

**174 Automation, Computer Integrated Technologies and Robotics**

Educational-professional Program «**174 Automation, Computer Integrated Technologies and Robotics**»

Guarantor of the program – **Prof. Nataliia Zaiets**\_\_\_\_\_   
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**Bachelor**  
**Field of Knowledge " Electronics & Telecommunications "**  
**in Specialty " Automation, Computer Integrated Technologies and Robotics "**  
**Educational-professional program «Automation, Computer Integrated Technologies and Robotics »**

Form of Training:	Licensed number of persons:
– Full-time	XXX
– Part-time	XXX
Duration of Training	3 years 10 months
Credits ECTS	240
Language of Teaching	Ukrainian, English
Qualification	Bachelor in Automation, Computer-Integrated Technology and Robotics

### **Concept of training**

The purpose of the educational and professional program is to train specialists capable of comprehensively solving the problems of developing new and modernizing and operating existing automation systems and computer-integrated technologies using modern software and hardware and information technologies, performing theoretical studies of the automation object, justifying the choice of automation hardware , design of automation systems and development of application software for various purposes.

### **Practical training**

The program provides for a mandatory condition for passing educational and industrial practice at leading enterprises operating automation systems, computer-integrated technologies and robotic complexes.

### **Proposed Topics for Bachelor theses**

1. Development of the automatic microclimate control system in the 4-generation Venlo type greenhouse using Siemens controller.
2. Development of an automated system for building an interactive network of devices using the Google Cloud Platform.
3. System for automatic temperature control of the drum boiler using a set of Schneider Electric hardware.
4. Development of a computer-integrated control system for the compound feeds production using OWEN controller.
5. Development of a control system for a mobile robot for collecting phytometric information in an industrial greenhouse.

**Academic rights of Graduates:** can continue their studies in specialties and educational (educational-professional or educational-scientific) master's programs in the specialty "Automation, Computer Integrated Technologies and Robotics" or other specialties of specific categories.

### **Employment of Graduates**

According to the current edition of the National Classifier of Ukraine: Classification of Occupations (DK 003:2010) and International Standard Classification of Occupations 2008 (ISCO-08), a graduate with the professional qualification "Bachelor in Automation,

Computer-Integrated Technologies and Robotics" can with the following professional title of work: Automation Technician, Information Technology Technician, Industrial Process Automation Technician, Metrology Technician, Computing Center Technician, Programmer Technician, Electronic Equipment Operator Technician, Industrial Robot Controllers and Regulators.

