CATALOG OF ELECTIVE DISCIPLINES

8D07 - Engineering, Manufacturing and Civil engineering
(Code and classification of the field of education)

8D071 - Engineering and engineering trades
(Code and classification of the direction of training)

0710
(Code in the International Standard Classification of Education)

D100 - Automation and control
(Code and classification of the educational program group)

8D07102 - Automation and control
(Code and name of the educational program)

(Level of preparation)

set of 2023

Semey 2023

Developed

By the Academic Committee of the EP
Head of the AC Nurymkhan G.N.
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Reviewed

at the meeting of the Quality Assurance Commission of the Faculty of Engineering and Technology
Recommended for approval by the Academic Council of the University
Protocol № 4/6 "10" April 2023

Approved

at the meeting of the Academic Council of the University
Protocol №5 "21" April 2023
Chairman of the Academic Council Oralkanova I.A.

Analysis of reliability of robotic systems

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

Short description of discipline

Study of theoretical and practical bases of reliability and technical diagnostics, principles of construction of technical means of devices and skills in the field of analysis and ensuring reliability of complex robotic systems. General patterns of robustness of robotic systems. Factors influencing consistency in design. Methods for increasing consistency. Operating conditions of systems and the problem of calculating their reliability. Ways to increase reliability. Methods and means of diagnosis of robots and mechatronic systems.

Purpose of studying of the discipline

the study of the fundamentals of the theory of experiment in the research of systems,
development of doctoral students` skills in solving the problems of designing robotic systems,
as well as the application of physical and mathematical apparatus for the description of mechatronic and
robotic systems encountered in professional activities.

Learning Outcomes

ON6 Possess knowledge on the implementation and configuration of a control system based on a mathematical model of a mechatronic system.
ON8 Knowledge of mechatronic systems and complexes, their capabilities, scope of their application; fundamentals of design and operation of mechatronic systems and complexes.

Learning outcomes by discipline

Has knowledge on the implementation and configuration of the control system based on the mathematical model of mechatronic system;
Knows mechatronic systems and complexes, their capabilities, their scope of application; the basics of design and operation of mechatronic systems and complexes.

Prerequisites

Masters degree course

Postrequisites

Research work of the doctoral student, including internship and doctoral dissertation III

Embedded and distributed mechatronics systems

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

Short description of discipline

Robotics, mechatronics and robotic systems - a field of science and technology focused on the creation of robots, mechatronic and robotic systems designed to automate complex processes and operations, including performed in undetermined conditions, to replace a person in the performance of heavy, tedious and hazardous work. Integrated control subsystems in complex mechatronic systems. Specialized (designed to perform narrowly targeted operations) and universal control subsystems.

Purpose of studying of the discipline

Development of the skills required to solve automation tasks with embedded and distributed mechatronics systems

Learning Outcomes

ON6 Possess knowledge on the implementation and configuration of a control system based on a mathematical model of a mechatronic system.
ON8 Knowledge of mechatronic systems and complexes, their capabilities, scope of their application; fundamentals of design and operation of mechatronic systems and complexes.

Learning outcomes by discipline

Has the knowledge to implement and configure the control system based on the mathematical model of mechatronic system
Knows mechatronic systems and complexes, their capabilities, their scope of application; the basics of design and operation of mechatronic systems and complexes

Prerequisites

Servo systems

Postrequisites

Research work of the doctoral student, including internship and doctoral dissertation III

Industrial and computer networks in robotics

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

Short description of discipline

Protocols of computer networks used in control systems: industrial networks - examples of organization of industrial networks on programmable logic controllers; comparative analysis of different protocols of industrial networks; design and modeling of computer networks in control systems. Features of computer network design. Influence on network characteristics of software and hardware of computer networks. Tasks of analysis of characteristics of computer network. Structure of computer network. Methodology of designing fragment of computer network.

Purpose of studying of the discipline

Mastering the principles of design, design and management of robotic systems, Formation of modern ideas and skills in the field of complex automation of production processes for various purposes with the use of modern flexible automation means - mechatronic devices and industrial robots.

Learning Outcomes

ON6 Possess knowledge on the implementation and configuration of a control system based on a mathematical model of a mechatronic system.
ON8 Knowledge of mechatronic systems and complexes, their capabilities, scope of their application; fundamentals of design and operation of mechatronic systems and complexes.

