Л.Б.ГОНЧАРОВ
АТЫНДАҒЫ
ҚАЗАҚ
АВТОМОБИЛЬ-ЖОЛ
ИНСТИТУТЫ

КАЗАХСКИЙ
АВТОМОБИЛЬНО-
ДОРОЖНЫЙ
ИНСТИТУТ
ИМ. Л.Б.ГОНЧАРОВА

KAZAKH AUTOMOBILE ROAD INSTITUTE
named after L. B. GONCHAROV

"APPROVED"
Rector KazARI
named after L.B. Goncharov
_____ R.A. Kabashev

26.04 2022

MODULAR EDUCATIONAL PROGRAM

Code and classification of areas of study:
6B071 Engineering and Engineering
Name: 6B07108 - "Mechatronics in the automotive industry"
Level of training: bachelor's degree

Almaty 2022

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN

KAZAKH AUTOMOBILE ROAD INSTITUTE named after L. B. GONCHAROV

ROAD FACULTY

The modular educational program in the direction of training 6B071 - "Engineering and engineering business" of the educational program 6B07108 - "Mechatronics in the automotive industry" was compiled in accordance with the Law of the Republic of Kazakhstan "About Education"; SCES, approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated in October 31, 2018 No. 604 (as amended and supplemented by the Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated in July 20, 2022 No. 2); The classifier of areas for training personnel with higher and postgraduate education Approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated in October 13, 2018 No. 569 (as amended and supplemented by the Order of the Ministry of Education and Science dated in June 5, 2020 No. 234); Classifier of occupations of the Tax Code of the Republic of Kazakhstan 01-2017, approved by the Order of the Committee for Technical Regulation and Metrology of the Ministry for Investment and Development of the Republic of Kazakhstan dated in May 11, 2017 No. 130)-od.; Guidelines for universities on the design of educational programs, MES RK; the Labor Code of the Republic of Kazakhstan and in accordance with the requirements of the current state compulsory standards of higher and postgraduate education; normative documents of KazARI.

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The modular educational program was discussed at a meeting of the Department of IC, OD and IS and recommended for approval.
Minutes No. 10 dated "14" april 2022

The modular educational program was reviewed at a meeting of the KazADI Educational and Methodological Council and recommended for approval.
Minutes No. 10 dated "19" april 2022

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN

KAZAKH AUTOMOBILE ROAD INSTITUTE named after L. B. GONCHAROV

ROAD FACULTY

CONTENT

1 PASSPORT OF THE EDUCATIONAL PROGRAM

1.1 Explanatory note

Due to the rapid development of technology and the introduction of electronics in all spheres of human life, the list of professions today is regularly and rapidly replenished with new specialties. At the same time, many of the professions of the future do not have similar or related specialties from the list of professions of the recently ended twentieth century.

Mechanics is not a new science. However, in combination with electronics, computer science, optics, the technology of the latest materials and many other disciplines, both mechanics and engineering, which, under the pressure of circumstances, had to unite, "sounded" in a completely new way.

1) A mechatronics engineer is a specialist who creates programs that provide control and monitoring of various mechanisms, which is carried out using a computer and microcircuits built into mechanical devices. In the event of a shutdown of automated systems, a representative of this profession must be able to find faults and eliminate them. Mechatronics also design and assemble automated system.

The educational program is developed in accordance with the following regulatory documents:

1) The State Program for the Development of Education and Science of the Republic of Kazakhstan for 2020-2025 Decree of the Government of the Republic of Kazakhstan dated December 27, 2019 No. 988
2) State obligatory standard of higher and postgraduate education. Approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018 No. 604 (as amended and supplemented by the Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2)
3) Model rules for the activities of educational organizations of the relevant types and types. Approved by order of the Ministry of Education and Science of the Republic of Kazakhstan on October 30, 2018 No. 595 (as amended and supplemented on August 31, 2022 No. 385)
4) Rules for organizing the educational process on credit technology of education. Approved by the order of the Minister of Education and Science of the Republic of Kazakhstan dated 20.04.2011. No. 152 (as amended and supplemented on September 23, 2022 No. 79)
5) On amendments to the order of the Minister of Education and Science of the Republic of Kazakhstan dated March 20, 2015 No. 137 "On approval of the Rules for organizing the educational process on distance learning technologies". Approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated November 3, 2021 No. 547.
6) Classifier of areas for training personnel with higher and postgraduate education. Approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 13, 2018 No. 569 (as amended and supplemented by the Order of the Ministry of Education and Science dated June 05, 2020 No. 234)
7) Professional standards.
8) Sectoral Qualifications Framework "Information and Communication Technologies"
9) National classifier of the Republic of Kazakhstan. Classifier of occupations of the Tax Code of the Republic of Kazakhstan 01-2017.
10) Regulatory documents of KazARI.

The educational program of the specialty 6B07108 - "Mechatronics in the automotive industry" is implemented on the basis of the State License number KZ59LAA00017181, issued by the Committee for Control in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan dated October 11, 2019.

The mission of the educational program is focused on the training of mechatronicians who develop, modernize and implement mechatronic systems in production, monitor, diagnose, maintain and repair them, organize and plan the production process, manage projects and subordinate personnel, provide advice on innovations in the mechatronic industry and their introduction into production.

1.2 Terms and definitions

In this educational program, terms and definitions are used in accordance with the Law of the Republic of Kazakhstan "On Education", as well as terms adopted in the Kazakh Automobile and Road Institute named after L.B.Goncharov (KazARI):

Higher special education is an educational program of higher education aimed at training specialists with qualification in the relevant specialty with a normative education period of at least 4 years.

Bachelor - an academic degree awarded to persons who have mastered the relevant educational programs of higher education.

Type of professional activity – methods, ways, techniques, the nature of professional activity impact on the objects in order to change it, transform.

Dublin Handle - The European Higher Education Qualification Framework. Describes in a generalized form the learning outcomes for different skill levels. The system of descriptors is invariant, i.e. not tied to a specific educational context, which facilitates the comparison of qualifications. Dublin descriptors represent the agreed requirements for the assessment of learning outcomes in each cycle of higher education and can be applied in national higher education systems with a greater degree of detail.

Credit unit (credit) - a measure of the complexity of the educational program.

Competences - the ability to practical use acquired in the process of learning knowledge and skills in professional activities;

Inclusive education is a process that ensures equal access to education for all students, taking into account special educational needs and individual opportunities.

Module - a set of parts of the discipline (course) or disciplines (courses), which has a certain logical completeness in relation to the established goals and results of education, training.

National qualification framework - a structured description of the qualification levels recognized in the labor market.

National qualifications system - a set of mechanisms of legal and institutional regulation of supply and demand for qualifications of specialists from the labor market.

The direction of training is a set of educational programs of various levels aimed at training specialists for the relevant professional field.

Sectoral Qualifications Framework - A structured description of the qualification levels recognized in the industry.

The field of professional activity is a set of objects of professional activity in their scientific, social, economic, industrial manifestation.

The object of professional activity - systems, objects, phenomena, processes, which are dirRCted to impact.

A professional group is a set of professional subgroups that has a common integration basis (similar or similar purpose, objects, technologies, including means of labor) and assumes a similar set of labor functions and competencies for their implementation.

A professional subgroup is a set of professions formed by an integral set of labor functions and competencies necessary for their fulfillment.

Professional standard - a standard that defines the requirements for the level of qualification and competence, content, quality and working conditions in a specific field of professional activity.

