CATALOG OF ELECTIVE DISCIPLINES

7M07 - Engineering, manufacturing and construction industries
(Code and classification of the field of education)

7M071 - Engineering and Engineering affairs
(Code and classification of the direction of training)

0710
(Code in the International Standard Classification of Education)

M100 - Automation and control
(Code and classification of the educational program group)

7M07102 - Automation and Control
(Code and name of the educational program)

Master
(Level of preparation)

set of 2024

Semey 2024

Developed
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Reviewed
at the meeting of the Commission on Academic Quality of the Faculty of Engineering and Technology
Protocol No. 3, January 15, 2024
at the meeting of the Commission on Academic Quality of the Higher School of Artificial Intelligence and Construction
Recommended for approval by the University Academic Council
Protocol No. 1, "6" June 2024

Approved
at a meeting of the University Academic Council by protocol No. 3 of January 16, 2024.

at a meeting of the University Academic Council by protocol No. 6 of June 18, 2024.

Organization and planning of scientific research

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course is devoted to the organization and planning of scientific research.The methodological foundations of scientific knowledge and creativity are outlined. The choice of the direction of scientific research and the development of the stages of research work are highlighted. The requirements for the search, accumulation and processing of scientific information are considered. The principles of theoretical and experimental research are described. Modeling in scientific and technical creativity has been analyzed. The methods of processing the results of experimental studies are generalized. The requirements for the design of the results of scientific work are formulated.

Purpose of studying of the discipline
Mastering the elements of the methodology of scientific research, for the development of rational creative thinking and the organization of optimal mental activity.

Learning Outcomes
ON2 Conduct experiments according to specified methods with the processing and analysis of results, apply information technology methods for information processing.

Learning outcomes by discipline
conduct experiments according to the specified methods with the processing and analysis of the results, apply information technology methods for information processing.

Prerequisites
Bachelor

Postrequisites
Final examination

Pulse and digital control system

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline allows deepening the study of methods of mathematical description, analysis, synthesis of pulse and digital systems.The article considers general information about discrete and pulse automatic systems, equations and transmission functions of closed and open pulse systems. Methods of calculation of frequency characteristics and properties of discrete and impulse systems, methods of calculation stability of systems are studied.Specificity of studying methods of design, adjustment and operation of impulse and digital control systems.

Purpose of studying of the discipline
The main goal of studying the discipline "Pulse and digital automatic control systems" is to master the basic and applied software of control devices on microcontrollers, languages, tools and methods for their programming.

Learning Outcomes
ON4 To form knowledge and skills of management of automated complexes on the basis of a systematic approach to solving problems.

Learning outcomes by discipline
As a result of studying the discipline, students must:
know:
- the main non-linear links of control systems;
- basic principles of constructing structural diagrams of automatic control systems with nonlinear links;
- methods of analysis of nonlinear automatic control systems.
be able to:
- to use specialized software for analysis and synthesis of nonlinear automatic control systems;
- analyze the structure of nonlinear automatic control systems;
- calculate the settings for nonlinear automatic control systems.
have skills:
- installation and maintenance of impulse and digital ACS.
be competent:
- in matters of design, adjustment and operation of impulse and digital control systems.

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Final examination

Methods of research and processing of experimental data

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline is aimed at teaching undergraduates methods of experimental research and processing of results in the field of

automation and control. Considers the application of statistical methods of variance, regression, correlation analysis of experimental data processing, solving problems using least squares methods, by modeling automation objects and research by experimental planning methods. Universal application software packages are used to solve experimental data processing problems.

Purpose of studying of the discipline

formation of necessary knowledge on planning, processing and analysis of experimental data with the help of modern information technologies and software.

Learning Outcomes

ON2 Conduct experiments according to specified methods with the processing and analysis of results, apply information technology methods for information processing.
ON3 Possess the basic methods, methods and means of obtaining, processing information, works with a computer as a means of information management.
ON4 To form knowledge and skills of management of automated complexes on the basis of a systematic approach to solving problems.

Learning outcomes by discipline

Conduct experiments according to the specified methods with the processing and analysis of the results, apply information technology methods for information processing
Upon completion of the discipline, the student
Conduct experiments according to specified methods with processing and analysis of their results, compile descriptions of completed studies and prepare data for the development of scientific reviews and publications
And receives competence: processing and presentation of data on the use of natural science and mathematical knowledge for orientation in the modern information space.

Prerequisites

Bachelor

Postrequisites

Basic and profile disciplines of the EP

Methods for analyzing and processing big data

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline is aimed at teaching undergraduates methods of analyzing and processing a large amount of data obtained during experimental studies of automation and control systems.
Examines the issues of the concept of analysis and processing of large amounts of data, correlation and regression analysis, statistical analysis of large and small samples.
Teaches the use of modern computer technologies for modeling the study of automation objects, for data analysis and processing, teaches graphical processing of research results.

Purpose of studying of the discipline

The course "Big Data Processing" aims to form students
` professional competence in the development and use of systems for processing and
analyzing large amounts of data. This goal correlates with the purpose of the educational
program, in particular, with the technologies for developing specialized software systems
responsible for processing big data. The study of this discipline prepares
the graduate to perform the following professional tasks:
- Statement of the data analysis problem.
- Preliminary data processing.
- Data visualization.
- Development, implementation and application of data mining methods to
a large array of data.
- Presentation of the results of the work.

