

PLAN

of complex of educational programs development

B064/M103/D103 –Mechanics and metalworking, educational programs for Bachelor's degree "Technological Machines and Equipment", "Mechanical Engineering", Master's degree "Mechanical Engineering", PhD program "Mechanical Engineering"

2020 / 2025

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**1PASSPORT OF THE EDUCATION PROGRAM DEVELOPMENT
PLAN «MECHANICAL ENGINEERING » FOR 2020 / 2025**

1	Reasons for investigating a EP development plan	<p>1) New EP developed according to GOP V064 / M103 / D103 - Mechanics and metalworking, Bachelor's degree programs "Technological Machines and Equipment", "Mechanical Engineering", Master's degree "Mechanical Engineering", PhD program "Mechanical Engineering".</p> <p>2) Many years of experience in the educational activities of KATU in domestic and international practice, which is one of the traditional and innovative universities of Kazakhstan, the personnel and scientific potential of the department, faculty and university as a whole.</p> <p>3) The task of fulfilling the social order of the company for the development and formation of demanded personnel in the labor market, owning the theoretical and practical foundations of improving the technological processes of manufacturing and assembly of industrial products</p>
2	The main designers of the EP development plan	The staff of the department "Technological machines and equipment", employers, partner universities and other interested parties (taking into account the requests of real and potential stakeholders of the EP)
3	Duration for implementation of EP development plan	Whole period of training 2020 - 2025. (a short-term forecast up to 5 years deep is established by the foresight method)
4	Amount and sources of financing	-
5	Expected final results of the EP development plan implementation	Obtaining of deep theoretical and practical knowledge and skills, which implies a clear orientation of students to successful professional activities, personal growth that meets the requirements of employers. Formation of the image of KATU as a key of educational and expert organization in the field of production of parts, mechanisms, machines and industrial products among the scientific and educational institutions of the republic and Central Asia.

2. ANALYTICAL SUBSTANTIATION OF THE EDUCATIONAL PROGRAM

2.1 Information about the educational program

The educational programs "Mechanical Engineering" and "Technological Machines and Equipment", "Mechanical Engineering", "Mechanical Engineering" at all levels of the bachelor-master-PhD doctor of profile and scientific-pedagogical direction are aimed at training highly qualified, competitive personnel, improving the quality of knowledge, building multi-level system of research activities in accordance with the urgent needs of modern education and science, harmoniously developed personality hundred in improving manufacturing processes of parts, tools, machinery, technological equipment and other industrial products.

EPs were developed jointly with professors from the University of California, Davis (USA) and taking into account the recommendations of leading experts in leading industrial enterprises, in accordance with the NQF and professional standards, agreed with the Dublin descriptors and the European Qualifications Framework, based on the State Compulsory Higher Education Standard, doctoral studies, approved by order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018 (No. 604), the classifier of higher and postgraduate specialties of the Republic of Kazakhstan, educational program and methodical documentation, individual work plans of doctoral students and other documents approved by the established procedure.

In order to ensure the individuality of the learning trajectory, students are offered two areas of implementation of the Mechanical Engineering EP Technological Machines and Equipment, developed on the basis of the requirements of partner universities and employers' requests.

The modular educational program, which is interdisciplinary and multidisciplinary in nature, which provides training at the junction of a number of areas of knowledge, is generally focused on training qualified competitive personnel for professional activities in all sectors and provides for broad basic professional training, which should be aimed at achieving fundamental knowledge of future specialists.

2.2 Information about students

The first students enrollment is planned for the new EP "Mechanical Engineering" and "Technological Machines and Equipment" for 2019-2020 academic year - 148 people. With a further increase in the number of applicants due to well-established career guidance work and raising the level of prestige of specialties.

Information of the contingent of students in the specialty “Technological machines and equipment” (old classifier) for June 2019.

Specialty	2015-2016	2016-2017	2017-2018	2018-2019
5B072400	618	690	680	660
6M072400	69	104	77	46
6D072400	-	-	1	3
Total	687	794	758	709

The analysis shows the demand for specialists in this field on the labor market and the prestige of the university as a whole.

