

Graduate Model **6B07138 " Robotic Systems"** is developed on the basis of the educational programme, missions and Education Quality Assurance Policy of Kostanay Engineering and Economics University named after M. Dulatov. The main normative documents of the Republic of Kazakhstan in the field of higher education were used in the preparation.

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Developers:

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| Head of EP, Master | <u>Inna Ivanovna Gerauf</u> |
| Vice-Rector for Science and Innovations,
Candidate of Technical Sciences, Associate
Professor of the Department of Power
Engineering and Mechanical Engineering | <u>Amangeldy Bulatovich Shayakhmetov</u> |
| Master, Senior Lecturer of the Department of
Information Technologies and Automatics | <u>Aldasheva Dinara Tulengalievna</u> |
| Instrumentation and control engineer of
SaryarkaAvtoProm LLP | <u>Saken Tleukabylovich Makaev</u> |
| 2nd year student of the EP "Robotic Systems" | <u>Alexander Valentinovich Privalov</u> |

Expert group::

- | | |
|--|--------------------------------------|
| Director of "Kostanayzhobakurylys" LLP | <u>Gabit Serikovich Abdulin</u> |
| Director of "KST BETON" LLP | <u>Yernar Amantayevich Kabzhanov</u> |

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Introduction

The educational programme 6BO7138 Robotic Systems is aimed at training specialists in the field of robotic systems for research, design, production and operation of robots, mechatronic and robotic systems for educational and research institutions, various automated and robotic production of industrial enterprises of the region, includes the necessary recommendations of employers on the formation of professional competencies and has a number of features:

- development of experimental samples of robotic systems, their modules and subsystems in order to verify and substantiate the main theoretical and technical solutions to be included in the terms of reference for development work;

- organisation and conducting of experiments on operating robotic systems, processing of experimental research results with the use of modern information technologies; maintenance of reporting and working documentation;

- acquisition of practical knowledge and skills in working in software products of international use;

- acquisition of practical skills on development and implementation of the CP (control programmes) of parts processing for CNC machines, as well as the use of modern systems of computer-aided design of technological processes of parts processing;

- acquiring practical skills of technological entrepreneurship and development of Start-Up projects for small and medium-sized businesses in the region.

The uniqueness of the educational programme is determined by the learning outcomes formed in accordance with the National Qualifications Framework and Dublin descriptors. The educational programme is focused on training a generalist in the engineering field, both in the region and in the country as a whole, through the formation of competencies related to the sectoral focus of the region.

Regulatory and legal support

1 Law of the Republic of Kazakhstan No. 319-III dated July 27, 2007 "On Education".

2 "On Approval of the Classifier of directions of training of personnel with higher and postgraduate education". Order of the Minister of Education and Science of the Republic of Kazakhstan from June 5, 2020 No. 234.

3 "On Approval of State Compulsory Standards of Higher and Postgraduate Education". Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2.

4 "On Approval of the Rules for Organisation of the Educational Process on Credit Technology of Education in Organisations of Higher and (or) Postgraduate Education". Order of the Minister of Education and Science of the Republic of Kazakhstan from April 20, 2011 No. 152.

5 Guidelines for the development of educational programmes of higher and postgraduate education. Annex 1 to the order of the Director of the National Centre for Higher Education Development of the Ministry of Education and Science of the Republic of Kazakhstan from 04.05.2023 No. 601.

6 "Algorithm of inclusion and exclusion of educational programmes in the Register of educational programmes of higher and postgraduate education" approved by Order No. 665 of the Minister of Education and Science of the Republic of Kazakhstan dated December 4, 2020.

Professional standard

1. Constituent components in the formation of the graduate model of the educational programme 6BO7138 "Robotic Systems"

1.1. Purpose of the educational programme 6BO7138 "Robotics systems"

To provide comprehensive and quality training of competitive highly qualified specialists in the field of robotic systems for research, design, production and operation of robots, mechatronic and robotic systems for various automated and robotised industries

1.2. General and professional competences

A graduate of 6BO71 Engineering and Engineering Studies with the qualification " Academic Bachelor" must have competences at the end of the discipline or course and reflecting the requirements.

List of general (GC) and professional (PC) competences of EP 6BO7138 " Robotic Systems":

GC1 - be able to freely communicate orally and in writing in Kazakh, Russian and foreign languages as a means of interpersonal, intercultural and business communication

GC2 - have the ability to analyse scientifically socially significant problems - and processes, to use in practice the methods of social and polytechnic, legal sciences in various types of professional and social activities

GC3 - have an understanding of the objective causes of national and cultural processes and values, modern psychological theories, social interactions of personality

GC4 - know the economics of free enterprise formation of demand and market for products. Methodology of business plan preparation and application of innovations in business planning

GC5 - have a detailed knowledge and understanding of the appropriate level of physical fitness and health promotion to ensure full social and professional activity

PCI - be able to apply modern research methods, evaluate and present the results of work; compose algorithms and develop programmes in accordance with the technology and structure of the programming languages used

PC2 - be able to use available software packages and, if necessary, develop new software required for information processing and control in robotic systems; be able to compile mathematical models of robotic systems.