Learning Outcomes

ON2 Conduct experiments according to specified methods with the processing and analysis of results, apply information technology methods for information processing.
ON3 Possess the basic methods, methods and means of obtaining, processing information, works with a computer as a means of information management.
ON8 Possess the latest design tools and methods, such as methods of artificial intelligence, digital information processing, modeling of complex dynamic systems.

Learning outcomes by discipline

formation of necessary knowledge on planning, processing and analysis of experimental data using
modern information technologies and software tools.

Prerequisites

Bachelor

Postrequisites

Research work of the undergraduate, including the implementation of the master s thesis II

Fundamentals of scientific work and the theory of solving inventive problems

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline gives an idea of scientific activity, the main types of scientific research, inventive activity, methods of solving inventive tasks, scientific organizations, financing, planning, conducting research and presenting their results; training and certification of scientific personnel.Considers issues such as types of scientific organizations and their interaction, financing and organization of scientific research, planning of research works. Introduces the concept of invention, teaches the creation of claims.

Purpose of studying of the discipline

Formation of a complex of knowledge, skills and skills for the development of creative approach to the solution of non- standard professional tasks under conditions of intensive development of innovative processes in all spheres of human activity

Learning Outcomes

ON2 Conduct experiments according to specified methods with the processing and analysis of results, apply information technology methods for information processing.
ON3 Possess the basic methods, methods and means of obtaining, processing information, works with a computer as a means of information management.

Learning outcomes by discipline

conduct experiments according to the specified methods with the processing and analysis of the results, apply information technology methods for information processing.

Prerequisites

Bachelor

Postrequisites

Research work of the undergraduate, including the implementation of the master s thesis II

Basics of scientific research, organization and planning of the experiment

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course covers the organization of research work. The fundamentals of the methodology of scientific cognition are presented. The role of choosing the direction of research is noted, and the development of all stages of scientific research is described separately. The basics of work in the search, collection and processing of scientific and technical information are formulated. The classification of research methods is carried out. Attention is paid to the correct design and implementation of the results of the conducted research. The effectiveness of the organization of work in the scientific team is summarized.

Purpose of studying of the discipline

The general purpose of studying the discipline is the acquisition by students of basic knowledge related to the planning and processing of experimental data.
Graduates` readiness for production, technological and project activities that ensure the modernization, implementation and operation of equipment for the food and light industry.
The readiness of graduates to be able to substantiate and defend their own conclusions and conclusions in classrooms of varying degrees of interdisciplinary professional training

Learning Outcomes

ON2 Conduct experiments according to specified methods with the processing and analysis of results, apply information technology methods for information processing.
ON3 Possess the basic methods, methods and means of obtaining, processing information, works with a computer as a means of information management.
ON8 Possess the latest design tools and methods, such as methods of artificial intelligence, digital information processing, modeling of complex dynamic systems.

Learning outcomes by discipline

upon completion of the discipline, the student knows the behavior and laws of distribution of random variables. Elements of the probability theory of evaluating the characteristics of random variables and their aggregates by testing statistical hypotheses of variance, correlation and regression types of statistical analysis. basic information on the theory of experiment planning.
And receives competencies in the field of mathematical processing of experimental data

Prerequisites

Bachelor

Postrequisites

Final examination

Fundamentals of the system approach and system analysis

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline considers the main sections of the basic course of general system analysisand the systematic approach of scientific research. The main tasks of system analysis, their features are studied, the classification of systems and their characteristics are given, deterministic systems without consequences with output signals of two classes, deterministic systems with consequences, stochastic systems are considered. and ways to solve them.The role of measurements in creating models of systems is considered.

Purpose of studying of the discipline

Graduates` readiness for production, technological and project activities that ensure the modernization, implementation and operation of equipment for all industries

Learning Outcomes

ON2 Conduct experiments according to specified methods with the processing and analysis of results, apply information technology

methods for information processing.

Learning outcomes by discipline

master the methods of preparation and organization of scientific research; modern methods of experimental research and processing of experimental research results and receives competencies in the field of mathematical processing of experimental data

Prerequisites

Bachelor

Postrequisites

Final examination

Control systems for technical objects

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline includes main issues and principles in field of control system of technical objects and methods of construction, installation of modern control system of technical objects.
The article studies methods of construction of control systems, security of operation of control systems, protection of information flows and stored data. The article considers cryptographic, constructive and technological methods of information protection in control systems.Specificity of design and development of systems of management of technical objects.

Purpose of studying of the discipline

training of a highly qualified specialist capable of independent creative work, to introduce into the production process the newest and progressive results of scientific activities of the world society

Learning Outcomes

ON4 To form knowledge and skills of management of automated complexes on the basis of a systematic approach to solving problems.

Learning outcomes by discipline

To form knowledge and skills of management of automated complexes on the basis of a systematic approach to solving problems.

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Final examination

Digital signal processing in information management systems

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline will provide knowledge and skills in the field of algorithms and basic principles of digital signal processing, hardware and software design of digital signal processing systems.
Mathematical models of signals and their representation in functional and vector spaces, orthonormal and multiplicative systems of basic functions are considered.
Specificity of the use of modern signal processing tools to improve the quality of management systems.