Profession is the main occupation of a person's labor activity, requiring certain knowledge, skills and practical skills acquired as a result of special training and confirmed by relevant documents on education.

Learning outcomes - acquired knowledge, skills and acquired competencies.

Labor function - a set of interrelated actions aimed at solving one or more tasks of the labor process.

KazARI is a higher education institution that:

- implements educational programs of higher and postgraduate professional education in a wide range of areas of training;
- performs fundamental and applied research in a wide range of sciences.

2 DESCRIPTION OF EDUCATIONAL PROGRAM

The purpose of the educational program	Providing comprehensive and high-quality training of mechatronics, upgrade and implement mechatronic systems in production, monitor, diagnose, maintain and repair them, organize and plan the production process, manage projects and subordinate personnel, provide advice on innovations in the mechatronic industry and their implementation in production. The EP complies with the requirements of SGES and professional standards of the Republic of Kazakhstan. It is compiled on the basis of professional standards approved by Order No. 259 of the Deputy Chairman of the Board of NCE RK "Atameken" dated December 24, 2019: Appendix No. 10 "Development of terms of reference for the creation of innovative products / services", Appendix No. 12 "Technical design of innovative products / services ", Appendix No. 41 “Working on NCE machines”; Appendix No. 49 "Maintenance and software support of robots"; No. 171 approved by order dated July 17, 2017: Appendix No. 4 "Development of technical documentation", Appendix No. 6 "Providing software maintenance". Agreed with OP "Mechatronics" Rezekne Academy of Technology (RTA) Rezekne, Republic of Latvia.
Training of the map dirRCtion in the educational program	
Code and classification of the field of education	6B07 Engineering, manufacturing and construction industries
Code and classification of the edacational training	6B071 Engineering and Engineering affairs
Code and name of the educational program	6B07108 - Mechatronics in the automotive industry
Qualification characteristics of the graduate	
Academic degree	Bachelor: Bachelor of Engineering and Technology in EP "6B07108 - Mechatronics in the automotive industry
The list of professions	Graduates of the specialty 6B07108 - "Mechatronics in the automotive industry" can work in the following positions: Assistant mechanical engineers; Chief mechanical engineer; Assistants to professionals in the field of technology; Assistant electronic engineers; Technicians in industry and production; Automotive Technicians; Computer hardware technicians; Electronic Instrumentation Technicians; Supervisors (foremen) of workers in metalworking, equipment maintenance and related occupations, except for electricians; Installers and adjusters of electronic equipment; Professionals in the field of engineering,

	excluding electrical engineers; Automotive engineers; Metal engineer; Electrician Engineer; Instrumentation and automation engineer; Digital Computing Engineer; Embedded systems engineer; Electronics engineer; System engineer; Software designer; Software Maintenance Specialist; Technicians in the field of physical and technical sciences; Electronic equipment assembler.
Professional field	Organizations of various forms of ownership in the field of military, aviation and space technology, robotics and automotive industry; enterprises producing office and medical equipment, household appliances and simulators for pilots and drivers; production of machinery and equipment.
The object of professional activity	The objects of professional activity of the graduate are: - mechatronic and robotic systems, including information-sensory, executive and control modules, their mathematical, algorithmic and software, methods and tools for their design, simulation, experimental research and design; - theoretical and experimental studies of mechatronic and robotic systems for various purposes.
Functions of professional activity	-organize and control the entire range of maintenance of mechatronic equipment: bypass, check serviceability and reliability; adjustment, adjustment of operating modes, selection of spare parts, adjustment, testing, installation and commissioning; - identify problems, develop methods for their prevention and repair entrusted equipment; check the equipment of production with the necessary materials and components; - develop proposals for optimizing the operation of mechatronic systems and introducing new technologies; - control the quality of work performed, develop measures to improve production performance; - to carry out computational work to determine the readings of the equipment and take into account statistical data; - draw up reports on identified problems, maintain operational and technical documentation, plans and schedules; train and instruct staff; - prevent emergencies, comply with safety requirements in the industry.
Types of professional activity	- research; - design and engineering; - organizational and managerial; - installation and commissioning; - service and operational.
Personal competency requirements	Responsibility. Diligence. Logical thinking. The flexibility of thinking. Focus on the result. Organization. Initiative. Mindfulness. Discipline. Decision making. The desire to improve the professional level of creativity, teamwork.
List of competencies	(EC-1): understand the surrounding reality on the basis of worldview positions formed by knowledge of the foundations of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical knowledge; interpret

	the content and specific features of the mythological, religious and scientific worldview. (EC -2): own cognitive-linguo-culturological methodology for solving communication problems in the multilingual and multicultural society of the Republic of Kazakhstan. (EC -3): to show a civil position based on a deep understanding and scientific analysis of the main stages, patterns and originality of the historical development of Kazakhstan; (EC -4): use scientific methods and techniques for researching a specific science; summarize the results of the study; synthesize new knowledge and present it in the form of socially significant products; carry out the choice of methodology and analysis. (EC -5): develop their own moral and civic position: operate with public, business, cultural, legal and ethical norms of Kazakhstani society; (EC -6): evaluate situations in various areas of interpersonal, social and professional communication, taking into account basic knowledge of sociology, political science, cultural studies, psychology. (EC -7): analyze particular and general problems of the functioning of the biosphere and rational nature management to reduce the impact on human health and the environment, demonstrate civic skills in critical life situations, apply the acquired knowledge and skills in the field of civil protection in their professional activities. (EC -8): independently apply modern computer technologies to solve research and production and technological problems of professional activity. (EC -9): demonstrate personal and professional competitiveness: build a personal educational trajectory for self-development and career growth, focus on a healthy lifestyle to ensure full-fledged social and professional activities through the methods and means of physical culture. BC-1): demonstrate basic knowledge in the field of mathematics and natural and engineering sciences, their use in professional activities. (BK-2): Use CAE and CAM technologies and analytical/numerical methods, ability to read drawings. (BC-3): Understand and predict the causes of damage / destruction of parts and prevent them, determine the causes of equipment failure. (BC-4): The ability to choose the best technical solutions for solving a specific problem. (BC-5): be aware of the need for self-organization and self-education, critically rethink the accumulated experience, change, if necessary, the type and nature of their professional activities. (BC-6): understand the nature of entrepreneurship and how to manage it as a process, identify areas in which entrepreneurship is manifested, including a start-up in professional activity. (BC-7): use various types of ICT in professional and personal activities (Internet resources, cloud and mobile services for searching, storing, processing, protecting and disseminating information). (BC-8): apply software solutions that combine text, graphics, multimedia materials, as well as other interactive tools.

