NJSC SHAKARIM UNIVERSITY OF SEMEY

EDUCATIONAL PROGRAM

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

8D072 - Manufacturing and processing
(Code and classification of the direction of training)

0720
(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)

Doctor of philosophy (PhD)
(Level of preparation)

Semey

Educational program

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)

Semey 2023

PREFACE

Developed

The educational program 8D07102 - Automation and control in the direction of preparation 8D071 - Engineering and engineering trades on the basis of the State Compulsory Standards of Higher and Postgraduate Education approved by the Order of the Ministry of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No 2 (as amended by the order) was developed by the Academic Committee dated 20.02.2023 No 66).

Members of the Academic Committee	Full name	Academic degree, academic title, position	Signature
Head of the Academic Committee	Nurymkhan Gulnur	Dean of the Faculty of Engineering and Technology, candidate of technical sciences	
Educational program manager	Kozhakhmetova Dinara	acting associate professor, PhD	
Member of the AC	Zolotov Alexander	Candidate of Technical Sciences, Associate Professor of the Department of Automation, information technology and urban planning	
Member of the AC	Ospanov Erbol	acting associate professor	
Member of the AC	Kdirbayev Ayan	Director of RTS - montazh LLP	
Member of the AC	Kagazbekov Daulet	Research Institute «Center of Nuclear Medicine and Oncology» of Semey. Engineer	
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Reviewing

Full name of the reviewer	Position, place of work	Signature
Shpuntov Evgeny	Director of LLP Reltex	

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
Chairman of the Commission on Quality Assurance Abdilova G.B.

Approved at the meeting of the Academic Council of the University Protocol No. 8 "25" April 2023.

Approved

at the meeting of the Academic Council of the University
Protocol № 1 "01" of September 2023
Chairman of the Academic Council of the University Orynbekov D.R.

Content

1.Introduction

1.1.General data

Doctoral studies under the educational program 8D07102 "Automation and Control" are carried out at the Department of "Automation and Information Technology" of the Faculty of Engineering and Technology. The EP was developed taking into account the needs of the regional labor market, the requirements of the normative documents of the Ministry of Science and Higher Education of the Republic of Kazakhstan and is a system of documents for organizing the educational process.

Having mastered this educational program, graduates acquire the skills and abilities of theoretical and experimental research in complex engineering activities in the field of automation and control and mechatronics; apply progressive methods of operating equipment of automation and control systems, apply modern methods to develop energy-saving and environmentally friendly automation and control systems that ensure the safety of people`s life and protect them from the possible consequences of accidents, catastrophes and natural disasters, gain knowledge and skills focused on creating robots and robotic systems with elements of artificial intelligence.

The novelty of this program is its informative uniqueness, which is the ability to combine design and programming in a single course as control systems built on a modern element base, and the study of mechatronics - applied science engaged in the development and operation of intelligent automated technical systems for their implementation in various spheres of human activity. Graduates of this educational program will master the latest tools and methods of design, such as artificial intelligence, digital information processing, simulation of complex dynamic systems and many others.

1.2.Completion criteria

The main criterion for the completion of the educational process for the preparation of PhD doctors is the student`s mastering of at least 45 credits of theoretical education, as well as at least 120 credits of doctoral student`s research work, including internship and doctoral dissertation, at least 12 credits for writing and defending a doctoral dissertation.

1.3.Typical study duration: 3 years.

2.PASSPORT OF THE EDUCATIONAL PROGRAM

2.1.EP purpose	Preparation of scientific and pedagogical personnel of the new formation, capable of solving the problems of automation and control in various industries, education, science and owning research methods in new directions of modern science
2.2.Map of the training profile within the educational program	
Code and classification of the field of education	8D07 - Engineering, Manufacturing and Civil engineering
Code and classification of the direction of training	8D071 - Engineering and engineering trades
Code in the International Standard Classification of Education	0710
Code and classification of the educational program group	D100 - Automation and control
Code and name of the educational program	8D07102 - Automation and control
2.3.Qualification characteristics of the graduate	
Degree awarded / qualification	PhD in education program 8D07102 – Automation and Control
Name of the profession / list of positions of a specialist	Lecturer at the university, colleges, gymnasiums; engineer; employee of research institutes, researcher of research and production institutions; Head of the scientific group of research, production, administrative, expert institutions, etc.
OQF qualification level (industry qualification framework)	8
Area of professional activity	Graduates are prepared for work in the field of research, research and produc-tion, teaching, industrial and technological, organizational, managerial, design and engineering activities.
Object of professional activity	The objects of the graduate`s professional activity are: Universities, colleges, gymnasiums; research institutes and centers; research and production; pro-duction, administrative, expert institutions, etc.
Types of professional activity	Performs research; introduces the results of scientific research into production; organizes information retrieval work in a selected scientific area; carries out teaching of disciplines. Research activities, pedagogical activities, educational activities, innovative activities, industrial and technological activities, organizational and manage-ment activities, design and engineering activities.
Graduate Model	Graduate Model OP 8D07104 "Automation and control" According to the results of the training, the student receives: 1. Professional competencies: 1 Mastered competencies expressed in the achieved learning outcomes As a result of mastering this OP of doctoral studies ,