Purpose of studying of the discipline

training in the principles of construction and application of devices of various functional complexity, from digital logical elements to microprocessors in information and management systems

Learning Outcomes

ON4 To form knowledge and skills of management of automated complexes on the basis of a systematic approach to solving problems.

Learning outcomes by discipline

teaching the principles of building and using devices of various functional complexity, from digital logic
elements to microprocessors in information management systems

Prerequisites

Bachelor

Postrequisites

Basic and profile disciplines of the EP

Integrated design and control systems

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The educational discipline teaches the basics of functional modeling of components of building an integrated automated production and standard architecture of an integrated automation system. The student gets acquainted with the basic principles of the integrated system of automatic control and learns the levels of control. Training in networking support of the integrated automation system, information exchange technology in the network. The components of the integrated control system software and the main features of the SCADA system are considered.

Purpose of studying of the discipline
The objectives of the discipline Integrated Design and Management Systems are:
Introduction to the principles of the structural organization of integrated systems;
Practical mastering by students of modern software and hardware design and management of complex technical and technological objects;
Education of students` responsibility for the product of their developments.
Learning Outcomes
ON6 To develop preliminary, technical and working projects of automated and automated production facilities, automation equipment, management, control, diagnostics and testing, product lifecycle and quality management systems using modern design automation tools of domestic and foreign experience in the development of competitive products.
Learning outcomes by discipline
the ability to develop an integrated production management system using modern tools and methods of analysis and design.
Prerequisites
Pulse and digital control system
Postrequisites
Final examination

Integrated production management systems

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
Formation of energy- resource efficiency in the production of complex cybernetic system and industry in integrated management systems. The discipline considers the principles of building an integrated automated control system in production. Designed for the development of structures and capabilities of ERP, MES SCADA, laboratory information and PI-systems. Students study the functional structure of the system of automatic quality management of finished products, methods of planning and management, flexible management of multidisciplinary productions (flexible management) and the basics of cybernetic organization.
Purpose of studying of the discipline
the purpose of studying the discipline is the study by undergraduates of current trends in the development of automation tools and integrated technologies for the creation of automation and control systems, automation levels of computer - integrated production, the relationship of design processes, pre-production and production management, software and hardware for the construction of integrated design and control systems, the functions of SCADA systems.
Learning Outcomes
ON6 To develop preliminary, technical and working projects of automated and automated production facilities, automation equipment, management, control, diagnostics and testing, product lifecycle and quality management systems using modern design automation tools of domestic and foreign experience in the development of competitive products.
Learning outcomes by discipline
Expected learning outcomes:
Knowledge: basic concepts of integrated system, functions and structures of integrated systems, tasks of I/O, Control, SCADA, MES, MRP levels of computer-integrated production, information interaction of subsystems of design and production management, software and technical support of integrated subsystems of design and production management, tasks of SCADA systems and their solution in software complexes.
Skills: to interpret the tasks of the computer-integrated production levels in relation to a specific production, to organize information interaction between the design and production management subsystems, to choose software and hardware for design and production management, to form a production display in the SCADA system
Skills: separation of the levels of computer-integrated production, formation of information flows between the subsystems of design and production management, system integration of software and hardware for design and production management, building a SCADA system to solve the problem of production control.
Competencies: the ability to develop an integrated production management system using modern tools and methods of analysis and design.
Prerequisites
Pulse and digital control system
Postrequisites
Final examination

Fuzzy control systems

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline forms knowledge about fuzzy control systems, areas of application and methods and algorithms for solving practical problems using the laws of fuzzy logic, allows you to master methods for calculating dynamic systems with incomplete information about the course of the process, learn how to synthesize fuzzy controllers in application programs and choose a strategy for implementation and determine the reliability of such control systems.
Purpose of studying of the discipline
The purpose of studying the discipline "Fuzzy control systems" is to master the mathematical foundations and principles of building fuzzy control systems, typical structures and algorithms for the functioning of fuzzy controllers and systems based on fuzzy logic, the

formation of the ability to build a management strategy based on the qualitative knowledge of experts, their experience and intuition, knowledge of methods for the synthesis of fuzzy controllers, information processing analysis skills in the fuzzy controller; obtaining skills in using standard methods of synthesis of fuzzy control systems, analyzing their stability and sensitivity to variation of parameters, using instrumental software for designing fuzzy control systems.

Learning Outcomes

ON5 Apply the acquired knowledge to solving the issues of choosing and implementing corporate systems and information technologies for solving management problems, design and develop intelligent systems for managing technical systems and technological processes, train artificial neural networks, apply software and hardware methods for implementing artificial neural networks and fuzzy control algorithms.
ON9 The theoretical and practical foundations in the field of designing and creating intelligent systems for the management of technical systems and technological processes, the principles of operation of the main types of intelligent systems, basic algorithms for training artificial neural networks, software and hardware implementation methods are studied.

Learning outcomes by discipline

As a result of mastering the discipline "Fuzzy control systems", students should achieve the following learning outcomes: to know the basic provisions of the theory of fuzzy systems, the specifics of their application in control systems, modern methods and models of analysis and synthesis of fuzzy control systems, to master the methods of calculating the elements of fuzzy control systems, to master modern methods and tools for automated solutions of applied control problems.
As a result of studying the discipline "Fuzzy control systems", the student should develop competencies in the design and operation of fuzzy control systems, the use of software and hardware for their calculation and construction.