	(BC-9): Formulate a business idea, analytically evaluate and develop a business plan, taking into account legal, financial and other aspects. (PC-1): Understand the interaction of mechanical, electromechanical, electronic and computer equipment in mechatronic equipment. (PC-2): Build simple systems of automatic, robotic control using microprocessors and computers. (PC-3): Navigate the range of mechanical engineering elements, (PC-4): Perform the functions of a programmer, adjuster and operator of a CNC metalworking machine. (PC-5): Design automated control systems for mechatronic equipment. (PC-6): To produce self-propelled guns for the simplest mechatronic equipment. (PC-7): Apply the knowledge and skills of metalworking technologies in their professional activities. (PC-8): prepare technical documentation for the design of mechatronic systems and software development.
Training results	Upon successful completion of the educational program, the student will: ON1: possess a system of subject, psychological, methodological, socio-humanitarian, environmental, economic knowledge, the ability to carry out their further professional development, using, among other things, their own physical activity in combination with other cultural values. ON2: to convince, argue one's position during discussions, both on historical and professional topics, legally competently state legal acts; the ability to quickly adapt when the situation changes due to the possession of extra-functional and multi-professional knowledge and abilities. ON3: use mathematical, natural science, engineering and technological competencies. ON4: use modern technologies to ensure the production process, optimization and innovative development. ON5: assess the availability and compliance of technological equipment; ensure the production of the necessary technological equipment and develop technological documentation. ON6: organize and manage the maintenance and repair of equipment. ON7: to carry out diagnostics, maintenance and repair of mechatronic systems, prepare proposals for improving the mechatronic system, ensure that the system operation complies with the requirements of the technological process, plan the necessary volumes of operational materials. ON8: improve their knowledge in the field of professional activity, observe ethical principles and norms of legal labor relations, communicate in the state and foreign languages, including using professional terminology. ON9: apply management system standards, participate in the development and improvement, implementation, maintenance and fulfillment of the requirements of the quality management system. ON10: use IT tools for information processing; analyze the compliance

	of design data with the terms of reference and the implementation of the production program; construction algorithms; visualize design results; identify risks in the operation of equipment; systematize and analyze data on maintenance and repair of equipment (using software for processing databases). ON11: to ensure compliance with the requirements of labor protection, fire safety, electrical safety, environmental protection and civil protection.

3 MATRIX FOR CORRELATING LEARNING OUTCOMES FOR THE EDUCATIONAL PROGRAM AS A WHOLE WITH THE COMPETENCIES BEING FORMED

	ON 1	ON 2	ON 3	ON 4	ON 5	ON 6	ON 7	ON 8	ON 9	ON 10	ON 11
EC1	+										
EC2	+	+									
EC3		+									
EC4	+										
EC5	+	+						+			
EC6	+	+									
EC7	+										+
EC8				+			+		+	+	
EC9	+						+	+			
BC1			+							+	
BC2				+			+				
BC3				+	+						+
BC4		+	+		+	+	+		+	+	+
BC5	+	+				+					
BC6								+	+		
BC7							+			+	
BC8							+			+	
PC1				+		+	+				
PC2			+							+	
PC3				+	+		+				
PC4						+	+				
PC5									+	+	
PC6					+		+				
PC7			+	+	+	+	+	+	+		
PC8				+	+				+	+	+

4 COMPETENCE MAP

General educational competencies	Learning Outcome
(GEC-1)	ON1
(GEC--2)	ON1,ON2
(GEC--3)	ON2
(GEC--4)	ON1
(GEC-5)	ON1,ON2,ON8
(GEC-6)	ON1,ON2
(GEC-7)	ON1,ON11
(GEC-8)	ON4,ON7;ON9,ON10
(GEC-9)	ON1,ON7,ON8
Basic competencies	**Learning Outcome**
(BC-1)	ON3,ON10
(BC-2)	ON4, ON7
(BC-3)	ON4, ON5, ON11
BC-4)	ON2,ON3,ON8
(BC-5)	ON3,ON6,ON8,ON11
(BC-6)	ON6,ON2 ON5
(BC-7)	ON1, ON2,ON6
BC-8)	ON8, ON9
(BC-9)	ON7, ON10 ON5
Professional competencies	**Learning Outcome**
(PC-1)	ON4,ON6,ON7
(PC-2)	ON3,ON10
(PC-3)	ON5,ON7,ON4
(PC-4)	ON6,ON7
(PC-5)	ON9,ON10
(PC-6)	ON5,ON7
(PC-7)	ON3,ON4,ON5, ON6,ON7, ON8, ON9
(PC-8)	ON4,ON5, ON9,ON10, ON11

5 TRAINING MODULE MAP

Module name	Competencies	Learning Outcome
General education disciplines		
Socio-Political Knowledge Module	GEC1,GEC2,GEC3,GEC4, GEC5,GEC6,GEC8,GEC9	ON1,ON2, ON 3, ON 8
Multilingual training module	GEC2, GEC5, GEC9	ON3,ON8
Security technology module	GEC1-GEC7, GEC9, BC3,BC5, BC7	ON1,ON11
Physical training module	GEC9	ON1

Basic disciplines		
Mechanics and Mathematics Module	GEC4,GEC8,BC1,BC2	ON1,ON3,ON4,ON5, ON7
General Engineering Module	GEC1,GEC4,GEC8,BC1,BC2,BC3,BC4,BC5,BC8, BC9,BC1,PC2,PC3,PC4,PC6,PC7,PC8	ON1,ON2,ON3, ON4,ON5,ON6,ON7,ON9,ON10,ON11
Information technology module	GEC8,GEC9,BC1,BC2,BC3,BC4,BC5,BC6,BC8,BC9, BC10,PC1-PC8	ON3,ON4,ON7,ON9, ON10
Automation and robotization module	GEC8,GEC9,BC1-BC6,BC9, PC1-PC8	ON3,ON4,ON5,ON7, ON10
Multilingual training module;	GEC5,GEC9	ON3, ON8
Mechanical engineering technology module	GEC8, BC1-BC6, BC8, BC9, PC1PC8	ON3, ON10
control module	GEC8, BC2,BC3,BC9, PC1-PC8	ON4,ON5,ON7, ON8,ON9,ON10
Security technology module	GEC5, GEC9, BC 4,BC5,BC8, BC 9,PC3,PC7,PC8	ON5, ,ON8,ON11
Major disciplines		
Mechanical engineering technology module	GEC8,GEC9, BC1-BC6,BC9, PC1- PC8	ON4,ON5,ON7, ON10,ON11
Information technology module;	GEC8, BC1,BC2,BC9,BC 1-8	ON1,ON4,ON9, ON10
Automation and robotization module	GEC1GEC2,GEC4,GEC5,GEC6,GEC8,GEC9,BC1,BC2,BC3,BC8,BC9,PC1,PC2,,PC3,PC5,PC7,PC8	ON7, ON10

6 INFORMATION ABOUT THE DISCIPLINES OF THE EDUCATIONAL PROGRAM

№	Discipline name	Brief description of the discipline (50-60 слов)	Number of credits	Formed learning outcomes (codes)
Cycle of general education disciplines -56 кредитов Mandatory component of GED -51 кредит				
1	Modern History of Kazakhstan	The discipline gives knowledge about the main stages of the history of modern Kazakhstan; state-political development, including the construction of an independent state; the main directions of foreign policy and culture of Kazakhstan. Brings to the consciousness of students the essence of the fundamental problems of history, teaches them the scientific methods of historical knowledge, forms a scientific worldview, critical thinking and citizenship. Active teaching methods used: brainstorming, case-study, round table, discussion, commented reading of primary sources.	5	**ON** 1, **ON** 2
2	Philosophy	Philosophy is a special form of cognition of the world, which develops a system of knowledge about the fundamental principles and foundations of human existence, about the most general essential characteristics of the human relationship to nature, society and spiritual life in all its main manifestations. Philosophy synthesizes and generalizes the results of the practical and spiritual development of the world, offering possible strategies and choices for the socio-cultural development of social life. ***Used active teaching methods:*** problematic lectures, round table, discussion, commented reading of primary sources.	5	**ON** 1
3	Module of socio-political knowledge (Psychology, Culturology, Sociology and Political Science)	The discipline "Psychology" forms a holistic view of the psychological and personal characteristics of a person, reveals such issues as emotions, emotional intelligence, human will, psychology of self-regulation, individual typological characteristics, values, interests, norms - the spiritual basis. Considers the psychology of the meaning of life, professional self-determination, health, communication between individuals and groups, as well as techniques for effective communication. ***Active***	8	**ON 1, ON 2**