	the graduate must have the following competencies: ▯ Uses the possibilities of written communication in the academic and scientific-technical field when writing research papers and conducting classes; Interprets the results of scientific research and the limits of their application; Possess knowledge, skills and abilities to improve the efficiency of managing complex processes and systems using modern research methods based on the development of methods of management theory and decision-making; ▯ Develop and improve existing structures, mechanisms and models of dynamic systems management by solving scientific research; ▯ Simulate mechatronic systems control systems. Implement algorithms for distributed embedded systems; ▯ Has knowledge of the implementation and configuration of a control system based on neural networks; Collection of the latest theoretical, methodological and technological achievements of domestic and foreign science, as well as consolidation of practical skills, application of modern methods of scientific research. 2 Personal qualities of the graduate The personal qualities of a graduate that must be possessed in order to be a competitively capable specialist in the field of automation and management: - Analytical skills: the ability to conduct a systematic analysis of information; systematize information; compare data; abstract information; design the result. - Diagnostic skills: the ability to structure the information received; to carry out innovative and combinational processes related to the ability to predict. - Verbal and non-verbal skills: the ability to build business relationships with colleagues; establish cooperation with partners; formulate professional tasks; master oral and written speech. - Predictive skills: confidence in one`s own actions in accordance with the assessment of everything that is happening; manifestation of extroversion and dominance as a condition of purposefulness, management, information modeling, energy mobilization, perseverance, activity, ability to withstand the load, perseverance when performing complex tasks. - Correctional skills: the ability to carry out self-analysis, self-correction; to determine the trajectories of self-development and self-education; to comprehend their own professional and personal capabilities.

3.Modules and content of the educational program

Research in scientific and pedagogical activities

Academic writing

Discipline cycle	Basic disciplines
Discipline component	University component
SubjectID	32640 (3010941)
Course	1
Term	1
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline

Features of academic writing. Genres of academic writing. Academic text. Principles of structuring a scientific text. Setting a research question. The structure of the introduction. Writing a grant application and reporting documentation for research projects. Bibliography and reference apparatus. Annotations and features of their compilation. Dissertation as a scientific qualification academic text. Reviewing a scientific text.

Purpose of studying of the discipline

To acquaint doctoral students with the basic concepts, terms and modern concepts of the basic principles of writing
academic texts. To help them acquire practical skills in the production of written texts of an academic nature, both educational and research

Learning Outcomes

ON1 Use the possibilities of written communication in the academic and scientific-technical sphere when writing research papers and conducting classes.

Prerequisites

Masters degree course

Postrequisites

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

Research methods

Discipline cycle	Basic disciplines
Discipline component	University component
SubjectID	32971 (3010942)
Course	1
Term	1
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline

Function of science. Scientific knowledge, its principles, laws of obtaining, levels of knowledge. The logic of scientific research. The hypothesis of the study. Systems approach in science and technology. Information approach in research. Modeling. Transformation of information in the research process. The problem of choice in scientific research. Planning and management of scientific research. Analysis and presentation of research results.

Purpose of studying of the discipline

The discipline gives an idea about the methods of scientific research as a special way of understanding reality and a means of forming technical knowledge. The course is aimed not only at the acquisition of theoretical knowledge, but also the ability to apply new research paradigms in practice, their introduction into the research process, the disclosure and study of historical facts, their adaptation to research work.

Learning Outcomes

ON2 Interpret the results of scientific research and the limits of their application.

