A. Burkitbayev Institute of Power and Mechanical Engineering

Department of «Mechanical engineering»

EDUCATIONAL PROGRAM

6B07220 - Machines and technologies for processing new materials

(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:
6B072- Industrial and manufacturing branches
Group of educational programs:
B069 Production of materials (glass, paper, plastic, tree)
Level based on NQF: 6
Level based on IQF: 6
Study period: 4 years
Amount of credits: 240

Almaty 2025

Educational program 6B07220 – Machines and technologies for
(code and name of educational program)

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

Minutes 10 dated «06» 03 2025.

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

Minutes 3 dated « 20 » 12 2024.

Educational program 6B07220 – Machines and technologies for
(code and name of educational program)
processing new materials

was developed by Academic committee on direction "6B072- Industrial and manufacturing branches"

Full name	Academic degree/ academic title	Position	Workplace	Signature
Teaching staff:				
Nugman E.Z.	Doctor PhD, Associate Professor	Head of the Department of "Mechanical Engineering"	Institute of Energy and Mechanical Engineering named after A.Burkitbaev	
Kerimzhanova M.F.	Candidate of Technical Sciences, Docent	Professor	Department of Mechanical Engineering	
Uderbayeva A.E.	Doctor PhD	Assoc. Professor	Department of Mechanical Engineering	
Employers:				
Andreev V.I.		General Director	Kazecotech STE LLP	
Students				
Myrzakhan A.		1st year doctoral 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
SDGs	Sustainable development goals

1 Description of the educational program

EP 6B07220 - "Machines and Technologies for Processing New Materials" is focused on learning outcomes that form professional competencies in accordance with the requirements of the labor market.

The objects of professional activity of the bachelor according to EP 6B07220 are machine-building plants, repair and mechanical facilities of power systems, metallurgical enterprises, transport and automotive enterprises, mining and processing industries, research organizations, design and technological organizations, marketing, transport and operational services, and service stations.

A Bachelor in EP 6B07220 - "Machines and Technologies for Processing New Materials" can perform the following professional activities:

Design and technological development, implementation, and operation of system-based, resource-saving technologies; development and implementation of technological processes for processing and assembling products; automation of machine-building production; creation of continuous-flow production processes, automated complexes, and flexible manufacturing systems; introduction of highly efficient technological equipment ensuring the environmental sustainability of machine-building production.

Organizational and managerial: organization of the production process and the work of personnel; setting goals and formulating management tasks related to the implementation of professional functions; organization of production services; management of the production process, taking into account technical, financial, and human factors; development of control algorithms; accounting and reporting, business plan development, and planning to improve production efficiency.

Experimental and research: use of modern experimental methods for studying processes occurring in machine-building production; research in new directions of modern mechanical engineering technologies; study of processing methods in mechanical engineering; research of automation systems in mechanical engineering; scientific substantiation of methods for ensuring product quality and increasing labor productivity.

Design and engineering: development of advanced designs; optimization of design solutions, taking into account environmental and energy-saving technologies; examination of design and technological developments; development of conceptual, technical, and detailed designs of complex products using computer-aided design tools and best practices for creating competitive products; carrying out technical calculations for projects; technical, economic, and functional cost analysis of the effectiveness of designed products and structures; assessment of the innovative potential of projects; assessment of commercialization risks of projects.