		teaching methods used: discussion, case method, fishbone, syncwine, inverted class method, project method.		
		The discipline "Culturology" reveals the foundations of the nature of culturological phenomena and processes, the specifics of the laws of functioning and development of culture; gives an idea of the basic concepts of cultural studies; methods of analysis of specific cultural phenomena, typology of cultures; ethnic and national, elite and popular culture; forms modern knowledge about culture and the place of cultural studies in the system of modern social and humanitarian, natural science and technical knowledge. ***Used active teaching methods:*** problem lectures, round table, discussion, presentations.		
		Sociology is the science of social life, of man and society, of the social interactions of the individual. The more complex the problems of society, the greater the role in their solution is played by knowledge about a person and society. Sociology is a way to understand complex social systems and processes, the problem of preserving society as a whole. Sociological knowledge allows us to consider any phenomenon in the human dimension, to see its social consequences. Used active teaching methods: problematic lectures, round table, discussion, presentations.		
		The purpose of the political science course is to develop students' skills of independent analysis of complex phenomena and trends in the sphere of political life, to give the necessary minimum knowledge about politics, about political institutions and their role in the modernization of Kazakhstani society, to contribute to the formation of students' conceptual apparatus. Political science forms the political outlook, political culture of students, promotes their active participation in society. ***Used active teaching methods:*** problematic lectures, round table, discussion, presentations.		

4	Information and Communication Technologies (in English)	The purpose of studying the discipline is to develop the ability to critically understand the importance of ICT in digital globalization, to acquire knowledge and skills in using modern ICT in various types of professional and social activities. The result of training is the ability to apply modern programming languages, system engineering methodology, ICT technological standards, understanding of methods and means of building information security systems in professional activities. ***Used active teaching methods:*** problem lectures, case-study, round table, discussion, presentations.	5	**ON3**, **ON** 8
5	A Foreign language	The discipline is designed to ensure the preparation of students in the general education discipline "Foreign language", as one of the compulsory disciplines that contribute to the formation of intercultural and communicative competence at a sufficient level. Students use language material with sufficient language means for a given level, correct mistakes in a timely manner and independently, analyze the causes and consequences of events in the texts and choose the forms and types of speech. ***Active teaching methods used:*** design method, role plays, round tables, etc.	10	**ON 8**
6	Kazakh (Russian) language	The discipline is aimed at developing students' speech skills in mastering additional means of communication and professional education in relation to the Kazakh (Russian) language. Development of lexical and grammatical skills; improving listening skills; development of information culture, language acquisition. In the learning process, students learn methods and techniques of various text analysis, use a system of subject and linguistic knowledge to solve problems of educational and professional communication. ***Active teaching methods used:*** case-study, syncwine, pair and group forms of work, discussion.	10	**ON 8,**
7	Physical education	The discipline forms knowledge in the field of conditions for maintaining and strengthening human health, the ability to build a	8	**ON 1**

		personal educational trajectory for self-development, focused on a healthy lifestyle to ensure full-fledged social and professional activity through the methods and means of physical culture, including planning activities aimed at maintaining and strengthening health, safety precautions in the process of physical education, organization and conduct of physical culture and health improvement work. ***Used active teaching methods:*** situational-problematic, situation dossier, game training, heuretic conversations, work in small groups.		
University component / Elective component – 5 credits				
1	Ecology and life safety	The discipline forms knowledge in the field of ecology, determines its role in solving modern economic and political problems, considers the basic ecological concepts and patterns of functioning of natural systems, the tasks of ecology as a science. Environmental Safety Management. Legal aspects of nature protection. Ensuring the protection of the population from the consequences of accidents, catastrophes, natural disasters; carrying out rescue and other urgent work in the affected areas. ***Used active teaching methods:*** lecture press conference; method "515"; Case Study; method "Chains", etc.	5	**ON 1**, **ON11**
2	Ecology and sustainable development	The discipline forms knowledge in the field of ecology and sustainable development. Studies the features and principles of interaction between human society and nature, the conditions for the development of an industrial society and the dehumanization of the planet's biosphere as a consequence of the demographic explosion and technogenic development. A number of global environmental problems have arisen: soil depletion, deforestation, the greenhouse effect, ozone depletion, pollution of the world's oceans, a decrease in fresh water supplies, desertification, and others. ***Used active teaching methods:*** problem lectures; brain attack; round tables; game		**ON 1**, **ON11**

		exercise.		
Cycle of basic disciplines -136 кредитов University component -110 кредита				
1	Higher Mathematics I	The discipline forms knowledge by creating a system of mathematical concepts and methods that will allow solving problems of both practical and theoretical content. As part of the course under consideration, using computer programs (Excel, Symbolab, Matlab, Maple). The training course covers the following topics: solving systems of linear equations; matrices, solution of matrix equations; operations with geometric vectors and vectors in the form of coordinates; incorrect and poorly regulated tasks; vector products (dot product of two vectors and cross product); straight lines and their equations, basic problems about a straight line on a plane; functions of one argument, illustration of problems with a graph of a discontinuous function; derivative of a function (geometric and mechanical interpretation, finding the derivative); differential, its practical application; the derivative is used to study functions and continuous processes (solving problems about extreme values of a function). ***Used active teaching methods:*** problem lectures, presentations	4	**ON1,ON3**
2	Higher Mathematics II	The discipline forms knowledge by creating a system of mathematical concepts and methods that will allow solving problems of both practical and theoretical content within the framework of the course under consideration, using computer programs (Excel, Symbolab, Matlab, Maple). The course program includes the following topics: functions with several arguments, their partial derivatives, extremal, indefinite and definite integral, double integral, surface integrals of the first type, linear integrals, ordinary differential equations, Taylor and Fourier series, the concept of functionality in the calculus of variations. ***Used active teaching methods:*** problematic lectures, presentations.	5	**ON1,ON3**
3	Technical graphics	The discipline forms a basic	4	**ON10**

		knowledge in the field of technical graphics, using CAD / CAM / CAE tools, which will allow you to perform high-quality design of equipment or its mechanical parts. The training course program includes the following topics: construction and transformation of drawings of spatial figures; technology for manufacturing parts and assembly units and methods for connecting parts; construction of axonometric projection of details; making sketches of parts, etc. During the course, technical graphics masters the execution, design and reading of assembly drawings, block diagrams and geometric structures. ***Used active teaching methods:*** game exercise; presentations		
4	Metrology	The discipline forms knowledge on the theoretical and legal foundations of metrology; forms competencies for the assessment, selection and effective use of methods and measuring instruments for solving the problems of managing innovative projects. The knowledge gained in the course of studying the discipline is used in practical engineering when planning measurements, choosing measuring equipment, developing measurement systems, as well as in the process of manufacturing parts, etc. Discipline Provides knowledge about quality control of parts, interchangeability, fits and sizes necessary for construction and maintenance various technical equipment. ***Used active teaching methods:*** game exercise; presentations	4	**ON5, ON7,ON9**
5	Electrical engineering	The discipline forms presentations on the calculations of electrical circuits of direct and alternating current, the construction of networks and measurements; teaches the most commonly used electrical installations, their general arrangement and principles of operation; provides the necessary knowledge of electrical safety; learn to understand and build typical electronic circuits so that the knowledge and skills gained can be used in the design and maintenance	4	**ON3,ON6,ON7, ON11**