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Final examination

Basics of operations research

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the main methods and stages of operations research, the application of the studied methods in practical research and analysis. Elements of game theory, dynamic modeling, queuing theory, network planning methods, etc. are considered. The methods of solving optimization problems, the development of models and the application of methods of operations research for solving practical production problems using modern computer technologies are investigated.

Purpose of studying of the discipline

The objectives of the discipline are to get acquainted with the main types of operations research tasks and training in methods of solving them; to get acquainted with trends in the use of modern information systems for solving optimization problems.

Learning Outcomes

ON5 Apply the acquired knowledge to solving the issues of choosing and implementing corporate systems and information technologies for solving management problems, design and develop intelligent systems for managing technical systems and technological processes, train artificial neural networks, apply software and hardware methods for implementing artificial neural networks and fuzzy control algorithms.
ON9 The theoretical and practical foundations in the field of designing and creating intelligent systems for the management of technical systems and technological processes, the principles of operation of the main types of intelligent systems, basic algorithms for training artificial neural networks, software and hardware implementation methods are studied.

Learning outcomes by discipline

acquire the knowledge and skills necessary to solve the tasks of operations research ;
mastering modern information systems for solving optimization problems.

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Final examination

Distributed computer information and control systems

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline considers integrated hierarchical distributed information processing and management systems, their architecture and principles of construction. The principles and standard protocols of interaction of distributed computer systems are studied on the example of a reference model of interaction of open systems. The international standards of interaction of open systems are considered. The application of programmable logic controllers for the construction of information and control systems, the development of application software modules for the implementation of the lower level of control is investigated.

Purpose of studying of the discipline

The purpose of the discipline is the development of disciplinary competencies on the theoretical foundations and technologies of working with distributed computer information and control systems in the automation of technological processes and production.

Learning Outcomes

ON5 Apply the acquired knowledge to solving the issues of choosing and implementing corporate systems and information technologies for solving management problems, design and develop intelligent systems for managing technical systems and technological processes,

train artificial neural networks, apply software and hardware methods for implementing artificial neural networks and fuzzy control algorithms.
ON9 The theoretical and practical foundations in the field of designing and creating intelligent systems for the management of technical systems and technological processes, the principles of operation of the main types of intelligent systems, basic algorithms for training artificial neural networks, software and hardware implementation methods are studied.

Learning outcomes by discipline

Knowledge: concepts of distributed computer control systems, their functions, applications, structures, elements, principles of operation, SCADA systems, their functions, use for the design of automated design systems; documentation, control and management of complex productions for various purposes, mathematical, methodological and organizational support of integrated design and control systems of automated and automatic production facilities; software and hardware used to build them.
Skills: to use SCADA systems for the design of automated and automated control systems, documentation, control, and management of complex productions, to use distributed computer- information control systems in their professional activities, to develop and use systems for describing and managing production data.

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Final examination

Robust automatic control systems

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the basic concepts and the principle of the construction and functioning of robust control systems that allow synthesizing regulators that ensure the stability and quality of automatic control systems (ACS) under conditions of uncertainty of disturbances. Methods of analysis and synthesis of robust ACS are investigated. The fundamentals of the theory of the sensitivity of ACS, the level of robustness of ACS, the principle of invariance for the construction of ACS, the foundations of the stability of robust systems are considered.

Purpose of studying of the discipline

The purpose of studying the discipline "Robust systems" is to train students in the field of robust automatic control systems, which allow, under conditions of uncertainty of disturbances acting on the ACS, to synthesize regulators (robust regulators) that ensure both stability and quality of the system.

Learning Outcomes

ON4 To form knowledge and skills of management of automated complexes on the basis of a systematic approach to solving problems.
ON5 Apply the acquired knowledge to solving the issues of choosing and implementing corporate systems and information technologies for solving management problems, design and develop intelligent systems for managing technical systems and technological processes, train artificial neural networks, apply software and hardware methods for implementing artificial neural networks and fuzzy control algorithms.

Learning outcomes by discipline

As a result of training in the discipline "Robust systems", the student should develop competencies, knowledge and skills that allow him to solve actual tasks of professional activity, taking into account the main trends and requirements.

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Final examination

Robotic systems

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline provides basic concepts in the field of robotic systems and a brief history of the development of robotics. Studies the structure, structure and classification of robotic devices used in industry. The discipline examines the device, principle of operation and classification of various drives of industrial robots: electric drive, hydraulic drive, pneumatic drive, combined. Software and hardware controls of robotic systems are investigated. The prospects for the development of robotics and the possibility of integration with artificial intelligence systems are considered.

Purpose of studying of the discipline

The purpose of studying the discipline "Robotic systems" is to get acquainted with the basic concepts of mechatronics and robotics, to master the principles of design, construction and control of robotic systems, to form modern ideas and skills in the field of complex automation of production processes for various purposes using modern flexible automation tools - mechatronic devices and industrial robots.

Learning Outcomes

ON4 To form knowledge and skills of management of automated complexes on the basis of a systematic approach to solving problems.
ON7 To master the basics of designing mechatronic objects and industrial robots and their control systems, methods and means of their modeling; concepts, terms and definitions in the field of designing mechatronic objects and industrial robots and their control systems; modern trends in robotics.

Learning outcomes by discipline

As a result of studying the discipline "Robotic Systems", the student should develop competencies for the formation of knowledge and

skills for managing automated complexes based on a systematic approach to solving problems.