Based on the theoretical and practical knowledge gained, the bachelor of technical sciences in the educational program forms professional competencies and must:

have an idea:

- about scientific, philosophical, and religious worldviews; about the essence, purpose, and meaning of human life; the variety of forms of human knowledge; and spiritual values in creative and everyday life;

- about the processes and phenomena occurring in animate and inanimate nature; the possibilities of modern scientific methods of understanding nature for solving natural science and professional problems;

- about the essence and social significance of their future profession, the importance of the disciplines that define the specific area of their activity, and their interrelation within an integrated system of knowledge;

- about the role of science in the development of civilization, the relationship between science and technology and related modern social and ethical problems, and the value of scientific rationality;

- about the main directions, trends, problems, and achievements in the field of metal forming (pressure processing) of various materials;

- about the features of plastic deformation and shaping of metallic and non-metallic materials;

- about advanced technologies for metal forming (pressure processing);

- about issues of environmental protection, ecology, and occupational health and safety.

know:

- theoretical foundations of the initiation of plastic deformation and the influence of thermomechanical and structural factors on the technological and operational properties of products and semi-finished products;

- the relationship between the composition of raw materials, technological stages, and the technical and economic indicators of processes;

- methods for predicting, calculating, and evaluating plastic and strength properties in developing rational shaping and deformation modes;

- basic principles of modeling technological processes under different stress-state schemes and loading conditions;

- methods for calculating the parameters of technological processes and the main characteristics of metal forming (OMD) operations;

- the main methods of developing CAD systems for material processing and selecting control parameters of the technological cycle to obtain high-quality products;

- fundamentals of economic theory and industrial economics;

- issues of occupational health and safety, as well as environmental legislation;

be able to:

- use regulatory and legal documents related to professional activities;

- conduct professional dialogue in the state and foreign languages using the rules of speech etiquette; read professional literature without a dictionary for information retrieval; translate texts using a dictionary; prepare annotations, abstracts, and business correspondence in a foreign language;

- analyze the possibilities of shaping and plastic deformation of various materials when varying temperature-rate, deformation-geometric, and structural-phase parameters;

- formulate technical and economic requirements for organizing and managing technological processes of metal forming (pressure processing);

- assess product quality, identify and eliminate the causes of defects, and develop preventive measures;

- analyze the production and economic activities of a department and/or the entire enterprise, including the use of modern software tools;

- ensure compliance with technological and labor discipline;

- use information technologies and application software packages to solve design and production problems.

have skills:

- knowledge of the state language and the language of interethnic communication; a lexical and grammatical minimum in one foreign language;

- knowledge of the basics of industrial relations and management principles, taking into account technical, financial, psychological, and human factors;

- ability to work with software products and modern information technologies for searching, collecting, processing, analyzing, and storing scientific and technical information;

- possession of specialized scientific terminology in the field of metal forming (pressure processing);

- design and production of equipment and tools for OMD operations, and organization of material processing workshops;

- selection of the necessary equipment, preparation of technological (route) maps, calculation of technical and economic indicators of production efficiency, and reduction of non-productive costs;

- mathematical modeling of OMD processes and optimization of material pre-treatment modes, including thermal and deformation processing methods.

be competent:

- in matters of technological and environmental safety, protection of human life, compliance with legal norms and international standards, and the application of modern information technologies used internationally.

The graduate of the educational program must:

1. Possess broad fundamental knowledge, demonstrate initiative, have the ability to adapt to changing labor market and technological requirements, and be able to work effectively in a team (general educational competencies);

2. Know the ethical and legal norms regulating relationships between individuals, society, and the environment, and be able to consider them when developing environmental and social projects (socio-ethical competencies);

3. Be able to perform commercial, financial, and administrative management functions; possess skills in situational and market analysis; apply economic management methods (commercial accounting, financial policy development, program-target management methods); use methods of modeling economic processes and evaluating economic projects; and demonstrate a professional approach to addressing key issues in economic and production management (economic and organizational-managerial competencies);

4. Be able to build and use models to describe and predict various phenomena and carry out their qualitative and quantitative analysis (professional competencies).

2 Purpose and objectives of additional educational program

Purpose of EP:

Training highly qualified and competitive specialists capable of successfully solving scientific and engineering problems in the field of materials processing, taking into account the principles of sustainable development. The program focuses on the design and implementation of advanced, resource-saving, and environmentally sound technological processes, the development of innovation-driven employment, as well as ensuring high-quality, accessible, and practice-oriented education in order to support the implementation of the Sustainable Development Goals (SDGs).