**Bachelor`s Program and Curriculum  
in Specialty «Agronomy»  
Educational-professional program « \_\_\_\_\_ »**

Code n/a	Components of the educational and professional program (education disciplines, course projects (paper), practice, qualification work)	Amount of credits ECTS	The final control
1	2	3	4
<b>1. GENERAL TRAINING CYCLE</b>			
<b>Compulsory components EPP</b>			
CC 1	Fundamentals of ecology	4,0	exam
CC 2	higher mathematics	17,0	exam
CC 3	Numerical Methods	5,0	exam
CC 4	Physics	10,0	exam
CC 5	Chemistry for renewable energy	4,0	exam
<b>Compulsory components EPP on the recommendation of the Academic Council of the University</b>			
CCU 1	History of Ukrainian statehood	4,0	exam
CCU 2	Ukrainian language in a professional direction	4,0	exam
CCU 3	Philosophy	4,0	exam
CCU 4	Foreign language	8,0	exam
CCU 5	Physical education	5,0	exam
<b>2. SPECIAL (PROFESSIONAL) TRAINING CYCLE</b>			
<b>Compulsory components EPP</b>			
CC 6	Computer graphics	4,0	exam
CC 7	Computer technology and programming	9,0	exam
CC 8	Electrical engineering and electromechanics	9,0	exam
CC 9	Electronics and microprocessor technology	8,0	exam
CC 10	Design of automation systems	8,0	exam
CC 11	Theory of automatic control	10,0	exam
CC 12	Technical means of automation	6,0	exam
CC 13	Metrology, process measurements and instruments	8,0	exam
CC 14	Identification and modeling of technological objects	8,0	exam
CC 15	Automation of typical technological processes and productions	5,0	exam
CC 16	Microprocessor control devices	4,0	exam
CC 17	Computer-integrated technologies	8,0	exam
CC 18	Information and measuring complexes	4,0	exam
CC 19	Modeling and optimization of control systems	4,0	exam
CC 20	Educational practice	10,0	exam
CC 21	Industrial practice	5,0	exam
CC 22	Diploma design	5,0	Defense of qualification work
<b>Total</b>		<b>180</b>	
<b>Optional components EPP</b>			
<b>Optional components by specialty (block 1)</b>			
OC 1.1	Engineering graphics	4,0	test
OC 1.2	Features of biotechnical objects of agricultural production	4,0	test
OC 2.1	Data transmission systems and networks	4,0	test
OC 2.2	Information security of automation systems	4,0	test
OC 3.1	Service maintenance of computer, network equipment and server systems	4,0	test
OC 3.2	Software architecture and design	4,0	test
OC 4.1	Theoretical and applied mechanics	4,0	exam
OC 4.2	Heat engineering and hydraulics	4,0	exam
OC 5.1	Electrical technologies in agricultural production	4,0	test
OC 5.2	Automated electric drive	4,0	test
OC 6.1	Cloud technologies and global databases	4,0	exam
OC 6.2	Programming real-time systems	4,0	exam
OC 7.1	Legal culture of the individual	4,0	test
OC 7.2	Political science and sociology	4,0	test

OC 8.1	Energy and resource saving technologies	4,0	exam
OC 8.2	Information theory	4,0	exam
OC 9.1	WEB technologies in automation systems	4,0	exam
OC 9.2	Robotic complexes of industrial production	4,0	exam
OC 10.1	Fundamentals of system analysis	4,0	test
OC 10.2	Integrated information security systems	4,0	test
OC 11.1	Fundamentals of technical operation of automation systems	4,0	exam
OC 11.2	Optimal control systems	4,0	exam
OC 12.1	Fundamentals of Scientific Research	4,0	test
OC 12.2	Economics of automated production in the agro-industrial complex	4,0	test
<b><i>Optional components by Student's Choice</i></b>			
OCS 1	<i>Elective discipline 1</i>	4	test
OCS 2	<i>Elective discipline 2</i>	4	test
<b>Total</b>		<b>8</b>	
<b>The total amount of Optional components</b>		<b>60</b>	
<b>THE TOTAL AMOUNT OF EPP (without military training)</b>		<b>240</b>	

## Annotations of Components in the curriculum

### 1. GENERAL TRAINING CYCLE

#### Compulsory components

**Fundamentals of ecology.** Legal and organizational issues of environmental protection. Global environmental problems: population problems, depletion of energy resources, the physical content of the greenhouse effect, the physical content of the formation of ozone holes. The concept of toxicity of substances. Protection of the hydrosphere. Atmospheric protection. Protection of the lithosphere. Ecological monitoring systems. Energy and its impact on the environment.

**Higher Mathematics.** Elements of linear, vector algebra and analytic geometry. Differential calculus of functions of one and several variables. Complex numbers. Laplace transformation, orthogonal series, correspondence between operations on originals and images. Integral calculus of functions of one and several variables. Differential equations, systems of differential equations. Rows are numerical and functional. Harmonic analysis.

**Numerical methods.** Linear algebraic systems of equations. Elementary transformation of the system. Gauss method algorithm and their application. Harmonic analysis. Methods for processing experimental data.

**Physics.** Physical bases of classical mechanics. Fundamentals of molecular physics and thermodynamics. Electricity and magnetism. Physics of oscillations and waves. Optics. Elements of atom physics and quantum mechanics. Elements of rigid body physics. Elements of the special theory of relativity. Elements of nuclear physics and nuclear energy.