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Final examination

Modern methods and means of creating automated control systems

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The purpose of the discipline is to form knowledge on the theory of optimal or suboptimal control of deterministic or stochastic nonlinear processes.

The task of teaching the discipline is to study the theory, methods and means of: adaptive optimal ACS based on a self-organizing optimal controller with extrapolation; synergetic optimal ACS; fuzzy multiple automatic control; expert information ACS; neural network ACS; automatic control systems with associative memory.

Purpose of studying of the discipline

The purpose of the discipline is to form knowledge on the theory of optimal or suboptimal control of deterministic or stochastic complex processes

Learning Outcomes

ON3 Possess the basic methods, methods and means of obtaining, processing information, works with a computer as a means of information management.

Learning outcomes by discipline

to be able to solve problems of analysis and synthesis of control systems using modern mathematical apparatus, programming systems and mathematical packages, to master methods of calculation of neural network technologies

Prerequisites

Pulse and digital control system

Postrequisites

Final examination

Modern computer systems ACS TP

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline is devoted to the study of various technical means, both hardware and software, used to build modern automated control systems — industrial computers, supercomputers, their device and capabilities, programmable logic controllers. The methods of creating a neural network ACS, digital control methods, methods of analysis and synthesis of control systems in conditions of incomplete certainty are considered. Adaptive systems are also being studied. Adaptation methods and algorithms and automatic control systems with associative memory.

Purpose of studying of the discipline

the study of modern computer control systems of technological processes as the basis of automated production.

Learning Outcomes

ON3 Possess the basic methods, methods and means of obtaining, processing information, works with a computer as a means of information management.

Learning outcomes by discipline

he knows the principles of management of organizational and integrated systems; the principles of building criteria for the effectiveness of systems; the methodology of conceptual, logical and physical design and receives competence in the application of basic knowledge on general requirements for the methodology and technology of designing information systems, the introduction of automated control systems, trends and development prospects

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Final examination

Control methods intelligent systems technical support of integrated and distributed control systems

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

When mastering the discipline, students get acquainted with the instruments of control and control of technological processes. Programmable logic controllers necessary for production management are studied. Discipline studies the choice of ways to provide integration solutions for the most effective management of production. The course topics include intelligent technology control devices and instrumental programmable conrollers. Top level systems: ERP, MES and the new SCADA system.

Purpose of studying of the discipline

formation of knowledge and skills in the use of modern integrated and distributed management systems

Learning Outcomes

ON6 To develop preliminary, technical and working projects of automated and automated production facilities, automation equipment, management, control, diagnostics and testing, product lifecycle and quality management systems using modern design automation tools of domestic and foreign experience in the development of competitive products.

Learning outcomes by discipline

to use SCADA systems for the design of automated and automated distributed and integrated control systems, to select the appropriate technical support for the construction of distributed and integrated control systems.

Prerequisites

Pulse and digital control system

Postrequisites

Final examination

Automation of technical systems

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

Studying the course will allow you to gain theoretical knowledge, practical skills in the field of analysis and synthesis of automation systems, development of a control algorithm that ensures the high- quality functioning of technical systems. The need to increase production efficiency based on automation of technical systems determines the main trends in the development of methods and theory of optimal and adaptive management of technical systems. The use of computer technology has a fundamental role in this.

Purpose of studying of the discipline

the purpose of the discipline is to study the principles of the system organization of automation procedures of technical systems, the formation of undergraduates` knowledge of the structural features of industrial automatic control systems and the characteristics of the main elements of these systems

Learning Outcomes

ON5 Apply the acquired knowledge to solving the issues of choosing and implementing corporate systems and information technologies for solving management problems, design and develop intelligent systems for managing technical systems and technological processes, train artificial neural networks, apply software and hardware methods for implementing artificial neural networks and fuzzy control algorithms.
ON8 Possess the latest design tools and methods, such as methods of artificial intelligence, digital information processing, modeling of complex dynamic systems.
ON9 The theoretical and practical foundations in the field of designing and creating intelligent systems for the management of technical systems and technological processes, the principles of operation of the main types of intelligent systems, basic algorithms for training artificial neural networks, software and hardware implementation methods are studied.

Learning outcomes by discipline

Knowledge: main characteristics of control objects, standard automatic controllers, tuning principles
industrial control systems, methods of calculation of optimal regulators for objects with delay.
Skills: be able to determine the main parameters of automated systems in statics and dynamics according to known
characteristics of elements.
Skills: gain practical skills in using the principles of a systematic approach, basic provisions of tasks
automation of technical systems, basic methods and algorithms for analysis and synthesis of analog and discrete (digital)
process control systems;
Competencies: ability to use technical means of controlling technical systems for practical purposes
various purposes.

Prerequisites

Bachelor

Postrequisites

Final examination

Computer-aided design of tools and control systems

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The study discipline will allow to master basic principles and methodology of development of application software, to develop new methods of design with improved characteristics.
The article considers approaches to design of MTS, its interpretation, specification, and unification of design solutions and design tools. Specialized approaches are studied when setting task of computer-aided design of MTS.Specification of application of functionalities of modern CAD for development of test equipment of electronic and electromechanical devices CS.