Tasks of EP:

- formation of knowledge in modern information technologies;
- acquisition of theoretical and practical knowledge in computer-aided design of blank production products;
- mastery of methods of mathematical and 3D modeling;
- acquisition of professional competencies in accordance with industry professional standards;
- acquisition of knowledge of the fundamentals of technological processes of stamping, forging, and rolling, as well as the design of technological processes for producing blanks;
- acquisition of knowledge of new materials, nanomaterials, nanopowders, and technologies for their production;
- formation of knowledge about the main trends in the development of technologies for processing new materials and the implementation 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 construction industries
2	Code and classification of training directions	6B072 - Industrial and manufacturing branches
3	Educational program group	B069- Production of materials (glass, paper, plastic, tree)
4	Educational program name	6B07220 Machines and technologies for

		processing new materials
5	Short description of educational program	The educational program "Machines and Technologies for Processing New Materials" provides fundamental knowledge in manufacturing technologies, including material forming and pressure processing. Students gain in-depth expertise through specialized courses in composite and polymer material processing, additive manufacturing, and modern engineering systems such as CAD/CAM/CAE/PLM/PDM.The program develops skills in modeling and analyzing various material processing operations, plastic deformation processes, production system design, and industrial engineering. Students also acquire competencies in designing forming machinery, operating modern computer-controlled equipment, including additive manufacturing systems. Special emphasis is placed on part manufacturing, technological process planning, development and implementation of control programs, and preparation of technical documentation for manufacturing process design.
6	Purpose of EP	The program aims to train highly qualified and competitive specialists capable of effectively addressing scientific and engineering challenges in the field of materials processing, with consideration for sustainable development principles. The program is focused on the design and implementation of advanced, resource-efficient, and environmentally sustainable technological processes. It also promotes innovation-driven employment and ensures high-quality, accessible, and practice-oriented education in support of the implementation of the Sustainable Development Goals (SDGs).
7	Type of EP	New
8	The level based on NQF	6
9	The level based on IQF	6
10	Distinctive features of EP	No
11	List of competencies of educational program	- Ability to apply general engineering knowledge and methods of mathematical analysis and modeling in professional practice; Ability to analyze and evaluate production and technological processes; - Ability to use modern information technologies for modeling technological processes and metal forming operations; - Ability to apply advanced methods for the design and calculation of die tooling and forming equipment in blanking and preforming production;

		- Ability to apply advanced materials, their manufacturing technologies, and additive manufacturing technologies.
12	Learning outcomes of educational program	LO1. Demonstrate commitment to ethical values, socio-cultural and professional communication skills, academic integrity, and the ability to apply knowledge of economics, occupational health and safety, environmental protection, artificial intelligence elements, multicultural awareness, and inclusive education principles. LO2. Apply fundamental knowledge of mathematics, physics, electrical engineering, intellectual property, research methodology, and the principles of interchangeability and standardization in equipment manufacturing. LO3. Apply knowledge in the design of machine structural elements using advanced materials and modern methods for strength, stiffness, and stability analysis. LO4. Select innovative technologies for manufacturing machine parts, advanced engineering materials, product lifecycle automation methods, and digital engineering technologies. LO5. Develop and implement engineering solutions in compliance with international quality standards and design engineering systems with consideration of economic efficiency and innovation. LO6. Use process modeling methods, software tools, and computer-aided design (CAD) technologies to solve engineering problems in the field of metal forming and pressure processing. LO7. Apply knowledge of hydraulics and hydraulic/pneumatic drive systems, metal forming theory, forging, and stamping in the design of tooling and technological equipment. LO8. Select resource-efficient, energy-saving, information-based, and environmentally sustainable technologies for forging, stamping, and press production. LO9. Apply principles of engineering economics, environmental safety, and sustainable production planning in forging and stamping operations while minimizing environmental impact. LO10. Apply modern innovative technologies that contribute to industrial development and continuous quality improvement.
13	Education form	full-time
14	Period of training	4 years
15	Amount of credits	240
16	Languages of instruction	russian, kazakh