2.3 Internal conditions for the EP development

For the development and implementation of the group of educational programs B064 / M103 / D103 - Mechanics and metalworking, educational programs in the Bachelor’s degree program “Technological Machines and Equipment”, “Mechanical Engineering”, in the Master’s degree “Mechanical Engineering”, in the PhD program “Mechanical Engineering” at the department Favorable and optimal conditions are created such as:

- highly qualified faculty;
- high material and technical equipment;
- training in three languages (state, Russian and English);
- close cooperation with employers;
- a modern educational and methodological base, with students' access to information and analytical resources of the world scientific world.
- application of modern and interactive TCO
- for conducting laboratory and practical classes there are training laboratories equipped with special equipment and materials (platform).

The platform (on the recommendation of scientists from the University of California at Davis (USA) includes the following experimental production facilities (educational resources), the functioning of which is the guarantor of the training of highly qualified specialists in modern time:

- Production and experimental workshop of metalworking and welding;
- Kazakhstan-Belarus Training and Production Center;
- Pavilion Kazakh-Chinese Center for Agricultural Mechanization;
- Laboratory "Robotics, mechatronics and 3D-printing";
- Laboratory "Materials Science and CMT";
- Laboratory "Installation and operation of technological machines";
- Training workshops.

All classrooms are equipped with digitalization systems of the educational process.

2.4 Characteristics of the society

The base of practice is determined, agreements and contracts are concluded with enterprises for passing educational, industrial and undergraduate practice at the department. Currently, there concluded and current agreements are 58 pcs.

The main practice bases are:

- LLP "MVTU"
- LLP "Spare Rail"
- LLP "Eurasia Group"
- LLP "ZMKA"
- Joint Venture Petropavlovsk Tractor Plant LLP
- Kazintech IRC LLP
- LLP "Agropromzapchast service"
- Vector Combine Plant LLP
- Astanapolymer LLP
- Asia Steel Rental LLP
- LLP "MK-Metal Shop"
- Universal Electro LLP
- JSC «Machine-Building Plant named after Kirov»
- PIK Astana Utaria LTD LLP
- KAMAZ-Engineering LLP

The practice of dual learning is being introduced within the learning process. For students of the 2nd year from the 2nd semester of the 2017-2018 academic year, laboratory work is carried out in the discipline "Metal-cutting machines" on the basis of LLP "ZapchastZhD".

Annually, representatives from partner enterprises, as well as foreign leading teachers of partner universities, are invited to read lectures. In order to develop academic mobility, close cooperation is underway with BSTU and the University of California at Davis (USA), and the search for new partner universities among foreign countries, countries of the customs union and the CIS continues.

2.5 Information about implementing the educational program by the academic staff

The academic degree of the department of "Technological machines and equipment" is 61.5%. The EP serves the highly qualified faculty of the university. The total number of faculty members on September 1, 2019 was 39 people (34 full-time), including with advanced degrees 5 doctors of technical sciences, 2 doctor of PhD, 14 candidates of science, 3 senior teachers with a long experience pedagogical activity and experience in production and 15 assistants (masters).

The faculty of the department "Technological machines and equipment" are constantly improving knowledge in this industry and undergoing further training,

including passing short-term advanced training courses, attending various kinds of seminars, internships at leading universities in Kazakhstan, near and far abroad, as well as in relevant industry organizations.

2.6 Characteristics of the EP achievements

The educational programs of the “Technological Machines and Equipment” specialty in 2015 successfully passed independent specialized accreditation in the accreditation body of the Independent Agency for Accreditation and Rating (hereinafter - IAAR). On April 17, 2015, by the decision of the Accreditation Council of the IAAR, the educational programs of the specialty were accredited and certificates were awarded for a full term of 5 years.

According to the results of the 2018 rating, educational programs of the "Technological Machines and Equipment" specialty in the national ranking of the IAAR occupy 5B072400 (bachelor) - 1 place, 6M072400 (master's) - 1 place, 6D072400 (PhD studies) - 3 place (there is no first graduation).