Purpose of studying of the discipline

The purpose of the discipline is to master these disciplinary competencies in
the field of computer-aided design of tools and control systems

Learning Outcomes

ON3 Possess the basic methods, methods and means of obtaining, processing information, works with a computer as a means of information management.

ON6 To develop preliminary, technical and working projects of automated and automated production facilities, automation equipment, management, control, diagnostics and testing, product lifecycle and quality management systems using modern design automation tools of domestic and foreign experience in the development of competitive products.
ON10 Take part in the creation and management of automated process control systems at all stages of the life cycle. Operate and maintain automated process control systems and dispatch control systems.

Learning outcomes by discipline

Knowledge: basic principles of functioning of modern integrated computer-aided design (CAD) systems; functional structure, principles of organization of technical, software and information support for integrated CAD control systems for technical objects; methods of modeling the processes and control objects under study; methods of modeling automatic and automated control systems and management of complex dynamic objects of various physical nature; methods of automation of design procedures for the analysis and synthesis of automatic and automated control and management systems for complex dynamic objects of various physical nature; means of information support for the design process of automatic and automated control and management systems for complex dynamic objects of various physical nature.

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Final examination

Diagnostics and reliability of AISU

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline allows to define and justify the role of reliability as one of the main sources of increasing the efficiency of equipment, saving materials, labor and energy costs.
Studies what failures are, their characteristics and methods of dealing with them; what is maintainability, reliability and durability indicators. Considers such methods of increasing reliability as the method of proportional, arbitrary, uniform and exponential distribution; recoverable redundant systems of various multiplicities.

Purpose of studying of the discipline

The purpose of studying the discipline is to form students` knowledge and skills of analyzing and ensuring the reliability of software and hardware and atomization systems

** apply methods for calculating the reliability of redundant and non-redundant speakers, complex multi-channel speakers;*
** conduct reliability tests and simulate the reliability of the AC*

Learning Outcomes

ON9 The theoretical and practical foundations in the field of designing and creating intelligent systems for the management of technical systems and technological processes, the principles of operation of the main types of intelligent systems, basic algorithms for training artificial neural networks, software and hardware implementation methods are studied.

Learning outcomes by discipline

Knowledge: to acquire a high level of theoretical knowledge in the field of reliability theory.
Skills: perform the necessary calculations in the design, manufacture and operation of technical systems for various purposes.
Skills: to master practical skills in monitoring and diagnosing, forecasting, obtaining estimates of reliability indicators and general principles of building quality management of technical systems.

Prerequisites

Bachelor

Postrequisites

Final examination

Intelligent control systems

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline is aimed at acquiring orientation skills in modern control systems based on artificial intelligence methods, using neural networks and fuzzy logic systems, the ability to apply intelligent control systems in technical processes.Such issues as knowledge base design and their representation in modern intelligent systems, dynamic expert systems, application and properties of neural network technologies, control systems with fuzzy logic are considered.

Purpose of studying of the discipline

the purpose of the discipline is to prepare the master student for an independent solution of the theoretical and applied problems of creating intelligent control systems for technical objects and technical processes in various industries.

Learning Outcomes

ON4 To form knowledge and skills of management of automated complexes on the basis of a systematic approach to solving problems.
ON7 To master the basics of designing mechatronic objects and industrial robots and their control systems, methods and means of their modeling; concepts, terms and definitions in the field of designing mechatronic objects and industrial robots and their control systems; modern trends in robotics.
ON11 Use technological and functional standards, modern models and methods for assessing quality and reliability in the design, construction and debugging of automatic control and control systems.

Learning outcomes by discipline
Knowing: the appointment and classification of intelligent control systems for technological processes, methods for the synthesis of expert control systems for technological processes, methods for the synthesis of control systems based on neural networks; methods and research of the quality of intellectual systems.
Abilities: use terminology and methods designed for targeted improvement of the structure and algorithms of action based on analysis in the process of information functioning.
Skills: skills in the design of the knowledge base, its formalized description and filling, the implementation of various strategies for deriving knowledge and explaining the results.
Competencies: the ability to master the methods of using software to solve practical problems, to develop interfaces "man - electronic computer".
Prerequisites
Basic and profile disciplines of the EP
Postrequisites
Final examination

Mechatronic systems in robotics

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The content of the discipline includes: the main mechanical, electronic and computer components of robotic and mechatronic systems, the definition and terminology of mechatronics and robotics. The discipline reveals the prerequisites, advantages and prospects for the development and application of mechatronic systems in robotics, the structure and principles of integration of mechatronic and robotic systems, mechatronic rotational motion modules based on high-torque motors.
Purpose of studying of the discipline
the study of the discipline aims at acquiring theoretical and practical knowledge in the field of construction, calculation and design methods, mastering the methods of using VT tools in electric drive control systems, as well as methods of selecting technical means that ensure high reliability and operation in optimal modes.
Learning Outcomes
ON7 To master the basics of designing mechatronic objects and industrial robots and their control systems, methods and means of their modeling; concepts, terms and definitions in the field of designing mechatronic objects and industrial robots and their control systems; modern trends in robotics.
Learning outcomes by discipline
Knowledge of the principles of operation and mathematical description of the components of mechatronic and robotic systems (information, electromechanical, electrohydraulic, electronic elements and computer equipment).
Skills: to develop mathematical models of the components of the objects of professional activity using the methods of the theory of automatic control; to apply the knowledge necessary for building models of the principles of operation and mathematical description of the components of mechatronic and robotic systems (information, electromechanical, electrohydraulic, electronic elements and computational equipment); to carry out kinematic, strength calculations, estimates the accuracy of mechanical components; set goals and choose ways to achieve it; set up and debug layouts.
Skills: development, production and operation of modern mechatronic and robotic devices and systems; skills in conducting analytical, simulation and experimental research for the purposes of design, production and operation of mechatronic and robotic equipment and systems
Competencies: the ability to apply the theories and methods of theoretical and applied innovation, management systems and strategies, quality management of innovative projects; the ability to develop computer models of the processes and systems under study and apply them to determine the optimal options for design, engineering and technological solutions.
Prerequisites
Pulse and digital control system
Postrequisites
Final examination

