A. Burkitbayev Institute of Power and Mechanical Engineering

Department of «Mechanical engineering»

EDUCATIONAL PROGRAM

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

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

Almaty 2025

Educational program 6B07131 – Design and technology in mechanical
(code and name of educational program)
engineering
was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

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Educational program 6B07131- Design and technology in mechanical
(code and name of educational program)
Engineering

was developed by Academic committee on direction of "6B071- Engineering and Technology "

Full name	Academic degree/ academic title	Position	Workplace	Signature
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Students				
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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
SDGs	Sustainable development goals

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 Purpose and objectives of the educational program

Purpose of EP:

EP 6B07131- Design and technology in mechanical engineering -
training of qualified and in-demand specialists in the labor market who are able to develop and implement innovative technological and design solutions, apply additive, scientific and resource-saving technologies aimed at the sustainable development of mechanical engineering, socio-economic and environmental development of society.

Tasks of EP:

- 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 educational program learning outcomes

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

№	Field name	Comments
1	Code and classification of the field of education	6B07- Engineering, manufacturing and consruction industries
2	Code and classification of training directions	6B071- Engineering and engineering affairs
3	Educational program group	B064- Mechanics and metal working
4	Educational program name	6B07131- Design and technology in mechanical engineering
5	Short description of 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	Purpose of EP	Training of qualified and in-demand specialists in the labor market who are able to develop and implement innovative technological and design solutions, apply additive, scientific and resource-saving technologies aimed at the sustainable development of mechanical engineering, socio-economic and environmental development of society.
7	Type of EP	Innovative
8	The level based on NQF	6
9	The level based on IQF	6
10	Distinctive features of EP	-
11	List of competencies of 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 educational program	LO 1 Apply communication skills, creativity, strategic thinking, teamwork, a culture of academic integrity, knowledge of economic laws, life safety and ecology, elements of artificial intelligence, multicultural skills, inclusive education skills. LO 2 Apply basic knowledge in the field of mathematical, natural and economic sciences in professional activities. LO 3 Apply general engineering knowledge in the design of structures and technological processes of machine production. LO 4 Perform engineering design of machinery and equipment structures, modeling of tooling and cutting tools using modern information technologies, providing an innovative, sustainable and inclusive approach to design and production. LO 5 Choose and apply modern engineering materials, equipment and tooling in the design of subtractive and additive technologies. LO 6 To develop design, engineering and technological documentation in accordance with the requirements of regulatory and technical documentation, ensuring the implementation of innovative and resource-saving solutions for the sustainable development of production. LO 7 Apply advanced processing methods, production technologies for machine parts and cutting tools.

		LO 8 Demonstrate the skills of designing automated equipment and processing on numerically controlled machine. LO 9 Perform analysis and evaluation of the accuracy of technical measurements, processing quality and economic indicators at all stages of machine-building production. LO 10 Apply innovative methods of project management and planning of machine-building production for the purpose of sustainable industrialization and infrastructure development. LO 11 Apply digital twinning and reverse engineering techniques to develop resource-efficient and environmentally friendly technologies. LO 12 To solve the problems of occupational safety, environmental safety and quality management in mechanical engineering, taking into account the principles of sustainable industrialization and responsible production.
13	Education form	full-time
14	Period of training	4 years
15	Amount of credits	240
16	Languages of instruction	Kazakh, russian
17	Academic degree awarded	Bachelor of engineering and technology
18	Developer(s) and authors	The educational program was developed by Academic committee on direction "6B071- Engineering and Technology "

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 Component of choice															
1	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											
2	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	v										
3	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 solve environmental problems; life safety in the technosphere; natural and man-made emergencies	5	v	v										

4	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										
5	Basics of Financial Literacy	Purpose: formation of financial literacy of students on the basis of building a direct link between the acquired knowledge and their practical application. Contents: using in practice all kinds of tools in the field of financial management, saving and increasing savings, competent budget planning, obtaining practical skills in calculating, paying taxes and correctly filling out tax reports, analyzing financial information, orienting in financial products to choose adequate investment strategies.	5	v											
Cycle of basic disciplines University component															
6	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										
7	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										
8	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	5		v		v								