Throughout the entire period of the learning process, students of the specialty achieved results regarding residual knowledge in the corridor above the average. According to the results of Freight One over the years, there was no case of overcoming the threshold level of knowledge, and the overall result for the university was average.

3. CHARACTERISTIC OF THE PROBLEMS EP DEVELOPMENT PLAN IS DIRECTED TO AND THE SUBSTANTIATION OF THEIR NECESSITY

Educational programs for Bachelor's degree "Technological Machines and Equipment", "Mechanical Engineering", for master's programs "Mechanical Engineering", for PhD programs "Mechanical Engineering" at all levels, the bachelor-master-doctor PhD of profile and scientific-pedagogical direction was created to train staff for professional activities in the field of creation and improvement of technological machines and equipment.

Trained staff should have skills in studying the state of regulatory and technical support of the system, have skills in scientific-production, organizational, managerial and research work, capable of conducting experimental and theoretical studies on modern problems in the field of mechanical engineering.

Trained staff should increase the percentage of scientific articles publication in the field of creating and improving technological machines and equipment in domestic and foreign publications with a non-zero impact factor.

Information publications faculty of the "Technological machines and equipment" department, the analysis depth of 3 years.

Publications	2016	2017	2018
In journals with impact factor above zero	-	1	7
In scientific journals that are part of CCSON and RSCI	6	10	24
In collections of international and republican scientific and practical conferences and other publications	16	14	15

Trained staff must be fluent in English at least C1 Advance. Currently, the university has organized English courses such as DynEd and IELTS.

4. MAIN GOALS AND OBJECTIVES OF THE EP DEVELOPMENT PLAN WITH INDICATION OF TIME AND STAGES OF ITS IMPLEMENTATION

The educational programs “Mechanical Engineering” and “Technological Machines and Equipment” were created on the basis of a request from employers. The main goal of the educational program and its development is to improve it in accordance with the vision, mission and strategy of the university aimed at training highly qualified, competitive personnel, improving the quality of knowledge, forming a multi-level system of research activity in accordance with the current needs of modern education and science, transforming it into an innovative university of world level.

The main objectives of the development plan are as follows:

№	Name of the task	Development time line	Stages of development
1	Providing conditions for obtaining a full, high-quality professional education	The entire period of study 2020 - 2025	Development of measures to improve the quality of educational services for the development of professional skills of future specialists
2	Formation of basic professional competencies among future specialists	The entire period of study 2020 - 2025	Conducting an update of the content of the EP. Acquisition of professional competencies in the field of creation and improvement of technological machines and equipment.
3	Ability to work with scientific and technical information, use domestic and foreign	The entire period of study 2020 - 2025	Development of measures for the analysis and processing of the results

	experience in professional activities, systematize and summarize the information received		
4	Consultations of employers and scientists of the research institute in the selection of relevant and practically significant topics of thesis and master's and doctoral dissertations	Final course of Bachelor's degree studies and initial course of Master's degree studies	Consultations of employers and stakeholders

5. ACTIVITIES FOR RISK INFLUENCE ON EP REDUCING

During implementing of educational programs to reduce risks, the following measures are applied:

№	Name of possible risks	Actions to eliminate them
1	Lack of educational and methodological literature on professional disciplines in Kazakh and English languages	To plan the annual release by scientists and faculty of scientific and educational literature in Kazakh and English languages, according to the work curriculum of students
2	The traditional way of conducting studies	To improve and introduce innovative educational technologies and the provision of educational services at the level of international standards in the educational process
3	Outdated training and laboratory facilities	Creation of a modern educational, research and laboratory base on the basis of public-private partnership, the purchase of modern laboratory equipment
4	Shortage of scientific and pedagogical staff in connection with retirement	Preparation of highly qualified scientific personnel through master's and doctoral programs (PhD) at the level of modern requirements
5	Small academic groups of students in Russian	The formation of the students contingent of this profile through vocational guidance and information and advertising, the creation of multilingual education groups