Learning outcomes by discipline

Has knowledge on the implementation and configuration of the control system based on the mathematical model of mechatronic system;
Knows mechatronic systems and complexes, their capabilities, their scope of application; the basics of design and operation of mechatronic systems and complexes

Prerequisites

Masters degree course

Postrequisites

Research work of the doctoral student, including internship and doctoral dissertation III

Artificial intelligence and neural network control

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

Short description of discipline

This course is designed to teach the most important methods of artificial intelligence and neural network management used in data analysis, identification, classification and prediction of objects. The course covers artificial neural networks, convolutional neural networks, LSTM models, decision tree and much more. The general idea of artificial intelligence methods is to create a mathematical model capable of analyzing data, identifying patterns and anomalies.

Purpose of studying of the discipline

Forming in future specialists the fundamentals of theoretical knowledge and practical skills in the field of basic artificial intelligence strategies: expert systems and artificial neural networks.

Learning Outcomes

ON3 To acquire knowledge in the field of management of complex processes and systems with the use of modern research methods on the basis of development of methods of management theory and decision-making.
ON5 Analyze the organizational structure and develop proposals for its improvement, use methods to optimize the production process, organize programs to improve management systems.

Learning outcomes by discipline

1 calculate using fuzzy logic
2 use modern computer technology and software to build fuzzy models
3 Solve the problems of automated control of technological processes under the uncertainty with the formation of knowledge in the use of artificial systems intellect

Prerequisites

Masters degree course

Postrequisites

Research work of the doctoral student, including internship and doctoral dissertation III

Synthesis of optimal control systems

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

Short description of discipline

Acquisition of the necessary knowledge in the field of modern methods of synthesis of systems of optimal management, taking into account their multi- connectivity, incomplete information in the description of the object and under the condition of perturbations, development of methods of building optimal management systems, including on the basis of modern computer technologies. Basic concepts of optimal and alaptic control systems. Classical variable calculus. Problems of variational calculus.

Purpose of studying of the discipline

to acquaint doctoral students with methods of synthesis of optimal systems,
To form the skills of building optimal feedback in a closed form and in the form of real-time implementation.

Learning Outcomes

ON3 To acquire knowledge in the field of management of complex processes and systems with the use of modern research methods on the basis of development of methods of management theory and decision-making.
ON4 Develop and improve existing structures, mechanisms and dynamic control systems model by solving research.

Learning outcomes by discipline

To possess knowledge, skills and skills of increasing the efficiency of management of complex processes and systems using modern research methods on the basis of development of methods of management theory and decision-making;
Develop and improve existing structures, mechanisms and models for managing dynamic systems through research;
Analyze the organizational structure and develop proposals for its improvement, use methods of optimization of the production process, organize programs to improve management systems

Prerequisites

Bachelor

Postrequisites

Research work of the doctoral student, including internship and doctoral dissertation III

Managing complex objects based on neural network technologies

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

Short description of discipline

Fundamentals of the theory of fuzzy sets. Fundamentals of creation of fuzzy output systems for management purposes. Classification of neuronetwork control systems. Fields of application, properties and architecture of neural networks. Algorithms of training of neural networks. Fundamentals of the theory of genetic algorithms. Development, creation and research of expert control systems and neural networks using modern software products. Elements of the theory of artificial neural networks. Building a neural network model. Structural identification of the neural network.

Purpose of studying of the discipline

Study of functions and algorithms of neurostete control, providing knowledge of methods of recursive evaluation of parameters and state variables

Learning Outcomes

ON3 To acquire knowledge in the field of management of complex processes and systems with the use of modern research methods on the basis of development of methods of management theory and decision-making.
ON4 Develop and improve existing structures, mechanisms and dynamic control systems model by solving research.
ON5 Analyze the organizational structure and develop proposals for its improvement, use methods to optimize the production process, organize programs to improve management systems.

Learning outcomes by discipline

- To own knowledge, skills and skills of increasing the efficiency of management of complex processes and systems using modern research methods on the basis of development of methods of management theory and decision-making;
-Develop and improve existing structures, mechanisms and models for managing dynamic systems through research solutions ;
-To analyze the organizational structure and develop proposals for its improvement, to use methods of optimisation of the production process, to organize programs of improvement of management systems;

Prerequisites

Servo systems

Postrequisites

Research work of the doctoral student, including internship and doctoral dissertation III