17	Academic degree awarded	Bachelor of Engineering and Technology
18	Developer(s) and authors	The educational program was developed by Academic committee on direction "6B072 - Industrial and manufacturing branches"

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

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)									
				ON1	ON 2	ON 3	ON 4	ON 5	ON 6	ON 7	ON 8	ON 9	ON10
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	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									
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	5	v						v			

		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												
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	5		v									

		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.											
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 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					
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 methodology of engineering design. Stages of creating cars. Design procedures. Principles of engineering design. Engineering design methods. Manufacturability of machine designs.	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	Standardization, interchangeability and technical measurements	The purpose of studying the discipline is to form students' knowledge of the basics of standardization, interchangeability and practical skills in performing technical measurements. The discipline studies the basic principles of standardization, types of interchangeability, uniform principles of building tolerance and fit systems for standard joints. Accuracy standards of smooth cylindrical, keyway, spline, threaded connections, cylindrical gears. Tolerances and fits of rolling bearings. Methods of measurement, measuring instruments and methods of processing multiple technical measurements are studied.	5		v			v					
13	Classic 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				
14	Equipment for machine-building production	The purpose of the discipline is to provide students with professional knowledge of equipment used in mechanical engineering. To give an idea of the basic kinematic characteristics of the equipment, to teach how to read diagrams. To develop the ability to analyze and make informed decisions when designing stamping equipment using innovative and controlled systems, safe and ergonomic equipment, and waste management. Designing equipment with minimal resources, using energy- and resource-saving technologies in mechanical engineering	5					v					v
15	Materials Science and Structural materials	The purpose of the discipline is to acquire theoretical and practical knowledge in the field of materials science, technology for the production and processing of structural materials. The basics of materials science are studied: classification of materials; interrelation of structure, properties and processing technology. Metal and polymer materials, composite polymer and composite materials are studied. The problems of corrosion and methods of corrosion protection, surface and anticorrosive coatings are considered. Students acquire knowledge and skills for the effective selection, processing and application of structural materials in engineering practice.	5			v	v						

16	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 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.	5	v	v								
17	Strength of materials	Stretching and compression. Stresses in cross sections and deformations of a straight rod. Mechanical properties of materials under tension and compression. Calculation of strength and stiffness in tension-compression. Geometric characteristics of flat sections. Shear and torsion. Calculation of strength and torsional stiffness. Bend. Normal and tangential bending stresses. Calculation of bending strength. Theory of stressed and deformed states. The limit state hypothesis. Complex resistance. Stability of the equilibrium of deformable systems. Dynamic load.	5		v	v							
18	Heating and heating devices	The purpose of the discipline is to provide knowledge of: modern methods of heating workpieces for subsequent pressure treatment; designs of heating installations used for these purposes; solving problems related to the design, search and selection of furnace designs and heating installations. The basic principles of the theory of heat transfer, the mechanics of gases, the principles of calculation and selection of fuel, the basics of calculation of technological processes of metal heating are considered. Basic principles of design, selection of heating devices; design of heating devices, their application in the design of forging and stamping shops, sites.	4					v			v		
19	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	5		v	v							

