastering the discipline involves an introduction to the problems of project management and the study of project management methodology, familiarization with the tools and methods of project management at all stages of the project life cycle, starting with initialization project, planning its work, organizing their use and control, and ending with completion.	5	v			v					v				
55	Capstone Project	The purpose of the discipline is the formation of a complex of theoretical knowledge and practical skills in management, maintenance and support of technical preparation of production. Practical possibilities are considered and professional skills of students to work in a team are formed. Students solve real engineering and technical problems of production, formation and implementation of the life cycle of machine-building products based on the collection of information, critical assessment of the feasibility of the project, in-depth analysis and execution of the project report.	5	v			v					v				

5. Curriculum of the educational program

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

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board
Rector of Kazatu named after K.Satpaye
M.M. Begentae
«01» 2023 y.

CURRICULUM
of Educational Program on enrollment for 2023-2024 academic year

Educational program 6B07131- "Design and technology in mechanical engineering"
Group of Educational programs B064 - "Mechanics and metalworking"

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

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	classroom volume of lek/lab/p	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on courses and semesters							
								I course		II course		III course		IV course	
								1 semester	2 semester	3 semester	4 semester	5semester	6 semester	7 semester	8 semester
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
M-1. Module of language training															
LNG 108	English language	GED, RC	10	300	0/0/6	210	E	5	5						
LNG 104	Kazakh (Russian) language	GED, RC	10	300	0/0/6	210	E	5	5						
M-2. Module of physical training															
KFK 101-104	Physical Culture	GED, RC	8	240	0/0/8	120	Difcredit	2	2	2	2				
M-3. Module of information technology															
CSE 677	Information and communication technologies (in English)	GED, RC	5	150	2/1/0	105	E				5				
M-4. Module of socio-cultural development															
HUM 101	History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE	5							
HUM 132	Philosophy	GED, RC	5	150	1/0/2	105	E				5				
HUM 120	Socio-political knowledge module (sociology, politology)	GED, RC	3	90	1/0/1	60	E				3				
HUM 134	Socio-political knowledge module (culturology, psychology)		5	150	2/0/1	150	E			5					
M-5. Module of anti-corruption culture, ecology and life safety base															
HUM 136	Fundamentals of Anti-corruption Culture and Law	GED, CCH	5	150	2/0/1	150	E			5					
MNG 489	Fundamentals of Economics and Entrepreneurship														
MSM500	Fundamentals of scientific research methods														
CHE 656	Ecology and life safety														
CYCLE OF BASIC DISCIPLINES (BD)															
M-6. Module of physical and mathematical training															
MAT 101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5							
PHY 111	Physics I	BD, UC	5	150	1/1/1	105	E	5							
MAT 102	Mathematics II	BD, UC	5	150	1/0/2	105	E		5						
PHY112	Физика II	BD, UC	5	150	1/1/1	105			5						
M-7. Engineering design module															
MSM132	Introduction to engineering design	BD, UC	5	150	1/2/0	105	E	5							
MSH501	Classical mechanics	BD, UC	4	120	1/0/2	75	E	4							
MCH502	Mechanics of materials	BD, UC	5	150	1/1/1	105	E			5					
MCH503	Graphic design of machine parts (CAD)	BD, UC	5	150	1/2/0	105	E			5					
MCH504	Interchangeability and basis of technical measurements	BD, UC	5	150	1/1/1	105	E			5					
MCH505	Modern construction materials	BD, UC	5	150	1/2/0	105	E				5				
MSM410	Theory of mechanisms and machine parts	BD, UC	5	150	1/1/1	105	E			5					
MCH506	Fundamentals of electrical engineering and industrial electronics	BD, UC	4	120	1/1/1	75	E				4				
MCH507	Design of foundry and forging technologies	BD, UC	5	150	1/0/2	105	E					5			
MCH508	Subtractive technologies	BD, UC	5	150	1/1/1	105	E					5			
MCH510	Engineering equipment of machine-building production	BD, UC	5	150	1/0/2	105	E					5			
MCH512	Technical design of machine-building equipment	BD, UC	5	150	1/2/0	105	E						5		
MSM136	Engineering economics	BD, UC	5	150	1/0/2	105	E						5		
MCH517	Design of automated machines and complexes	BD, UC	5	150	1/0/2	105	E							5	
MSM149	Hydraulics and hydraulic pneumatic drive	BD, EC	5	150	1/0/2	105	E					5			