		of the electrical part of equipment and mechatronic systems. The following topics are considered: basic concepts and laws of electrical engineering; electrical safety; direct current (DC) and alternating current (AC) in electrical circuits and their calculation; three-phase electrical circuits; transformers; calculation of wire sections; design of electronic circuits; carrying out electrical measurements. ***Used active learning methods:*** presentations		
	Thermodynamics and heat engineering	The discipline forms the basic knowledge of thermodynamics and heat engineering, which allows to understand the principles of operation of various thermal equipment and to calculate thermodynamic processes, water vapor, moist air, heat losses in buildings, heat transfer, on flat and cylindrical surfaces, drying equipment and heat exchangers, so that the knowledge, skills and competencies could be used in the design, installation, operation, maintenance and repair of equipment. The following topics are considered: basic concepts and laws of thermodynamics; thermodynamic diagrams and cycles; properties of water vapor and moist air; drying processes of materials, thermal conductivity, free and forced convection, radiation and complex heat transfer; heat exchange equipment. Students learn to solve engineering problems in thermodynamics and heat engineering analytically and with the help of special computer programs (Comsol). ***Used active teaching methods:*** game exercise; presentations	3	**ON3,ON7**
6	Professionally oriented foreign language	A professionally oriented foreign language (English) provides for learning to speak and write in a foreign language, forms a complex of knowledge, skills and abilities in the use of the basics of project management in accordance with international standards, the specifics of project management. The program provides for an introduction to the subject area of	4	**ON8**

		the specialty in a professional foreign language, as a disciplinary phenomenon serving all spheres of human activity. ***Active teaching methods used:*** design method, role-playing games, case-study, syncwine, pair and group forms of work.		
7	Materials Science	The discipline forms ideas about the structure of materials, with mechanical, physico-chemical properties and methods for changing properties; learn to determine various parameters of materials and find out the patterns of their change, so that the knowledge gained can be used in materials processing technologies, development, operation and maintenance of equipment and mechatronic systems. The following topics are considered: the structure of materials; mechanical, physical and chemical properties, methods for determining these properties; formation of the structure of cast materials; influence of chemical composition on the equilibrium structure of alloys; iron-based materials; heat treatment of alloys; strengthening the surface of parts; non-ferrous metals and their alloys. ***Used active teaching methods:*** game exercise; presentations, cases	5	**ON3,ON7**
8	Mechanics I	The discipline forms ideas about the concept of the laws of balance and motion of bodies, the basic principles of strength, stability and durability; teaches to calculate the characteristics of the movement of bodies, forces and moments of forces in structural parts, determine the dimensions of parts corresponding to a given load, predict the stability and durability of parts so that the knowledge, skills and abilities gained can be used in the design, installation, operation, maintenance and repair of mechanical details. The following sections of mechanics are considered: mechanics of a material point, conservation laws, rotation of bodies, mechanics of a solid body, fundamentals of continuum mechanics, mechanical oscillations and waves, analysis of the causes of	6	**ON3,ON4, ON5,ON7**

		man-made accidents, calculations for the durability of parts. Solve real engineering problems in mechanics using appropriate models and specialized computer programs (Comsol, MatLab, etc.). ***Used active learning methods:*** presentations		
9	Mechanics II	The discipline forms the concept of the laws of balance and movement of bodies, the principles of strength, stability and durability; learn to calculate the characteristics of the movement of bodies, forces and moments of forces in structural parts, determine the dimensions of parts corresponding to a given load, predict the stability and durability of parts so that the knowledge, skills and abilities gained can be used in the design, installation, operation, maintenance and repair of mechanical details. The following sections of mechanics are considered: a model of a material point, a model of a rigid body, a model of a continuous deformable body, the theory of elasticity, the principle of minimum total potential energy, the use of variational methods and the finite element method in solving mechanical problems, using analytical calculations and specialized computer programs (Comsol, matlab, etc.). Used active learning methods: presentations	5	**ON3,ON4, ON5,ON7**
10	Electronics and industrial electronic equipment	The discipline forms ideas about the structure, properties and methods of changing materials used in electronics, the most popular devices used in industrial electronics are considered, a practical definition of their physical parameters, and an introduction to the use of these devices is given. The materials used in electronics, their properties when using electronic devices, the most popular electronic devices, their practical application, logic circuits, their development are considered. ***Active teaching methods used:*** presentations.	4	**ON3, ON4, ON5,ON10,ON11**
11	Computer programs in mechanical engineering	The discipline forms the views on the use of CAD software to solve specific engineering problems. Teaches you how to perform engineering calculations in the	3	**ON3,ON10**

		COMSOL Multiphysics computer program for multiphysics process simulation, as well as deepen your knowledge and skills in working with CAD software. SolidWorks, so that the acquired knowledge, skills and competencies can be used in the design, installation, operation, maintenance and repair of equipment. The following topics are considered: engineering calculations of heat transfer processes (thermal conductivity, convection, radiation) in stationary and non-stationary modes; calculations of stress and deformation fields of bodies under static and dynamic loads; calculations of the frequencies of self-oscillations of bodies and modes of oscillations in the computer program for the complex modeling of physical processes COMSOL Multiphysics; working with CAD and CAE SolidWorks software, which allows you to create detailed structural models, including 3D models and 2D drawings from complex parts and their assemblies, allows you to eliminate model errors and process them using integrated displacement and load calculation tools. ***Used active learning methods:*** presentations, projects		
12	Robotics	The discipline forms the concepts of the basic principles of the work of robots; actuators, sensor systems and control systems used in robotics; learn to program the Mitsubishi robotic arm and Festo Robotino robots. Considers the history of the development of robots, their classification, compares various sensor systems and drives, introduces robot control systems and their types. In practice, the programming of the manual control system of the robot is performed. ***Used active learning methods:*** presentations	4	**ON3,ON4,ON10**
13	Automatic control	The discipline is aimed at mastering the typology and principles of operation of automatic control systems using the MATLAB software. With which you can analyze the management systems	4	**ON3,ON4,ON5**

		and analyze the sustainability criteria. The course also covers the practical development of automatic control systems on microcontrollers and PLC controllers in the form of laboratory work and practical work. ***Used active learning methods:*** presentations		
14	Basics of programming	The discipline forms programming skills in the C++ language. The course introduces the study of algorithms and development programs for solving various problems. For this the structure of programs, principles of construction algorithms and programs, solution methods, algorithmization, programming, debugging and implementation of programs, the use of modern methodologies and technologies for creating programs and complexes. ***Used active learning methods:*** presentations, group work, game learning	4	**ON3,ON10**
15	Hydraulic and pneumatic drive	The discipline forms concepts about the general laws of equilibrium and motion of liquids and gases, as well as methods for applying these laws to solve problems; fundamentals of hydraulic machines and hydraulic drives and their areas of application, taking into account the specifics of the specialty. The main goal of the theoretical course is to form in students a systematic understanding of the subject being studied, methods, rules and norms of calculation. The following topics are considered: basic concepts and laws of hydrostatics and hydrodynamics; types of fluid flow; calculation of hydraulic losses; hydraulic / pneumatic systems, design, principle of operation and designation of their elements; basics of design, safety rules when working with hydraulic and pneumatic systems; fundamentals of automatic control of hydraulic and pneumatic drives. ***Used active learning methods:*** presentations, group work, case studies	4	**ON3,ON4,ON5, ON11**
16	Robotics practice	The discipline forms the concepts of designing a mechatronic device (a simple robot, a CNC device, a	3	**ON3,ON4**