		and methodology for calculating standard machine parts, computer technologies for designing assemblies and machine parts. Basic requirements for machine parts and assemblies_											
20	Test and Measurement, Measurements and Statistics	The purpose of the discipline is to master the principles, methods and means of measurement, as well as the skills of statistical processing of results. Students gain knowledge about metrological fundamentals, quality control methods, and data analysis. They study control and measuring devices, methods and measuring instruments. Principles of operation of measuring instruments, calibration and verification of instruments. Quality control and process management, methods of statistical quality control, optimization and use of control maps and rationing. They acquire practical skills in the use of control and measuring instruments, quality analysis and measurement process management.	5		v						v		
21	Forging and hot stamping technology	The main purpose of the discipline is to study the methods of manufacturing forgings, the operations of technological processes, the principles of designing forgings and die tooling. Production of workpieces and parts by forging and hot stamping selection and calculation of the stamping force, temperature regime, tools for processing metals and alloys. Study of the structure, mechanical properties of forgings and finished products after the forging and hot stamping process. Study of the structure, mechanical properties of forgings and finished products after the forging and hot stamping process.	5					v		v			
22	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		

23	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 scanners, practical skills are acquired to create three-dimensional models of real machine-building objects.	5						v				v
24	Automated design of PMP processes	The purpose of the discipline is to acquire theoretical and practical knowledge in the field of computer-aided design of technological processes for processing materials by pressure. The discipline outlines the basic principles of modeling and CAD development of OMD processes. Aspects of constructing algorithms for calculating specific CAD tasks are considered. Examples of the use of various CAD systems for tool design are presented OMD - QForm technological process modeling program.	6			v		v	v				
25	Occupational health and industrial safety (by industry)	Purpose: formation of knowledge, skills and abilities of students on the occupational health and safety management system at enterprises, taking into account industry specifics. Contents: regulatory and legal framework for occupational safety; harmful production factors; accidents and occupational diseases at work; industrial sanitation and occupational health; regulatory and technical regulation in the field of industrial safety; measures to protect employees at the enterprise	5	v							v		v
Cycle of basic disciplines Elective component													
26	Theory of materials processing by pressure	In the process of studying the discipline, students acquire skills in the comprehensive analysis of technologies and equipment for special methods of metal forming (OMD). Group methods of cold stamping. Rubber-pad stamping, operations performed by the rubber-pad forming method. Tooling for rubber-pad stamping. Hydroforming. Tooling and equipment for hydroforming. Magnetic pulse forming. Electrohydraulic forming. Explosive forming. Rotary	5				v		v				

		forming. Cold rotary deformation of cylindrical billets and products. Tooling and equipment for rotary deformation.											
27	Fundamentals of Artificial Intelligence	Purpose: To familiarize students with the fundamental concepts, methods, and technologies in the field of artificial intelligence, including machine learning, computer vision, and natural language processing. Contents: General concepts and definitions of artificial intelligence; intelligent agents; information retrieval and state-space search; logical agents; architectures of artificial intelligence systems; expert systems; supervised learning; statistical learning methods; probabilistic natural language processing; semantic models; and natural language processing systems.	5	v				v					
28	Forging and stamping equipment	The purpose of the discipline is to acquire theoretical and practical knowledge on the creation, operation and improvement of forging and stamping equipment. The discipline examines the composition and structure of forging and stamping equipment (FSE), the principles of design and analysis of FSE; structure, kinematic and force analysis of crank machines; stamping and forging hammers, hydraulic forging and stamping machines. Forging and stamping machines for special purposes are studied: horizontal forging machines, bending and sheet-stamping presses, rotary forging machines, principles of their operation, issues of improving the reliability of operation.	5					v	v				
29	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	
30	Design of forging and stamping equipment	The purpose of the discipline is to provide knowledge on the design of forging and stamping equipment used in blanking and preforming production. The course covers basic concepts of manufacturing technology for standard components of forging and stamping equipment. It includes the machining and processing of rams (sliders), anvils,	5					v		v			