		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.													
9	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								
10	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		v						
11	Production workshops	The purpose of the discipline is to form knowledge about the technological processes of manufacturing machine parts and practical knowledge of metalworking. The workshops study the locksmith's workplace, locksmith and cutting tools, tool materials, work on universal metal-cutting machines (turning, drilling, milling and grinding). Familiarity with the purpose and classification of machines. Machining of workpieces on sheet bending machines, laser machine with numerical control, milling machining center.	5	v						v					
12	The theoretical mechanics	The purpose of the discipline is to form the foundations of engineering thinking among students by studying the basics of mechanics and mastering the basic principles and laws of theoretical mechanics The content of the discipline: the basic laws of mechanical motion and mechanical interaction of material bodies; the basic concepts of the law of mechanics, methods for studying the equilibria of motion of a material point, a solid and a mechanical system	5		v	v									
13	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,	5		v	v									

		torsion and bending), dynamic action of forces, calculation of structural elements beyond elasticity.														
14	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					
15	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.	5			v						v				
16	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, 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.	5					v								v
17	Bases of designing and details of cars	Purpose: to acquire knowledge of calculations and design of machine parts and assemblies, taking into account the criteria of strength, reliability and stability.Contents_ general principles of design and construction, construction of models and calculation algorithms for standard machine parts taking into account performance criteria, fundamentals of theory and methodology for calculating standard machine parts, computer technologies for designing assemblies and machine parts. Basic requirements for machine parts and assemblies_	5			v			v							
18	Electrical and Electronic Engineering	The purpose of the discipline is to acquire theoretical and practical knowledge on the basics of electrical engineering and electronics. The basic laws of the processes occurring in electromagnetic and electronic circuits and methods for determining the electrical quantities characterizing these processes are studied. Methods of calculation of DC electric circuits are studied; analysis and calculation of linear AC circuits; analysis and	5		v			v								

		calculation of magnetic circuits. Electromagnetic devices and electrical machines. Fundamentals of electronics and electrical measurements. The element base of modern electronic devices. Fundamentals of digital and microelectronics, microprocessor tools.														
19	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 designing technological processes for the manufacture of blanks by casting and forging production methods.	5						v	v						
20	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						
21	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						
22	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							
23	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	5		v							v				

		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.														
24	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									
25	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	
Cycle of basic disciplines Component of choice																
26	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					
27	Fundamentals of Artificial Intelligence	Purpose: to familiarize students with the basic concepts, methods and technologies in the field of artificial intelligence: machine learning, computer vision, natural language processing, etc. Contents: general definition of artificial intelligence, intelligent agents, information retrieval and state space exploration, logical agents, architecture of artificial intelligence systems, expert systems, observational learning, statistical learning methods, probabilistic processing of linguistic information, semantic models, natural language processing systems.	5	v	v											

28	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								
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. Content: 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.	5	v		v										
30	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	
31	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 Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.	5												v	v
Cycle of profile disciplines University component																
32	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							

33	Engineering Product Lifecycle Management	The purpose of the discipline is to generate knowledge in the field of automation of industrial product life cycle management, basic methods and technologies of life cycle management systems. Practical skills are acquired in automated systems of technical preparation of production and management, automated systems of enterprise management (PDM- product data management, PLM-Product Lifecycle Management), their individual subsystems, optimization of management according to the criterion of economic efficiency and high competitiveness of products, organization of a single information space about the product.	5										v		v
34	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					
35	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	
36	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.	5					v		v					
37	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 production of an industrial	6							v		v	v		

		enterprise, methods of planning, ensuring, evaluating and managing quality at all stages of the product life cycle are acquired.													
Cycle of profile disciplines Component of choice															
38	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	
39	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				
40	Innovative technologies in mechanical engineering	The purpose of the discipline is to acquire theoretical and practical knowledge and skills in the field of innovative technologies in mechanical engineering, technological processes of repair and restoration of worn parts and machine components. The discipline examines innovative technologies in mechanical engineering, including modern methods of obtaining blanks by casting, pressure treatment, powder metallurgy and cutting, processing methods, designs of metal-cutting machines, tools for the manufacture of complex parts, methodological foundations for the construction of modern technological processes of mechanical processing and assembly of machine-building products.	5					v		v					v
41	Additive Manufacturing	The purpose of the discipline is the formation of theoretical knowledge and practical skills in the application of additive manufacturing methods. The concept of additive manufacturing processes. The history of the emergence and development of additive technologies. 3D modeling as the basis of additive technologies. The main methods of additive technologies are: FDM, SLA, DLP, SLS/SLM, LOM, MJM, computers. Preparing 3D models for printing The concept of slicers. Variations and the ratio of printing parameters. Defects and their classification. Post-processing. Optimization of printing taking into account post-processing.	5					v		v					
42	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	5							v		v			

		fundamental and applied aspects of the development and application of 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.														
43	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				
44	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
45	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					

5. Curriculum of the educational program

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: 6B07131 - "Design and technology in mechanical engineering"
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)																	
M1 Module of language training																	
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							
M2 Module of physical training																	
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					
M3 Module of information technology																	
CSE677	Information and communication technology		GED, RC	5	150	30/15/0	105	E				5					
M4 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					
M5 Module fundamentals of anti-corruption culture, ecology and life safety																	
MSM500	Fundamentals of scientific research methods	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						
HUM136	Fundamentals of anti-corruption culture and law	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)																	
M6 Module of physical and mathematical training																	
MAT101	Mathematics I		BD, UC	5	150	15/0/30	105	E	5								
PHY111	Physics I		BD, UC	5	150	15/15/15	105	E	5								