		3D printer, etc.), manufacturing its elements, selecting electronic control systems, their creation and configuration. The discipline considers the mechatronic structure, through the disciplines of mechanics, electronics and programming; equipment design, selection of its components (mechanical, electronic parts), manufacturing, during which the practical skills of students are tested. ***Used active learning methods:*** presentations, group work, game learning		
17	Basics of design I	The discipline forms concepts about the basic elements of machines, about technological processes, in order to be able to design equipment or its mechanical parts using CAD / CAE computer programs. The discipline introduces the elements of mechanical engineering, the application and calculation of these elements. The course covers working with CAD and CAE SolidWorks software, which allows you to create detailed structural models, including 3D models and 2D drawings from complex parts and their assemblies, allows you to eliminate model errors and process them using integrated displacement and load calculation tools. ***Used active learning methods:*** presentations, group work, game learning	3	**ON10**
18	Basics of design II	The discipline forms concepts about the basics of machine elements, technological processes, in order to be able to design equipment or its mechanical parts using CAD / CAE computer programs. Introduces the elements of mechanical engineering, the application and calculation of these elements using CAD and CAE SolidWorks software, which allows you to create detailed structural models, including 3D models and 2D drawings of complex parts and their assemblies. These technologies allow you to eliminate model errors and process them using integrated tools for calculating displacements and loads. ***Used active learning methods:*** presentations, group	3	**ON10**

		work, game learning		
19	Electrical machines and electric drives	The discipline forms the concepts of the basic principles of the design and operation of electrical machines and electric drives used in engineering and mechatronic systems; design and connect electronic circuits consisting of electric drive elements; carry out measurements of the parameters of the electric drive and make calculations of electric motors so that the knowledge and skills gained can be used in the design and maintenance of the electric drive of equipment and mechatronic systems. The following topics are considered: electric drive mechanics; physical foundations of electromagnetic energy conversion; three-phase asynchronous motors, synchronous machines, DC machines and other types of electric motors, their design, operation, characteristics, starting, braking, speed control, transients; power engineering of the electric drive; selection and calculations of electric motors; measurement of electric drive parameters; obtaining motor characteristics; safety regulations when working with an electric drive. ***Used active learning methods:*** presentations, group work	5	**ON3,ON5.ON11**
20	Servo drive	The discipline forms: concepts about the use of servos, the operation and structure of their components. Forms requirements for choosing a servo drive for a specific task. Introduces students to the types of servo drive, the device and the use of feedback sensors included in it, technological solutions for the power supply electronics circuit. It also gives an introduction to setting up servo parameters, the main elements of the software used and how to use them. ***Used active learning methods:*** presentations, group work	3	**ON3,ON5,ON7**
21	Computer architecture	The discipline forms the ability to analyze technological solutions in the field of software and computer processing of information, based on the formed system of knowledge, skills and abilities in the field of computer architecture. In the course of studying the discipline, the	3	**ON3,ON10**

		classification of computers is considered according to various criteria, characteristics and features of various classes of computers, development trends computing systems; forms of presentation of information in a computer; structural and functional diagram of a personal computer, etc. ***Active teaching methods used:*** presentations, group work		
22	Robotic control systems	The discipline forms concepts about the basic principles of robot control systems; understanding of sensor systems, actuators and their interaction in control systems; teaches you how to build your own robot control system using microprocessors. The course is devoted to various types of control systems and principles of their operation, practical development of robot control systems to perform tasks of varying complexity. ***Used active learning methods:*** presentations, group work	3	**ON3,ON4,ON10**
23	Automatic control systems for electric drives	The discipline forms the basic principles of construction and operation of automatic control systems (ACS) for electric drives (ED) used in mechatronic systems; design and connect automation schemes; program and configure PLCs and frequency converters (FC) so that the acquired knowledge and skills can be used in the design and maintenance of automatic control systems for electric drives of mechatronic systems. The following topics are considered: basic principles of construction and operation of automatic control systems for electric drives; construction of electronic circuits containing elements of automated control systems; design of electronic circuits in CAD; configuration of frequency converters; setup and programming of the PLC for automatic control of the electric drive. ***Used active learning methods:*** presentations, group work	4	**ON3,ON4,ON10**
24	Computer control systems	The discipline forms the concepts of conceptual understanding of the principles of automated systems.	4	**ON4,ON10**

		The following topics are considered: development of models of computer systems; training of specialists in discrete computer control and implementation of scientific research. work independently with Matlab Simulink modeling tools. Know the general aspect of Matlab software systems. learn the details of designing and analyzing Simulink models. ***Used active learning methods:*** presentations, group work		
25	Business (IT in business and management)	The discipline forms the development of professional competencies in the field of entrepreneurship in aspiring entrepreneurs by acquiring knowledge and skills in the field of entrepreneurship, generating business ideas and developing projects, office work, financial management, commercial and labor law and social dialogue in society. Development of skills for innovative approaches, development of a business plan, presentation, communication and argumentation. ***The methods used to study the course include discussions and trainings with the active participation of students;*** solution and analysis of practical examples; group work, business environment case, entrepreneurial games and other practical methods for acquiring competencies.	6	**ON8, ON9,ON10**
26	Introduction to Research	The discipline forms an understanding of the research cycle (planning, initiation, management) and the development of basic skills for understanding scientific work, improving the ability of students to recognize problems in their field of study, formulate research questions and the main stages of individual research planning. The course introduces the process of research work, starting with defining the role of the researcher and planning the structure of the first academic work. Particular attention is paid to the development of scientific interests of students and their formulation of individual research questions. ***Used active learning methods:*** presentations, group work	2	**ON1,ON3,**

27	Educational practice	Educational practice is a necessary component of the educational process for the training of specialists in the specialty "Mechatronics". During the practical training, the skills of working on a personal computer, using the capabilities of application packages, specialized literature, searching for the necessary information on the Internet, preparing and formalizing technical documentation are consolidated. Active teaching methods used: solving practical problematic problems; exercise situation.	1	**ON** 1, **ON 3, ON8,ON11**
28	Internship 2c	The industrial practice of students is aimed at the stages of assisting the training of qualified specialists, the purpose of which is to consolidate in practice the theoretical knowledge gained by students in the learning process, as well as to deepen and develop the skills of practical work in enterprises, taking into account the development and implementation of mechatronic systems. ***Used active learning methods:*** analysis of a specific situation; situation-exercise; solution of practical problems.	3	**ON** 3, **ON** 8, **ON10,ON11**
Selectable Component -26 credits				
1	Accuracy and standardization of parts	The discipline forms knowledge in the field of details of control methods, the technical equipment used, be able to read and use the tolerances of centering units and parts. Select the alignment points: shaft - gear, shaft - bearing, bearing - housing. Determine the tolerances of parts in accordance with the nature of their alignment and display them on the drawing, display the tolerance fields. Acquire the skills of choosing alignment sites and determining the tolerances of parts in accordance with their processing and control capabilities. ***Used active learning methods:*** presentations, group work	5	**ON7,ON9**
2	Introduction to the Internet of Things	The discipline forms knowledge about the basic principles of organization and functioning, the history of emergence and development, the main factors in the development of the Internet of things, existing technologies, trends		**ON 3, ON 4, ON9, ON10**