6. EP DEVELOPMENT PLAN

№	Name of events	Time line of implementation	Responsible	Expected results
1	Formation of a working group to develop educational programs for 2020-2025	November 2019 - April 2020 (further annually until 2025)	Head of TME department	Formed team of authors
2	Development of the goals and objectives of the educational program for 2020 - 2025	November 2019 - April 2020 (further annually until 2025)	Head of TME department, team of authors of EP	Developed goals and objectives of the educational program
3	Determination of the competencies of the specialist and disciplines of the specialty 2020-2025.	November 2019 - April 2020 (further annually until 2025)	Head of TME department, team of authors of EP	Developed competency positions
4	Formation and coordination of specialist competencies and disciplines with Dublin descriptors	November 2019 - April 2020 (further annually until 2025)	Head of TME department, team of authors of EP	Formed and agreed competencies
5	EP formation in accordance with professional standards	November 2019 - April 2020 (further annually until 2025)	Head of TME department, team of authors of EP	Formed educational program
6	Preparation of academic calendar and working curriculum of the specialty in accordance with the developed EP	April 2020 (further annually until 2025)	Head of TME department	Academic calendar and work curriculum
7	Consideration of the EP at the extended	August-September	Stakeholders (faculty	Discussion of the educational

	meeting of the Department with the employers participation	2020 (further annually until 2025)	members, employers, etc.)	program
8	Consideration and approval of the EP at the academic Council of the faculty	May 2020 г. (further annually until 2025)	Board members of the Technical Faculty, employers	Approval of the educational program

7. EP DEVELOPMENT PLAN IMPLEMENTATION MECHANISM

The implementation of the plan is carried out in accordance with the tasks:

- 1) ensuring the conditions for obtaining high-quality professional education by introducing innovative educational technologies into the educational process at the level of world standards;
- 2) based on the results of theoretical knowledge gained, the formation of basic professional competencies;
- 3) the creation of prerequisites for independent search and research activities of the student in the framework of the experiment at all its stages;
- 4) the formation of skills to work with scientific and technical information, systematize and summarize the information received;
- 5) at the final stage, the selection of relevant and practically significant topics of diploma projects, master's and doctoral dissertations.

8. EVALUATION OF SOCIAL AND ECONOMIC EFFICIENCY OF EP PLAN DEVELOPMENT IMPLEMENTATION

When implementing the plan for the development of the educational program, it is effective:

- 1) the possibility of concluding agreements with universities of far and near abroad;
- 2) the formation of the contingent of students;
- 3) the creation of a modern educational, research and laboratory base;
- 4) the possibility of organizing professional practices on the basis of leading enterprises in foreign countries;
- 5) the preparation of highly qualified scientific personnel through the master's and doctoral programs (PhD) at the level of modern requirements.

9. EP GRADUATE MODEL

The educational programs "Mechanical Engineering" and "Technological Machines and Equipment" are focused on the following learning outcomes: be able to independently resolve issues regarding:

- collection, analysis and interpretation of information (instrumental competence);
- problems in new situations in the design, creation and improvement of machines and technological equipment;
- development of ideas and critical argumentation (interpersonal competence);
- self-motivation and self-government (system competence);
- implementation of methods and technologies for the production and processing of parts, machines and technological equipment;
- development of plans for the rational use of energy and labor resources in production, environmental protection measures.

be able to use effectively in various situations:

- one's intuition (instrumental competence);
- your emotional understanding (interpersonal competence);
- the ability to think and work flexibly, adapting to new changing circumstances (instrumental and interpersonal competence);
- Ability to improve and develop their intellectual and cultural level;
- knowledge of the culture of thinking, the ability to generalize, analyze, perceive information, set goals and choose ways to achieve it;
- the ability to control and, where possible, prevent the tension and stress associated with performing activities (interpersonal competencies);
- the ability to logically, reasonably and clearly build oral and written speech;
- organize the work of performers during scientific research, experiments, supervision of the use of requirements of regulatory and technical documents, as well as the correctness of their use.