Reliability of technical systems

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies general methods of analysis and calculation of the reliability of technical information security systems. The proposed course examines such issues as the calculation of the reliability of technical systems, requirements for reliability indicators. Calculation of reliability characteristics of non-recoverable systems, systems with sequential connection of elements. Calculation of reliability characteristics of non-recoverable redundant systems, how to calculate reliability by gradual failures, calculation of reliability of systems with recovery are considered various. methods of increasing reliability and reliability testing.
Purpose of studying of the discipline
formation of students` system of theoretical knowledge, practical skills and skills to increase the level of safety by taking into account the complex properties of the reliability of operating systems
Learning Outcomes
ON9 The theoretical and practical foundations in the field of designing and creating intelligent systems for the management of technical systems and technological processes, the principles of operation of the main types of intelligent systems, basic algorithms for training artificial neural networks, software and hardware implementation methods are studied.

Learning outcomes by discipline
Knowledge: theory of reliability and its quantitative indicators, methods of reliability analysis of technical systems.
Skills: to perform the necessary reliability calculations in the design, manufacture and operation of technical systems of various values, the use of computers in reliability analysis.
Skills: to master practical skills in monitoring and diagnosing, forecasting, obtaining estimates of reliability indicators and general principles of building quality management of technical systems.
Prerequisites
Bachelor
Postrequisites
Final examination

Neural network

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline includes basic questions and principles in field of artificial intelligence construction.The history of artificial intelligence systems development, methods of knowledge acquisition, solving problems of deductive choice and fuzzy logic are considered. Programming languages of intelligent solvers, experimental systems, types of systems and their modes of operation, algorithms of learning of neuronet are studied.Specificity of acquisition of knowledge, solutions of problems of deductive choice, fuzzy logic, programming languages of intellectual solvers.

Purpose of studying of the discipline
familiarization of masters with modern approaches that are used in the construction of artificial intelligence. The program of study of the discipline provides the acquisition of knowledge and skills in the field of building elements of artificial intelligence.
Learning Outcomes
ON6 To develop preliminary, technical and working projects of automated and automated production facilities, automation equipment, management, control, diagnostics and testing, product lifecycle and quality management systems using modern design automation tools of domestic and foreign experience in the development of competitive products.
Learning outcomes by discipline
Knowing:history and directions of development of artificial intelligence systems; mathematical methods and algorithms for solving problems related to the construction of intelligent sys- tems; methods of initial organization of artificial intelligence systems, classification of types and architectures of artificial neural networks (NN), the algorithms for training NN, the main application problems solved with the help of NN.
Abilities: to use the principles and methods of construction and training of artificial intelli-gence systems in automated production; to use the basic rules and technology of introduction of artificial intelligence systems in the automation of technological processes and productions; to build and train a single-layer neural network based on perceptrons, to build and train associative memory based on THE art network, to build a recognition system based on cognitron.
Skills: formation of the student`s primary knowledge and skills about the methods of se-lection and description of intelligent processes, functions and operations to be automated; solving problems of forecasting the behavior of time series using NS, solving recognition problems using NS.
Competencies: competence in the field of ac- quisition of knowledge, solutions of problems of deductive choice, fuzzy logic, programming languages of intelligent solvers.
Prerequisites
Basic and profile disciplines of the EP
Postrequisites
Final examination

Software and hardware of modern ACS

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The content of the discipline includes the study of modern ACS software: system, application, hardware. The course covers PAO controllers, real-time operating systems of controllers and operator consoles. The discipline studies the process of creating a PAO using traditional programming languages and operator console configurators to improve th e efficiency of the production process of modern ACS, as well as a variety of applications.
Purpose of studying of the discipline
acquisition by undergraduates of theoretical and practical knowledge in the field of software and hardware of modern integrated and distributed control systems.
Learning Outcomes
ON7 To master the basics of designing mechatronic objects and industrial robots and their control systems, methods and means of their modeling; concepts, terms and definitions in the field of designing mechatronic objects and industrial robots and their control systems; modern trends in robotics.
Learning outcomes by discipline
Expected learning outcomes:

Knowledge: the main provisions of the modern theory of management of technical objects; nomenclature of modern hardware for automatic control systems; software packages used in the design, modeling of automatic control systems and object management.
Skills: to develop and research control systems for technical facilities, as well as to ensure their safe operation.
Skills: working with modern technical and software tools for building control systems for technical objects, skills in analyzing and synthesizing control systems for technical objects.
Competencies: in the process of mastering the discipline, undergraduates acquire knowledge, skills and experience corresponding to the results of the main educational program.