MAT102	Mathematics II		BD, UC	5	150	15/0/30	105	E		5							MAT101
PHY112	Physics II		BD, UC	5	150	15/15/15	105	E		5							PHY111
M7 General technical training module																	
MSM132	Introduction to engineering design		BD, UC	5	150	15/30/0	105	E	5								
AAP419	Educational practice		BD, UC	1				R		1							
ISO111	Production workshops		BD, UC	5	150	0/0/45	105	E		5							
GEN412	The theoretical mechanics		BD, UC	5	150	30/0/15	105	E			5						
MCH503	Graphic design of machine parts (CAD)		BD, UC	5	150	15/30/0	105	E			5						
ELC101	Electrical and Electronic Engineering		BD, UC	5	150	15/15/15	105	E			5						
MCH505	Modern construction materials		BD, UC	5	150	15/30/0	105	E				5					
MCH502	Mechanics of materials		BD, UC	5	150	15/15/15	105	E				5					
GEN125	Bases of designing and details of cars		BD, UC	5	150	15/15/15	105	E				5					
MCH504	Interchangeability and basis of technical measurements		BD, UC	5	150	15/15/15	105	E					5				
MCH507	Design of foundry and forging technologies		BD, UC	5	150	15/0/30	105	E					5				
MCH510	Engineering equipment of machine-building production		BD, UC	5	150	15/0/30	105	E					5				
MCH512	Technical design of machine-building equipment		BD, UC	5	150	15/30/0	105	E					5				
MSM149	Hydraulics and hydraulic pneumatic drive		BD, UC	5	150	15/0/30	105	E					5				
MCH508	Subtractive technologies		BD, UC	5	150	15/15/15	105	E						5			
MCH511	Finite element method in engineering	1	BD, CCH	5	150	15/15/15	105	E						5			
CSE831	Fundamentals of Artificial Intelligence	1	BD, CCH	5	150	15/0/30	105	E						5			
MCH513	Cutting tool life cycle	2	BD, CCH	5	150	15/15/15	105	E						5			
MNG562	Legal regulation of intellectual property	2	BD, CCH	5	150	30/0/15	105	E						5			
MCH515	Reverse engineering	3	BD, CCH	5	150	15/30/0	105	E						5			
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan	3	BD, CCH	5	150	30/0/15	105	E						5			
MSM136	Engineering Economy		BD, UC	5	150	15/0/30	105	E							5		
M8 Module of production and technological preparation																	
HYD482	Occupational health and industrial safety (by industry)		BD, UC	5	150	30/0/15	105	E							5		
CYCLE OF PROFILE DISCIPLINES (PD)																	
M8 Module of production and technological preparation																	
AAP420	Industrial practice I		PD, UC	3				R				3					
MCH518	Computer-aided design systems and design of machine structures		PD, UC	5	150	15/30/0	105	E					5				
AAP421	Industrial practice II		PD, UC	5				R						5			
MCH529	Advanced processing methods	1	PD, CCH	5	150	15/15/15	105	E						5			
MCH530	Precision processing methods	1	PD, CCH	5	150	15/15/15	105	E						5			
MSM467	Engineering Product Lifecycle Management		PD, UC	5	150	15/0/30	105	E							5		
MCH522	Production engineering		PD, UC	5	150	15/0/30	105	E							5		
MCH523	Digital twins in mechanical engineering		PD, UC	5	150	15/30/0	105	E							5		
MSM192	Innovative technologies in mechanical engineering	2	PD, CCH	5	150	15/0/30	105	E							5		
MSM119	Additive Manufacturing	2	PD, CCH	5	150	30/0/15	105	E							5		
MCH521	Additive manufacturing processes		PD, UC	5	150	15/30/0	105	E								5	
MCH525	Production organization, planning and management		PD, UC	6	180	30/0/30	120	E								6	
MCH527	Digitalization of machining processes	3	PD, CCH	6	180	30/30/0	120	E								6	
MCH528	Programming of processing on CNC machines	3	PD, CCH	6	180	30/30/0	120	E								6	
M9 «R&D» Management Module																	
MNG481	Theory and practice of project management	1	PD, CCH	5	150	30/0/15	105	E								5	
MSM418	Capstone Project	1	PD, CCH	5	150	15/30/0	105	E								5	
M10 The module of final certification																	
ECA103	Final examination		FA	8												8	
Additional type of training (ATT)																	

AAP500	Military training																			
Total based on UNIVERSITY:									32	28	30	30	30	30	30	30				
									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	0	5	56
BD	Cycle of basic disciplines	0	101	15	116
PD	Cycle of profile disciplines	0	39	21	60
Total for theoretical training:		51	140	41	232
FA	Final attestation				8
TOTAL:					240

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. B.

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 - Mechanical Engineering — Nugman E. .

Representative of the Academic Committee from Employers ____Acknowledged____ — Andreev V. I.