**Chemistry for renewable energy.** The structure of atoms, molecules, substances, their state of aggregation. Chemical reactions Solutions of electrolytes and non-electrolytes. Corrosion and protection of materials and alloys. The concept of Ph. Electrochemical processes. Chemistry for renewable energy.

#### Compulsory components on the recommendation of the Academic Council of the University

**History of Ukrainian statehood.** The study of the objective laws of development of the Ukrainian state. Adoption of the Constitution Analysis of the general problems of Ukraine's transition to a social market economy and integration into the world community.

**Ukrainian language in the professional direction.** Scientific terminology, terms and their application, specific to the specialty of an engineer in automation and computer-integrated technologies, as well as the reproduction of previously acquired knowledge.

**Philosophy.** A system of philosophical knowledge from the main sections of philosophy, developing a type of consciousness based on constructive-critical approaches to the ideals of humanism.

**Foreign language.** Comprehensive training of speech activity (reading, listening, speech). Mastering the skills of communication and translation.

**Physical education.** The purpose of teaching the discipline is to form the physical culture of a young specialist and the ability to implement it in social and professional training and in the family. The task of studying the discipline is to strengthen the health of students and develop physical abilities that meet the professional activities of the future specialist.

### 2. SPECIAL (PROFESSIONAL) TRAINING CYCLE

#### Compulsory components

**Computer graphics.** The use of computer tools when performing tasks, including the creation of graphic objects of various types. Modeling by geometric and computer methods of instrument-making products. Construction and design of their technical drawings and diagrams in accordance with existing standards. The use of information design systems in their professional activities.

**Computer technologies and programming.** Algorithmic languages and programming methods Area of use of algorithmic languages. Fundamentals of programming in high and low level languages. The use of programming methods in engineering activities.

**Electrical engineering and electromechanics.** Electric and magnetic fields. Electrical circuits. Methods for calculating DC electrical circuits. Multipoles. Non-linear circles. Methods for calculating circuits at periodic currents and voltages. Transient processes in linear circuits and methods for their calculation. Methods for calculating non-linear circles Transient processes in non-linear circles.

**Electronics and microprocessor technology.** Passive elements of electronics. Semiconductor diodes, transistors, thyristors. Photoelectric, optoelectronic and indicator devices. Electronic amplifiers. Digital and impulse devices. Means of nutrition. Microprocessor devices. Microcomputer structure, microprocessor architecture, microprocessor command system, microcontroller hardware, interrupt system, object-matching devices.

**Design of automation systems.** Automation schemes, ways of choosing complex technical means of automation at the stage of designing and analyzing automation systems are considered.

**Theory of automatic control.** Automation systems, classification. Elements of systems. Static and dynamic properties. Dynamic links. Characteristics of system elements and control objects. Linear systems. Schemes, transfer functions. Conditions and criteria of stability. Adjustment quality. Synthesis. Statistical analysis. Nonlinear systems. Research by methods of fitting, phase portrait, harmonic linearization. Statistical linearization. Sustainability.

**Technical means of automation.** State system of devices. Sensors. Amplifiers. Logical elements. Executive elements. Automatic regulators. Classification. Features of choice and calculation. Device, design features. Control.

**Metrology, technological measurements and devices.** Legislative and normative acts in the field of metrology. General problems of the theory of measurements and errors. Theory and practice of ensuring guaranteed accuracy of measurements and systems. Analog measuring devices. Measuring mechanisms. Recording devices. Digital devices. Measurement of electrical and magnetic quantities.

**Identification and modeling of technological objects.** The classification of technological actions and productions as objects of automatic control is given. Methods for constructing static and dynamic objects of agricultural technological actions and industries are considered.