Prerequisites
Pulse and digital control system

Postrequisites
Industrial robot control systems

Design of automated information processing and management systems

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The study of discipline will allow training in field of information technology in development of automated methods and systems for information processing in various control system of technical objects.The general characteristics of information processing and control systems and their typing are considered. The process of designing and information training of ASOIU, user interface development is studied.Specific application of knowledge and skills in design of automation tools and systems, use of automated design tools.

Purpose of studying of the discipline
The mastery of the theoretical background of system design automation and remote control and the implementation of the settlement and research on the design and operation of control systems based on the tools of modern computer technology

Learning Outcomes
ON6 To develop preliminary, technical and working projects of automated and automated production facilities, automation equipment, management, control, diagnostics and testing, product lifecycle and quality management systems using modern design automation tools of domestic and foreign experience in the development of competitive products.
ON10 Take part in the creation and management of automated process control systems at all stages of the life cycle. Operate and maintain automated process control systems and dispatch control systems.
ON11 Use technological and functional standards, modern models and methods for assessing quality and reliability in the design, construction and debugging of automatic control and control systems.

Learning outcomes by discipline
Knowledge: know the theoretical foundations, basic principles and mathematical methods of system design.
Skills: able to design automation systems and robot.
Skills: Development has different structural and functional schemes of management systems, basic algorithms. Provides work for standard industrial regulators.

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Final examination

Design of systems on a chip

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The study of the discipline will provide knowledge, skills and skills in the design of systems on the crystal.Features of implementation and prospects of application, programmable systems on the PSoC crystal, methods of creation of systems on the basis of PLD FPGA are considered. The use of VHDL designs for simulation, AMBA bus-based and MICROBLAZE kernel-based design is studied.Specificity in the field of development, design and programming of systems on the crystal.

Purpose of studying of the discipline
Acquisition of theoretical and practical skills in the development, design and programming of digital systems (portable systems, control and control systems, video/audio systems, etc.).

Learning Outcomes
ON6 To develop preliminary, technical and working projects of automated and automated production facilities, automation equipment, management, control, diagnostics and testing, product lifecycle and quality management systems using modern design automation tools of domestic and foreign experience in the development of competitive products.
ON10 Take part in the creation and management of automated process control systems at all stages of the life cycle. Operate and maintain automated process control systems and dispatch control systems.

Learning outcomes by discipline
Knowledge: principles of construction, parameters and characteristics of digital and analog circuits of high-complexity FPGA computing systems
Skills: to develop and analyze circuit engineering and software models of systems on a chip, to set and solve circuit engineering problems related to the choice of a system of elements with specified requirements for parameters (time, power, dimensional, reliability).

Prerequisites
Basic and profile disciplines of the EP
Postrequisites
Final examination

Systems of artificial intelligence in management

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline includes the main issues and principles in the field of approaches, methods and techniques of research and construction of artificial intelligence systems, used to solve the problems of production automation.The main issues and concepts of development of artificial intelligence systems in automation systems, methods of programming and software development are considered. The main types of AI systems and their learning algorithms are studied.Specificity in the development and design of AI systems.

Purpose of studying of the discipline
the development of approaches, methods and techniques of research and construction of artificial intelligence systems used to solve practical problems of automated production.
Learning Outcomes
ON4 To form knowledge and skills of management of automated complexes on the basis of a systematic approach to solving problems.
ON7 To master the basics of designing mechatronic objects and industrial robots and their control systems, methods and means of their modeling; concepts, terms and definitions in the field of designing mechatronic objects and industrial robots and their control systems; modern trends in robotics.
Learning outcomes by discipline
Knowing:
history and directions of development of artificial intelligence systems; mathematical methods and algorithms for solving problems related to the construction of intelligent systems; methods of initial organization of artificial intelligence systems, as well as methods of their training, providing the required quality of performing automated intellectual processes, functions and operations.
Abilities: use the principles and methods of building and teaching artificial intelligence systems in automated production; read and professionally analyze the contents of articles or sections of special literature, databases and knowledge; To use the basic rules and technology of introducing artificial intelligence systems in the automation of technological processes and industries
Skills: Forming the student`s primary knowledge, skills and habits about the methods of identifying and describing the intellectual processes, functions and operations to be automated
Competencies: competences in the field of knowledge acquisition, solutions of deductive choice problems, fuzzy logic, programming languages of intellectual solvers.
Prerequisites
Basic and profile disciplines of the EP
Postrequisites
Final examination

Industrial robot control systems

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the robot control system: bus systems, start-up, description and design, mechanics, robot operating modes, control panel and its functions, loads, calibration. The discipline considers the use of industrial robots in production and in everyday life. The content of the discipline includes remote control of the robot: preparation for the launch of the PLC program, connection and project management using workvisual.
Purpose of studying of the discipline
The purpose of the discipline "Industrial Robot Control systems" is to prepare students to independently solve theoretical and applied problems of creating and operating highly efficient industrial robot control systems based on modern tools and methods.
Learning Outcomes
ON4 To form knowledge and skills of management of automated complexes on the basis of a systematic approach to solving problems.
Learning outcomes by discipline
As a result of training in the discipline "Industrial robot control systems", the student should develop competencies in the application of modern methods of analysis and synthesis of industrial robot control laws.
Prerequisites
Pulse and digital control system
Postrequisites
Final examination