3201	Elective	BD, EC	5	150	1/0/2	105	E					5			
3202	Elective	BD, EC	5	150	1/0/2	105	E						5		
3203	Elective	BD, EC	5	150	2/1/0	105	E						5		
AAP196	Educational practice	BD, UC	2						2						
CYCLE OF PROFILE DISCIPLINES (PD)															
M-8. Digital production organization module															
MCH518	Computer-aided design systems and design of machine structures	PD, UC	4	120	1/2/0	75	E					5			
MCH519	CAE/CAD tooling design and modeling	PD, UC	5	150	1/2/0	105	E						4		
HYD482	Occupational health and industrial safety (by industry)	BD, UC	5	150	2/0/1	105	E							5	
MCH522	Production engineering	PD, UC	5	150	1/0/2	105	E							5	
4301	Elective	PD, CCh	4	150	1/2/0	105	E							5	
4302	Elective	PD, CCh	6	180	2/2/0	120	E								5
4303	Elective	PD, CCh	6	180	2/0/2	120	E							6	
4304	Elective	PD, CCh	5	150	1/0/2	105	E							6	
4305	Elective	PD, CCh	5	150	1/0/2	105	E								5
4306	Elective	PD, CCh	5	150	1/1/1	105	E								5
AAP197	Industrial practice I	PD, UC	2								4				
AAP198	Industrial practice II	PD, UC	3										6		
M-9. Management module															
4307	Elective R&D	PD, CCh	5	150	2/0/1	105	E								5
M-10. Module of final attestation															
ECA108	Final certification	FC	8												8
M-11. Module of additional types of training															
AAP500	Military training	ATT	0												
Total based on UNIVERSITY:								31	29	32	28	30	30	32	28
								60		60		60		60	

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
		required component (RC)	university component (UC)	component of choice (CCH)	Total
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of basic disciplines		100	15	115
PD	Cycle of profile disciplines		24	37	61
	Total for theoretical training:	*51*		*57*	*232*
FA	Final attestation	8			8
	TOTAL:	59	124	57	240

Decision of the Academic Council of Kaznu named after K.Satpayev. Protocol № 9 от "25" 01 2025 y.

Decision of the Educational and Methodological Council of Kaznu named after K.Satpayev. Protocol № 4 от "10" 01 2025 y.

Decision of the Academic Council of the Institute E&ME. Protocol № 3 от "14" 11 2024 y.

Vice-Rector for Academic Affairs — B. A. Zhautikov

E&ME Institute Director — K.Yelemessov

ME Department Head — E.Nugman

Specialty Council representative from employers — I. Dyusebaev

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY after K. SATBAYEV

SATBAYEV UNIVERSITY

APPROVED
Director of the Institute E&ME
K. Yelemessov
2023

MAJOR ELECTIVE DISCIPLINES educational program for the 2023-2024 academic year admission
Educational program 6B07131- "Design and technology in mechanical engineering"
Group of Educational programs B 064 - "Mechanics and metalworking"

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

Year of study	Code of elective	Code of discipline	Name of discipline	Semestr	Cycle	Credits	Total hours	lec/lab/pr	SIW (including SIWT) in hours
	Engineering design module								
3	3201	MSM106	Probabilistic models in industrial engineering	5	БД КВ	5	150	1/1/1	105
		MCH511	Finite element method in engineering						
	3202	MCH513	Cutting tool life cycle	6	БД КВ	5	150	1/1/1	105
		MCH514	Cutting tool manufacturing technologies						
	3203	MCH515	Reverse engineering	6	БД КВ	5	150	1/2/0	105
		MCH516	3D Scanning techniques and technologies						
	Digital production organization module								
4	4301	MCH523	Digital twins in mechanical engineering	7	ПД КВ	5	150	1/2/0	105
		MCH524	Professional engineer ethics					2/0/1	
	4302	MCH520	Additive manufacturing design	8	ПД КВ	5	150	1/2/0	105
		MCH521	Additive manufacturing processes						
	4303	MCH525	Production organization, planning and management	7	ПД КВ	6	180	2/0/2	120
		MCH526	Enterprise management information technology (CASE)					1/1/2	
	4304	MCH527	Digitalization of machining processes	7	ПД КВ	6	180	2/2/0	120
		MCH528	Programming of processing on CNC machines						
	4305	SCM115	Economics of quality, standardization and certification	8	ПД КВ	5	150	1/0/2	105
		SCM116	Sustainable development through standardization tools						
	4306	MCH529	Advanced processing methods	8	ПД КВ	5	150	1/1/1	105
		MCH530	Precision processing methods						
	Management module								
4	4307	MSM418	Capstone Project	8	ПД КВ	5	150	1/2/0	105
		MNG481	Theory and practice of project management					2/0/1	

Credits numbers of elective disciplines over the entire period of study	
Cycle of disciplines	Credits
Cycle of basic disciplines (B)	15
Cycle of special disciplines (S)	37
Overall:	52

Decision of the Academic Council of the Institute_ E&ME__. Protocol № 3 от "14" 11 2022y.

ME Department Head E.Nugman

Representative of the Council for ЕР from Employers I. Dyusebaev