		guides, and die plates. The discipline also addresses technological processes for the assembly of forging and pressing machines, as well as the specific features of manufacturing key components of forging and stamping equipment. Special attention is given to the assembly processes of forging and stamping machinery and the production of dies and die tooling used in forging and stamping operations.											
31	Legal regulation of intellectual property	Purpose: The course aims to develop a comprehensive understanding of the legal framework governing intellectual property, including its fundamental principles, mechanisms for the protection of intellectual property rights, and the specific features of their enforcement. Content: The discipline covers the fundamentals of intellectual property law, including copyright, patents, trademarks, and industrial designs. Students study the protection, management, and commercialization of intellectual property rights, as well as legal disputes in the field of intellectual property and the methods for their resolution.	5	v								v	
Cycle of profile disciplines University component													
32	Cold stamping technology	The purpose of the discipline is to study the technological foundations of cold stamping. Upon completion of the course, students are expected to master the methods for developing cold stamping technological processes and to understand the principles of designing and selecting technological equipment and tooling. The discipline examines the technological processes of cold stamping and explores the development and calculation of stamping operations and die tooling. It also covers their layout and structural design, performance characteristics, technical requirements, and design evaluation criteria.	5					v		v			v
33	Composite materials processing technology	The purpose of the discipline is to study and analyze the application of composite materials in the manufacturing of high-quality machine parts, as well as the economic performance of their production. The course examines the structure and properties of composite materials, including the characteristics of matrix materials. It also addresses the development of specialized equipment, the creation of the required energy conditions for material processing, and the	5			v					v		

		application of combined energy effects to ensure high economic efficiency in the production of composite components.											
34	Computer-aided design systems of machine structures	The purpose of the course is to familiarize students with computer-aided design (CAD) systems and to develop the knowledge and practical skills required for preparing technical documentation and performing engineering calculations using specialized software. Objectives of the discipline: to provide fundamental knowledge of various CAD systems used in technical and engineering documentation, and to develop students' ability to effectively apply this knowledge in professional practice.	4						v				v
35	Lean manufacturing	The purpose of the discipline is to develop students' competencies in the field of 3D scanning as an innovative digitalization tool that enhances design accuracy, manufacturing processes, and modern industrial activities in alignment with the objectives of Sustainable Development Goal 9 (Industry, Innovation, and Infrastructure). The course covers fundamental 3D scanning methods, their principles, and industrial applications. It examines the role of 3D scanning in supporting sustainable industrial development and innovation-driven employment in engineering. Special attention is given to analyzing the economic efficiency of implementing 3D scanning technologies at industrial enterprises and understanding their contribution to sustainable industrialization and workforce development.	5								v	v	
36	Organization and planning of forging and stamping production	Objectives of the discipline: To provide students with knowledge of the organization and design methods of forging and stamping plants and workshops. The course covers the fundamental principles of designing forging and stamping production facilities, taking into account generally accepted approaches to the calculation and development of technological processes for manufacturing parts, tooling, and equipment. Special attention is given to the principles of planning workshops, organizing processing and assembly operations, and designing forging and stamping equipment in accordance with established engineering standards and production requirements.	6					v			v		v
37	Engineering Product Lifecycle Management	The purpose of the discipline is to develop knowledge in the field of automation of industrial product lifecycle management and to study the fundamental methods and	5								v	v	

		technologies of lifecycle management systems. The course provides practical skills in the use of automated systems for technical preparation of production and enterprise management, including Product Data Management (PDM) and Product Lifecycle Management (PLM) systems and their subsystems. It also covers management optimization based on economic efficiency and product competitiveness criteria, as well as the organization of an integrated information environment for product data management.											
Cycle of profile disciplines Component of choice													
38	Tool and mold design	The purpose of the discipline is to develop the knowledge and skills required for the design and calculation of dies for cold sheet metal stamping and molds for manufacturing parts from polymer press materials. Objectives of the discipline: Students must learn to develop working drawings of parts produced by cold sheet metal stamping and compression molding. They must also acquire the ability to design dies for various cold stamping operations, as well as molds for the compression molding of plastic components.	6					v		v			
39	Advanced materials processing technologies	The purpose of studying the discipline is the formation of knowledge, skills and abilities in the field of advanced technologies for processing machine-building materials and surfaces of machine parts. The discipline presents the types of surface treatment of workpieces by ultrasonic, electrophysical and electrochemical methods, laser treatment. Technologies of heat treatment and surface alloying of metals using plasma, electron beam, waterjet and electroerosion methods. Methods of hardening treatment, methods of coating are considered.	6						v		v		
40	Basics of designing machines for pressure processing	The purpose of studying the discipline is to develop knowledge, skills, and competencies in advanced technologies for processing engineering materials and surface treatment of machine parts. The course covers various surface treatment methods for workpieces, including ultrasonic, electrophysical, electrochemical, and laser processing. It also examines heat treatment technologies and surface alloying of metals using plasma, electron beam, waterjet, and electrical discharge (EDM) methods. In addition, methods of surface hardening and coating technologies are studied.	5						v	v			