be able to:

- plan acquired knowledge for solving specific scientific, practical, information retrieval and methodological problems;
- organize and conduct production, research and teaching work (for graduate and doctoral studies in the scientific and pedagogical direction);
- assess the status of regulatory and technical support for the production of parts, machines and technological equipment, processes;
- independently plan and carry out work on the organization of production, repair, installation;
- monitor progressive methods of machining parts, reinforcing methods to improve quality and performance;
- justify promising areas in the field of creation, processing, production of parts, machines and technological equipment;
- have effective communication and social skills, including the ability to:
 - on the preparation of feasibility studies and the development of plans and programs for innovative projects;

- carry out design and survey work using modern equipment and information technology;
- use freely foreign language as a means of business communication;
- the ability to use regulatory legal documents governing the organization and methodology of research in the industry

Competency model (portrait) of a graduate – bachelor student

Professional area of a bachelor student:

- technological machines and equipment; power equipment; running equipment; working equipment; machine drive systems;
- motion control systems; operator life support systems; common housing to accommodate all parts of the machine;
- construction and maintenance materials;
- equipment for the manufacture, testing and disposal of technological machines;
- equipment for maintenance and repair of technological machines;
- instrumentation for the manufacture and operation of machines;
- equipment for automating the working processes of machines;
- equipment for the design of machines.

• General educational competencies

- providing social and humanitarian education on the basis of knowledge of the laws of socio-economic development of society, the history of Kazakhstan, modern information technologies with the introduction of elements of Industry 4.0, the state language, foreign and Russian languages, as a means of international communication;
- fluent monolingual oral, written and communicative skills;
- the ability to not fluent communication with a second language;
- the ability to use communicative communication in various situations;
- The basics of academic writing in the native language;
- basic mathematical thinking at the communication level - the ability to solve situational problems on the basis of the mathematical apparatus of algebra and the beginnings of mathematical analysis.

• Basic competencies

- providing in-depth knowledge of a natural-scientific, technical and economic nature as the foundation of vocational education;
- a basic understanding of the scientific picture of the world with an understanding of the essence of the basic laws of science;
- understanding of basic hypotheses, laws, methods, formulation of conclusions and estimation of errors.

• Professional competencies

- providing deep theoretical knowledge and practical experience in the field of technological machinery and equipment;
- carrying out work on the preparation of technical documentation and established reporting on approved forms;
- conducting training and instruction in safety measures, labor protection and the environment;
- monitoring the implementation of the requirements for the preparation of documentation on the quality management of technological processes at production sites;
- improving the design of technological machines and equipment using breakthrough technologies and capabilities;
- complex mechanization and automation of technological processes;
- the establishment and maintenance of optimal operating modes of technological machines and equipment.

Competency model (portrait) of graduate – master’s degree student

Professional sphere of the master’s degree student (scientific-pedagogical and profile areas):

- research activities in experimental research and design organizations, centers, institutes;
- production activities in agricultural and processing enterprises and organizations, complexes, corporations;
- engineering, technical and managerial activities in design, consulting, engineering centers, public unions and associations, ministries and holding companies.

• General educational competencies

The master of the profile direction after mastering the educational program should:

- fluent in a foreign language as a means of business and professional communication;
- apply the necessary psychological theories and techniques to the study of man as a subject of activity and cognition, solve the problems of communication and correctly use the knowledge of psychology for successful management activities;
- know and be able to apply managerial theories to solving specific production situations;
- independently develop and apply methods and means of cognition, training and self-control to acquire new knowledge and skills;

• Basic competencies

- choose analytical and numerical methods when designing machinery and equipment for agricultural and processing industries;

- receive and process information using modern information technologies, apply applied software to solve practical problems using personal computers using general and special purpose software, including remote access;
- apply automated methods for the design and manufacture of machinery and equipment for the agricultural sector;
- to apply in the process of production and restoration of machinery and equipment advanced methods of metalworking and welding, taking into account the requirements of quality, reliability, labor safety and environmental cleanliness of production.