**Automation of typical technological actions and productions.** classification and structure of modern automated standard technological processes; main characteristics of automation of typical technological processes; setting tasks for automation of typical technological processes; automation of specific typical technological actions. Classification and structure of modern automated control systems; types of ACS support; automated control systems for specific objects and production processes in animal husbandry, crop production and fodder production; functional diagrams of automation; formulation of ACS tasks

**Microprocessor control devices.** Passive elements of electronics. Semiconductor diodes, transistors, thyristors. Photoelectric, optoelectronic and indicator devices.

Electronic amplifiers. Digital and impulse devices. Means of nutrition. Microprocessor devices.

**Computer-integrated technologies.** Creation and operation of computer-integrated control systems that provide solutions to the problems of coordinating the functioning of subsystems, the use of intelligent decision support subsystems based on databases, knowledge, and their management systems. Computer-integrated technologies are closely related to automatic control and process automation systems in various industries and production.

**Information-measuring complexes.** Modern information-measuring systems that are part of complex software and hardware complexes and consist of technical means for obtaining experimental information, a technical object and a computer system. Computer systems in such complexes perform the functions of managing the processing, display and storage of information, data exchange with computer networks, building information and expert systems, modeling and research of computer models, planning, forecasting, diagnostics, design, construction, training and solve many other problems.

**Modeling and optimization of control systems.** Formulating the tasks of optimal and adaptive control, it is reasonable to choose the optimization method, the method of synthesis of AOSAK, to develop algorithms for the operation of AOSAK, to know the main tasks of the AOK of TPPs, NPPs and industrial enterprises, to be able to design mathematical software for AOK subsystems in APCS.

## **Optional components**

### ***Optional components by specialty***

**Engineering graphics.** Projection drawing. Views, cuts and cuts. Sketches and working drawings. Elements of constructive connections. Assembly drawing. Detailing. Drawing using the AutoCAD system. The scope of computer graphics. Fundamentals of working with computer graphics software. AutoCAD automated drawing system. Statement of tasks on computer graphics.

**Features of biotechnical objects of agricultural production.** Technologies for the production of crop products. Technologies for the production of livestock and poultry products. Technologies for processing and storage of crop, livestock and poultry products.

**Systems and data transmission networks.** The scope of the use of PCs and computer technologies, bases for working with software, database management systems. Work in a computer network.

**Information security of automation systems.** Basic concepts of information technology security. Information security in the field of application. Information properties. Principles of ensuring information security. Ensuring information security. Functions and methods of ensuring information security of companies.

**Service maintenance of computer, network equipment and server systems.** Hardware and software for organizing local networks. Fundamentals of construction, programming and use of local computer networks. Principles of construction of computer networks. Designing software for the exchange of information between computers included in the local network. Work in a computer network.

**Architecture and software design.** Designing the architecture of software systems. Object approach. System-wide approach. The field of software architecture. Description of architecture. Architectural frameworks. Design Methodologies. Examples of architectural models and styles.



**Theoretical and applied mechanics.** Mechanics. Theory of devices and machines. Mechanics of materials and structures. Machine details.

**Heat engineering and hydraulics.** Thermal and colorful state parameters. Thermodynamic processes. First and second laws of thermodynamics. Wet air. Cycles of heat engines and refrigeration machines. Theory of heat transfer. Heat conduction, convection. Thermal radiation. Heat exchangers. Sources of thermal energy. Boiler installations. Heat generators, Thermal processing of products. Renewable energy sources: solar energy, wind energy, biogas, energy saving technologies.

**Electrical technologies in agricultural production.** Fundamentals of the conversion of electrical energy into heat. Calculation of electric heating installations. Direct, indirect, electric arc, induction, dielectric, thermoelectric heating.

**Automated electric drive.** Modern methods and means of control in electromechanical automation systems of technological objects. Structural-functional and methodological principles of construction and operation of automated electromechanical systems. Mechanical and electromechanical characteristics of direct and alternating current electric motors. Adjustment of the coordinates of the electric drive and the electric drive control system.