PC3 - develop methods of conducting experiments and conduct experiments on operating models and samples of robotic systems and their subsystems process the results using modern information technologies and technical means

PC4 - be able to debug software and hardware complexes and their interfacing with technical objects as part of robotic systems

PC5 - possess knowledge in the field of structural materials, basics of electrical engineering, heat-exchange and heat power plants, basics of hydraulics. Readiness to use basic methods of protection of production personnel and population from possible consequences of accidents, catastrophes, natural disasters.

PC6 - knowledge of modern information technologies, readiness to use modern means of computer-aided design and machine graphics in designing systems and their individual modules, as well as for the preparation of design and technological documentation, to comply with the basic requirements of information security.

PC7 - capability to develop mathematical models of mechatronic and robotic systems, their subsystems and individual elements and modules, including information, electromechanical, hydraulic, electro-hydraulic, electronic devices and computer facilities.

PC8 - capability to calculate and design individual devices and subsystems of mechatronic and robotic systems using standard actuators and control devices, automation, measuring and computing equipment in accordance with the technical assignment

PC9 - be able to consolidate the acquired knowledge in production, implement the results of theoretical developments in the production of robots and robotic systems.

1.3. Learning Outcomes

1 Formulate knowledge and understanding in the field of robotic systems, which are based on advanced knowledge on these issues with the ability to analyse and use the information obtained to correctly orientate reality

2 Possess a high level of professional culture, including a culture of professional communication with a civic attitude.

3 Differentiate information to further form judgements and considerations on social ethical and scientific issues

4 Use written and verbal communication to document work and present findings and have a high level of professionalism in the Kazakh, English and Russian languages

5 Be competent in the relevant field of science and technology, to have the skills necessary for independent continuation of further studies in the field of study

6 Be able to perform a professional function in the relevant field of science and technology, be able to analyse, calculate and describe the results obtained

7 Be able to develop rationalisation proposals and inventions for modernisation of equipment and technological equipment on the basis of best practices and innovative approaches

8 Be able to work effectively in a team, understand the principles and values of academic integrity

2. Qualification characterisation

2.1. Field of professional activity

The graduate can carry out professional activity in public and private enterprises and organisations in the following spheres:

- analytical, consulting, organisational and production activities at enterprises and firms in the mechanical engineering industry of various forms of ownership,
- design and construction, research and development activities in research institutes,
- at production organisations of light, medium and heavy machine-building.
- at production organisations with automated and/or robotised production lines.

2.2 Objects of professional activity

The objects of professional activity of the graduate are:

- robotic systems, including information-sensor, executive and control modules, their mathematical, algorithmic and software, methods and means of their design, modelling, experimental research and design;
- technical systems, units, machines and complexes of machines for various purposes, built on the basis of mechatronic modules;
- software and algorithmic support for controlling robotic systems, their design and operation
- machine technologies and complexes of machines for production,
- educational activity in secondary specialised, vocational and technical educational institutions of technical profile;
- scientific and managerial work in scientific and production institutions.
- management activity in branch subdivisions of district, regional, republican structures;
- machine technologies and complexes of machines for various kinds of production;
- design, project and technological organisations;
- machine repair enterprises.

2.3 Subjects of professional activity

The subjects of professional activity of the graduate are:

- technological equipment of machine-building enterprises;
- design and technological solutions in the development and design of machine-building products;
- automation of machine-building production;
- mechanisms and regularities of the processes of functioning of automated and robotised lines;
- software for the machine-building industry;
- development and improvement of production technology of machine-building products;
- means of technical maintenance of machine-building equipment;
- means of adjustment of technological equipment;
- software and algorithmic support for controlling robotic systems
- modern methods of production management and organisation;
- innovative and legislative activity in the branch of mechanical engineering and new technologies in the Republic of Kazakhstan.

2.4 Types of professional activities

Types of professional activities are:

- organisational and managerial: organisation and management of production activities
- calculation and design: design of automated lines, robotic complexes;
- production and technological: development of technological processes of machining of machine parts and assembly;
- experimental and research: research of technological processes quality, technological characteristics of equipment, progressive methods of processing, perspective types of equipment;
- information-computer: creation of software for engineering labour;
- educational (pedagogical): professional activity in secondary professional educational institutions.