		and prospects in areas of the Internet of things; practical skills in working with Arduino microcontrollers, connecting and programming end devices, creating a software solution for creating and storing data using cloud technologies. Team projects (brainstorming, presentation and discussion) are carried out during practical classes.		
3	Power electronics	The discipline forms knowledge on the operation of power electronics converters. Ability to formulate requirements for choosing a transducer for a specific task, to select a transducer and its elements. Acquaintance with the structure, operation, parameters, characteristics of power electronic devices, teach how to create simple power electronic circuits, make calculations in them so that the knowledge gained serves as the basis for the development, use and maintenance of automatic control and regulation. The following topics are considered: General definitions of power electronics and mathematical apparatus. The device and operation of power semiconductor switches. Characteristics and parameters of power switches. Switch element selection. DC converters and special converters. Network converters of medium and high power. Voltage inverters. Power inverters. resonant inverters. Functions and structure of control systems. Methods for regulating direct voltage. The use of powerful semiconductor switches in power circuits. Development of power converters using modern solutions. The practical part includes laboratory work, modeling of converters, problem solving, it is possible to manufacture and test a certain electrical circuit. ***Used active learning methods:*** presentations, group work	4	**ON3, ON4, ON11**
4	Automation of business documentation support **	The discipline helps to understand the need to implement electronic document management systems in the business processes of any organization, to gain experience in assessing the capabilities and complexity of the chosen system.		**ON**4,**ON**5

		Introduces the principles of operation of automated document management systems. The theoretical foundations of electronic document management technologies and the practice of their application in the IS of enterprises for the purpose of document management are considered. Use of technology to collect, manage, store, protect and deliver information related to organizational processes. ***Used active teaching methods:*** problematic lectures, round table, discussion, presentations.		
5	CAM technologies	The discipline forms the knowledge of programming and setting up CNC metalworking machines (lathe, milling machine) using CAM tools. The following topics are considered: the device and principles of operation of CNC metalworking machines (EMCO Concept Turn 450, EMCO Concept Mill 450); acquisition of programming skills for these machines using CAM tools: EMCO CAM-Concept, MasterCAM, SolidWorks CAM. Select (according to the technological process) and measure a cutting tool, set up a CNC machine, independently manufacture (turn, mill) a given part, check its dimensions, and, if necessary, make appropriate settings on the machine; has knowledge and skills in labor protection on CNC metalworking equipment. ***Used active learning methods:*** presentations, group work	3	**ON3, ON4,ON10**
6	Patenting and protection of intellectual property	The discipline forms the knowledge of normative legal acts on the regulation of civil circulation of intangible goods; intellectual property legislation, nature and purpose of the patent system, methods of information analysis, procedure for obtaining patent rights; practical skills in interpreting legal terms in the field of intellectual property law, identifying objects of invention, literary and patent search, processing individual application materials. ***Used active learning methods:*** case-study; brainstorm; individual projects.		**ON 2, ON9**

7	Fundamentals of artificial intelligence	The discipline forms knowledge of artificial intelligence methods based on decision-making in various aspects - business, management, production and information technology; about the structure and functions of decision support systems, decision making using artificial neural networks and genetic algorithms, the use of modern information technologies and the study of their practical application. Gives an idea to software engineers about the basic procedures for quantitative processing of information obtained as a result of research using modern information technologies and learn how to apply them in practice. The course provides an initial understanding of artificial neural networks and the possibilities of their application in real situations. ***Used active learning methods:*** presentations, group work	4	**ON3, ON4,ON10**
8	Business Process Modeling	The discipline forms: general scientific and specific methods of business process management; methodology for describing activities; methodology for describing various subject areas of activity; methods of process analysis; methods of controlling and monitoring business processes. In the course of studying the discipline, tools for modeling business processes will be considered; analysis of business processes; managerial functions within the framework of projects and programs for improvement of business processes. ***Used active teaching methods:*** individual projects (computer simulation, presentation and discussion).		**ON 6, ON 8, ON 9,ON10**
9	Labor protection and labor legislation	The aim of the training course is fostering a safe worldview among students and gaining knowledge about: the main legislative acts of the Republic of Kazakhstan on labor protection; harmful and dangerous industries and factors; peculiarities of working conditions, injuries and morbidity at work; features of labor protection at work. Discipline shapes the necessary theoretical base in the field of the legislation of the Republic of Kazakhstan in the field	3	**ON8,ON11**

		of ensuring labor protection at work; knowledge about the peculiarities of working conditions, injuries and morbidity at work; obtaining knowledge about sanitary norms and rules. ***Used active teaching methods***: presentation and discussion.		
10	Certification and technical documentation	The discipline forms students' knowledge in the field of product certification, as well as in technical document management, application of the requirements of regulatory documents to the main types of services and processes, national and international systems of standardization and certification, standards for processing documents, regulations, protocols and organizing their own activities, choosing standard methods and ways of performing professional tasks, evaluating their effectiveness and quality. ***Used active teaching methods:*** lecture-conversation; solving practical problematic problems; situation-problem; presentation.		**ON5,ON8**
11	Production organization and planning	The discipline forms students' knowledge on the issues of planning and organizing the production process. During the training, the student acquires knowledge about the essence of production and organization of production, regulations, technological documentation necessary for production, materials, equipment, labor, auxiliary operations, site and premises planning, risk management of production processes and financial planning. planned production project. ***Active teaching methods used:*** solving practical problematic problems; situation-problem; presentation.	3	**ON9,ON10**
12	Digital media technologies	The discipline considers current trends in the development of new information (digital) technologies in professional activities. Considered: stages of application development with GUI; widgets, tkinter event handling; creating classes and objects in Python; processing NumPy arrays; Matplotlib basics, Matplotlib plot structure, Matplotlib plotting, Matplotlib special plot elements;		**ON 4, ON10**

		Pygal library, design of Pygal chart elements. ***Used active teaching methods:*** group mini-projects; brainstorm.		
13	IT project management	The discipline forms a complex of knowledge, skills and abilities for project management in accordance with international standards and PMI PMBOK guidelines; modern practices in project management, including several types of flexible management methodologies (AGILE, KANBAN, SCRUM, LEAN, etc.); specifics of project management in the field of information technology, the use of various software products in project management. ***Used active learning methods:*** team projects (brainstorming, presentation and discussion); solution of practical problems.	4	**ON 4, ON 5, ON 9**
14	Digital management by industries	In the course of studying the discipline, the current requirements of the local and global labor market are considered, who have in-depth skills in applying IT in the field of the economy, who are able to solve problems in the development of the digital economy, e-business and commerce using digital resources. The discipline forms a complex of knowledge, skills and abilities in the field of using digital tools in company management. ***Used active teaching methods:*** lecture - "brainstorming"; the use of multimedia tools; case-study; work in small groups; discussion.		**ON 9, ON 10**
The cycle of major disciplines - 65 credits University component - 61 credits				
1	Metalworking technologies and equipment I	The discipline forms students' knowledge of metalworking technologies, their technological equipment, learns to determine the scope of the cutting tool, be able to choose a cutting tool for a certain type of processing, study the nuances of the design of metalworking machines, use the knowledge and skills gained in order to be able to perform high-quality equipment design or its mechanical parts. To acquaint students with metalworking technologies, technological equipment, devices and fixtures used in metalworking, metalworking equipment (lathes,	4	**ON4, ON5,ON11**