41	Welding equipment and tools	The purpose of studying the discipline is to familiarize students with the technological processes used in modern welding production for the manufacture of various welded structures. The objectives of the discipline are to provide students with comprehensive knowledge of welded structure fabrication and to develop an engineering understanding of the appropriate selection and application of technical equipment, methods, and techniques that ensure proper welding process performance under specified operating conditions.	5						V	V			
42	CAM(Solidworks, Inventor)	The purpose of the discipline is to develop professional design skills using the SolidWorks software. The course aims to form students' fundamental understanding of modeling concepts, including the structure, classification, applications, and requirements of engineering models. It introduces the theoretical foundations and optimization methods of modeling processes in mechanical engineering, as well as techniques for processing and analyzing information from various sources. Students learn to analyze model structures, apply modeling methods, and use modern engineering software tools in the design of machine components, mechanisms, drives, and systems. The discipline also covers the development of physical and mathematical models of engineering phenomena and objects.	5					V	V				
43	Additive Manufacturing	The concept of additive manufacturing. The history of the emergence and development of additive technologies. 3D modeling as the foundation of additive manufacturing. Types of additive manufacturing processes: Fused Deposition Modeling (FDM). Stereolithography (SLA). Digital Light Processing (DLP). Selective Laser Sintering / Selective Laser Melting (SLS/SLM). Three-Dimensional Printing (3DP). Laminated Object Manufacturing (LOM). Material Jetting (MJM) and Electron Beam Melting (EBM). Optimization of additive manufacturing processes. Preparation of 3D models for printing. Engineering calculations in additive manufacturing. Consideration of material properties in additive manufacturing. The concept and functions of slicer software. Variation and correlation of printing parameters. Defects in additive manufacturing and their classification. Post-processing methods: Mechanical	5				V						V

		finishing of printed parts. Heat treatment. Chemical treatment. Optimization of printing processes with consideration of post-processing requirements.												
44	Project management in mechanical engineering	The purpose of the discipline is to provide knowledge of project management methodology in mechanical engineering, including enterprise organization, production planning, and product development. The course covers the fundamentals of project management, Scrum and Scrum-based tools and methods, and the implementation of agile approaches in engineering organizations. It also examines methods for analyzing and planning key performance indicators of machine-building production based on a qualimetric approach, evaluating project effectiveness and personnel performance, and organizing and planning teamwork for sustainable development.	5					V				V	V
45	Capstone Project	The purpose of the discipline is to develop a comprehensive set of theoretical knowledge and practical skills in the management, maintenance, and support of technical preparation of production. The course explores practical applications and develops students' professional teamwork skills. Students address real engineering and production challenges related to the development and implementation of the lifecycle of mechanical engineering products. This includes information gathering, critical evaluation of project feasibility, in-depth analysis, and preparation of a comprehensive project report.	5								V	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: B069 - "Production of materials (glass, paper, plastic, tree)"
Educational program: 6B07220 - "Machines and technologies for processing new materials"
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								

Additional type of training (ATT)																			
AAP500	Military training																		
Total based on UNIVERSITY:									32	28	30	30	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	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.