**Cloud technologies and global databases.** The principles and software tools that implement the concept of cloud computing are analyzed. The main objectives of the course are illustrated by the example of public and private cloud platforms. Modern practical solutions and technologies in the field of design, implementation and maintenance of distributed information systems; familiarization with the technologies for creating information resources based on Intranet technologies; study of ways to organize distributed information and hardware resources of such systems. Cloud computing for monitoring technological processes with their subsequent analysis, applications for various business processes.

**Programming for real time systems.** Definition of the present tense system. Management based on sequential programming. Interrupt based control. Sequential programming and real-time programming tasks. Real-time programming methods. Algorithms for real-time problems. Operating systems of the present. Architecture of operating systems of the present time.

**Legal culture of the individual.** Patterns of development of the state and law, certain areas of the legislation of Ukraine. Characteristics of constitutional, labor, environmental, land, civil, administrative, criminal and family law.

**Political science and sociology.** The assimilation of knowledge about the mechanisms of the functioning of society, its institutions and social groups, the development of the ability to analyze and predict the development of social processes are the most important conditions for the formation of an active life and citizenship of future specialists.

**Energy and resource saving technologies.** Conservation of resources and their economical use in the production, conversion and consumption of various types of energy and modern energy-saving technologies in market conditions. Ways to save energy resources and energy. Current state and prospects for the use of renewable energy sources. Ecological problems and methods of environmental protection in the process of extraction, transportation and use of various types of energy resources.

**Information theory.** Entropy as the degree of uncertainty of the state of the system. Entropy and information. Ways to measure the amount of information. Methods for encoding information during transmission. The relationship between the amount of information and the length of the code that provides a given reliability for a given noise level. Calculations of the bandwidth of communication and control channels.

**WEB technologies in automation systems.** Formation of a system of theoretical knowledge about the technological components of the WWW service, their place among other computer technologies and a set of skills for creating automation systems.

Fundamentals of automation systems based on web technologies. Benefits of using Web technologies. Expanding the capabilities of automation systems using web technologies. Web-enabled SCADA/HMI software.

**Robotized complexes of industrial production.** General concepts of industrial work (IW) and robotic technological complexes (RTC). Structure of PR and RTK. Classification of IW and RTK, their composition Use of IW in production and industry. IW as part of the RTK. Varieties of RTK. Robot control systems (CS). Classification of SU robots. Types of work management systems. Unified PR control systems. RTK control systems. Information system of robots and RTK. Auxiliary elements of RTK. Devices for object recognition. Design of robots and RTK.

**Fundamentals of system analysis.** Creation of mathematical models of the subject area of information systems, in particular, systems for automation of design work, and refers to the cycle of disciplines of professional and practical training.

**Integrated information security systems.** Algorithms for creating modern protection programs and coding algorithms. Modern methods, technologies, software and technical means of protection. Database and confidential information management systems. Conceptual models for the development, distribution, processing, use and storage of confidential documents. Strategies for choosing intrusion detection systems. Working with security devices in local and global computer networks in order to use them, opportunities to improve security performance.

**Fundamentals of technical operation of automation systems.** Normative-legal bases and problems of operation of the equipment. Power equipment in the agro-industrial complex, optimization and reliability. Maintenance and repair of equipment. Organization of commissioning, acceptance tests and operation of rural energy facilities.

**Optimal management systems.** Fundamentals of building computer models of control systems. Calculation of optimal automatic control systems and application of knowledge in practical calculations of ACP. Methods of computer modeling for the synthesis of management systems. Problems of optimization and optimal control.

**Fundamentals of scientific research.** Methodological foundations of the organization of scientific research. The specifics of research activities. General methodology of scientific research. Principles of work with scientific information. General requirements for writing and designing scientific papers.

**Economics of automated production in the agro-industrial complex.** Economic efficiency of investments in the energy sector. economic mechanism. Planning of labor and wages in the energy sector Profit, profitability, financial activities in the electricity industry. Energy planning. Restoration of basic income spending.