		milling machines, abrasive processing equipment, etc.), their design, work with them, safety rules, cutting tools used in various works, their design and basic principles of operation. ***Active teaching methods used;*** use of multimedia tools; case-study; presentations		
2	Metalworking technologies and equipment II	The discipline forms students' knowledge in the field of metalworking technologies, their technological equipment, learn to determine the scope of the cutting tool, be able to choose a cutting tool for a certain type of processing, study the nuances of the design of metalworking machines, use the knowledge and skills gained in order to be able to perform high-quality equipment design or its mechanical parts. To acquaint students with metalworking technologies, technological equipment, devices and fixtures used in metalworking, metalworking equipment (lathes, milling machines, abrasive processing equipment, etc.), their design, work with them, safety rules, cutting tools used in various works, their design and basic principles of operation. ***Active teaching methods used;*** use of multimedia tools; case-study; presentations	5	**ON4, ON5,ON11**
3	Programming and setting up CNC machines I	The discipline forms students' knowledge of programming and setting up CNC metalworking machines (lathe, milling machine) at the initial level. The course is devoted to the device and principles of operation of CNC metalworking machines (EMCO Concept Turn 450, EMCO Concept Mill 450); Basic G-code programming skills for these machines are acquired using the EMCO WinNC SINUMERIK 810D/840D Turning/Fring and EMCO WinNC Heidenhain TNC 426 Conversational part programs. Students learn to select (according to the technological process) and measure a cutting tool, set up a CNC machine, independently manufacture (grind, mill) a given part, check its dimensions, and, if necessary, make appropriate	3	**ON4, ON5,ON10**

		settings on the machine; has knowledge and skills in labor protection on CNC metalworking equipment. ***Used active teaching methods:*** the use of multimedia tools; case-study; presentations		
4	Programming and setting up CNC machines II	The discipline forms students' knowledge of programming and setting up CNC metalworking machines (lathe, milling machine) at the user level. The course is devoted to the device and principles of operation of CNC metalworking machines (EMCO Concept Turn 450, EMCO Concept Mill 450, EMCO Concept Mill 55); the skills of programming these machines in G-codes are acquired using the EMCO WinNC SINUMERIK 810D/840D Turning/Franking and EMCO WinNC Heidenhain TNC 426 Conversational control programs. Students learn to select (according to the technological process) and measure a cutting tool, set up a CNC machine, independently manufacture (grind, mill) a given part, check its dimensions, and, if necessary, make appropriate settings on the machine; has knowledge and skills in labor protection on CNC metalworking equipment. ***Used active teaching methods:*** the use of multimedia tools; case-study; presentations	3	**ON4, ON5,ON10**
5	Technique and programming of microcontrollers I	The discipline develops students' knowledge of the principles of design and operation of microprocessors, choose the appropriate microprocessors in accordance with the specific tasks that need to be performed, connect microprocessors to various peripheral devices, write code for microprocessors in the C ++ programming language. . The history of microprocessors, their design, their practical application is presented. Learning the basics of programming microprocessors by connecting them to various peripheral devices. ***Used active methods:*** teaching the use of multimedia tools; case-study; presentations	5	**ON10**
6	Technique and programming of microcontrollers II	The discipline forms students' skills in programming microprocessors, gain an understanding of the	**4**	**ON10**

		practical application of microprocessors and be able to use the knowledge gained in the implementation of practical projects. The course is devoted to the in-depth use of microprocessors, programming microprocessors for more complex tasks. The interaction between peripheral devices and microprocessors and its results are discussed in detail. ***Used active methods:*** teaching the use of multimedia tools; case-study; presentations		
7	Maintenance and repair of CNC machines + Course project	The discipline forms students' knowledge on the supervision of mechatronic equipment and CNC equipment, issues of their maintenance, repair and operation features to ensure their high-quality and long-term operation in production conditions. During the course, the student learns the nuances of the design of mechatronic, computer numerical control (CNC) machines, other machine-building equipment, their operation, so that the knowledge, skills and competencies gained can be used in the installation of equipment, operation, maintenance, diagnostics and repair. ***Used active methods:*** teaching the use of multimedia tools; case-study; presentations	6	**ON4, ON5,ON10**
8	Design of automatic control systems + Course project	The discipline forms students' knowledge of the development of automated control systems for mechatronic equipment and the manufacture of their prototypes. The methodology for designing automated control systems is considered; students acquire in-depth knowledge and skills in working with CAD for the design of automated control systems; ACS prototypes for the simplest mechatronic equipment were made. ***Used active methods:*** teaching the use of multimedia tools; case-study; presentations	6	**ON3,ON7,ON10, ON11**
9	Designing Computer Control Systems + Course Project	The discipline forms students' knowledge on the development of an educational project in the field of computer control systems. The course continues the study of the concepts of development of computer control systems.	6	**ON3,ON7,ON10, ON11**

		Particular attention is paid to the practical aspects of computer control systems. Preparation for the development of a training project on computer control systems. ***Used active methods:*** teaching the use of multimedia tools; case-study; presentations		
10	Industrial practice 3c	Industrial practice of students is the most important part of the training of highly qualified specialists. It is aimed at consolidating and expanding theoretical knowledge and practical skills in the field of mechatronics, in the use of innovative technologies in the field of robotics; in the development of methods and means of researching the subject area of production, economic and other purposes. ***Active teaching methods used:*** solving practical problematic problems; group work.	5	**ON 4, ON 5, ON 8, ON9, ON10,ON11**
11	Undergraduate internship 4c	Pre-diploma practice is aimed at consolidating the theoretical and practical knowledge obtained at the university in the field of application: study of promising developments in the field mechatronics and robotics at the enterprise; participation in the implementation of design and experimental research work related to the topic WRC; study of technological equipment used for production of mechatronic robotic systems; case studies use of robots, mechatronic modules, components and assemblies, conditions and features their operation, installation and computer-aided design; getting skills programming and adjustment of mechatronic and robotic systems; familiarization with the organization of labor and production management; study of protection measures labor and safety. ***Active teaching methods used:*** solving practical problematic problems; group work.	14	**ON2,ON3,ON4, ON5, ON6,ON7,ON8, ON9,ON10,ON11**
Elective component – 4 credits				
1	Smart transport	Discipline shapes students have theoretical and practical knowledge of trends	4	

		development of digital ecosystems; technologies that ensure the creation a specialized system of digital interaction and a standardized environment information support of transport and logistics processes; introduces the basic principles and technological trends of the ecosystem and the structure of the digital economy; classification of digital platforms, introduction of digital technologies and platform solutions; ecosystem architecture (platforms) of the digital industry. ***Active teaching methods used:*** solving practical problematic problems; group work, presentations.		
2	BigDate Technologies and Cloud Computing	The discipline forms theoretical knowledge of the main characteristics of "cloud" technologies. During the training, students get acquainted with the methods of researching large data sets containing disparate information, get the skills to extract the necessary information from various sources. The student must know the methodology of research, data collection, data processing and transformation, model building, ways of organizing data storage. In the course of studying the discipline, students will gain skills in working with tools for organizing data storage, skills in software implementation in programming languages; developing applications for existing "cloud platforms", etc. ***Active learning methods used:*** situational tasks; solving practical problematic problems; discussions; presentations.		**ON** 4, **ON 10**
Total attestation				
1	Final attestation	Writing and defending a thesis (project) or preparing and passing a comprehensive exam research, formulation of conclusions, patterns, recommendations and proposals on the topic of the thesis	14	**ON3,ON4, ON5, ON6,ON7,ON8, ON9,ON10,ON11**
Totally			**271**	