• Professional competencies

1) know:

- The theoretical foundations of the design and construction of machinery and equipment;

- Automation processes for the design and manufacture of machines;

- advanced methods of metal processing and restoration of machine parts and equipment;

2) be able to:

- apply automated machine design programs;

- apply advanced methods of processing and restoration of parts in practice;

- integrate the knowledge gained in different disciplines, use it to solve complex engineering and managerial tasks in the development of scientific and technical progress;

- apply in practice new approaches to the organization of management of engineering departments of enterprises and the enterprise itself;

- make engineering decisions independently in complex and non-standard production situations;

- summarize the results of experimental research and analytical work in the form of a master's project, article, report, analytical note, etc.

3) acquired skills and abilities:

- solutions to engineering problems in a production environment;

- conducting statistical analysis and solving practical problems in the design and manufacture of machinery and equipment;

- expanding and deepening the knowledge necessary for everyday professional activity and professional growth in industrial and scientific activities

- the use of modern information and computer technologies in the field of professional activity;

Competency model (portrait) of a PhD graduate

Professional area of PhD (scientific-pedagogical and specialized areas):

- research work;

- management activities;
- production and technological activities;
- information and design activities.
- Organization and management of services of production enterprises;
- development of structures of production and technological, service and maintenance, installation and commissioning and design divisions;
- Creation and improvement of technological machines and equipment.

• General educational competencies

1) own the methodology of a systematic approach to organization, modern approaches to management and analytical methods of management, methods of diagnosis, analysis and problem solving, as well as methods of decision making and their implementation in practice;

2) to competently solve practical problems of management and bring these decisions to life, be prepared for the implementation of management functions and be able to solve professional problems in the interests of the organization as a whole;

3) possess the knowledge, skills and abilities necessary to occupy an appropriate managerial position and based on a deep understanding of the characteristics of a market economy and its capabilities, functions and economic role of the state, understanding of environmental problems, awareness of the social responsibility of business and adherence to civilized ethical standards of its conduct:

4) be able to assess the current problems and prospects of socio-economic development of Kazakhstan, understand the current trends in the development of the world economy and globalization, navigate the issues of international competition.

• Basic competencies

1) demonstrate a systematic understanding of the field of study, mastery of the skills and research methods used in this field;

2) demonstrate the ability to think, design, implement and adapt an essential research process with a scientific approach;

3) to contribute by own original research to expanding the boundaries of the scientific field, which deserves publication at the national or international level;

4) critically analyze, evaluate and synthesize new and complex ideas;

5) communicate their knowledge and achievements to colleagues, the scientific community and the general public;

6) to promote the advancement in the academic and professional context of the technological, social or cultural development of a knowledge-based society.

• Professional competencies

Organizational and technological activities:

- development of design, technological, design and estimate documentation for the creation and repair of technological machines and equipment;
- organization of the work of the team of performers, taking into account various opinions and making managerial decisions;
- compromise solutions taking into account various requirements (cost, quality, deadlines and safety) for different types of planning and determining optimal solutions;
- accounting of various types of costs in order to ensure the release of high-quality products.

Production and management activities:

- optimization of manufacturing technologies of technological machines and equipment;
- quality control of technological processes, materials and finished products;
- selection and effective use of materials, equipment and other means for the implementation of production processes;
- metrological verification of measuring instruments for product quality indicators;
- carrying out measures for standardization and certification of technological machines and equipment, technology for their manufacture and repair;
- Organization and management of services, enterprises related to the operation and repair of technological machinery and equipment.

Project Activities:

- determination of the goals and objectives of the project, taking various factors into account when building the structure of their relationships and identifying priority areas for solving problems;
- development and analysis of solutions to the problems of forecasting consequences, planning and implementation of projects;
- development of projects of technological machines and equipment, taking into account technological, design, aesthetic, economic and other parameters;
- the use of information technology in the selection of materials, technological machines and equipment