Prerequisites

Masters degree course

Postrequisites

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

Pedagogical practice

Discipline cycle	Basic disciplines
Discipline component	University component
SubjectID	32977 (3010943)
Course	2
Term	1
Credits count	10
Pedagogical practics	300hours
Total	300hours
Knowledge control form	Total mark on practice

Short description of discipline
Pedagogical practice is aimed at the formation of functional competencies, development of abilities to perform tasks in the professional and educational spheres. In the process of pedagogical practice, the professional and personal development of future teachers is intensified. During the practice, doctoral students draw up and implement a plan of educational activities with a group of students, develop and carry out a system of classes reflecting the completed part of the learning process on the basis of the content of major disciplines, demonstrate their mastery of modern technologies and teaching methods.

Purpose of studying of the discipline
Formation and development of the doctoral student's professional skills of the teacher of higher education; mastering the basics of pedagogical skill, skills and skills of independent conducting educational work.

Learning Outcomes
ON1 Use the possibilities of written communication in the academic and scientific-technical sphere when writing research papers and conducting classes.

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Final examination

Control of mechatronic, robotic and intellectual systems

Servo systems

Discipline cycle	Basic disciplines
Discipline component	University component
SubjectID	32703 (3010951)
Course	1
Term	1
Credits count	5
Lections	30hours
Practical and seminar classes	15hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline
The course examines the purpose, composition, construction principles, control systems and operating modes of complete electric drives of direct and alternating currents, as well as their energy compatibility with the supply network and problems of energy conservation

Purpose of studying of the discipline
Mastering doctoral students principles of construction and methods of implementation of drive control systems, for specific technological mechanisms providing cartridges of operation of electric drives, acquisition of design skills, calculation and research of electrical drive systems of industrial machinery

Learning Outcomes
ON7 Choose systems of complete energy-saving electric drive and its correct operation.

Prerequisites
Masters degree course

Postrequisites
Embedded and distributed mechatronics systems

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

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	32972 (3010945)
Course	1
Term	1
Credits count	15
The research work	450hours
Total	450hours

Knowledge control form	Total mark on practice

Short description of discipline
Modern scientific achievements in automation and management. The role of the state of science and technology in Kazakhstan at the present stage. Methodology of scientific research. Scientific knowledge. Planning and organization of scientific research. Various systems for searching scientific information. Methods and tools of research. Presentation of the results of scientific work and communication of information.

Purpose of studying of the discipline
To prepare a doctoral student, who possesses the methodology of scientific knowledge and is able to apply scientific methods in the study of problems of modern science and education.

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.

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Research work of the doctoral student, including internship and doctoral dissertation II

Analysis of reliability of robotic systems

Discipline cycle	Profiling discipline
Discipline component	Electives
SubjectID	32892 (3010953)
Course	1
Term	2
Credits count	5
Lections	15hours
Practical and seminar classes	30hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
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.

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.

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
Discipline component	Electives
SubjectID	32973 (3010952)
Course	1
Term	2
Credits count	5
Lections	15hours
Practical and seminar classes	30hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
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.

Prerequisites

Servo systems

Postrequisites

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

Artificial intelligence and neural network control

Discipline cycle	Profiling discipline
Discipline component	Electives
SubjectID	32245 (3014284)
Course	1
Term	2
Credits count	5
Lections	15hours
Practical and seminar classes	30hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
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.

Prerequisites

Masters degree course

Postrequisites

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

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

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	27385 (3010946)
Course	1
Term	2
Credits count	20
The research work	600hours
Total	600hours
Knowledge control form	Total mark on practice

Short description of discipline

The scientific component of the educational program is formed from the doctoral research work, scientific publications and the writing of the doctoral thesis. The planning of the PhD program in the weeks is determined based on the doctoral student's standard working time during the week. The number of credits allocated for the implementation of INDH in a specific academic period is determined by the work plan of the vocational education program.

Purpose of studying of the discipline

To prepare a doctoral student, who possesses the methodology of scientific knowledge and is able to apply scientific methods in the study of problems of modern science and education.

Learning Outcomes

ON5 Analyze the organizational structure and develop proposals for its improvement, use methods to optimize the production process, organize programs to improve management systems.
ON6 Possess knowledge on the implementation and configuration of a control system based on a mathematical model of a mechatronic

system.

Prerequisites

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

Postrequisites

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

Industrial and computer networks in robotics

Discipline cycle	Profiling discipline
Discipline component	Electives
SubjectID	32974 (3010954)
Course	1
Term	2
Credits count	5
Lections	15hours
Practical and seminar classes	30hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
Knowledge control form	Examination

Short description of discipline

Protocols of computer networks used in control systems: industrial networks - examples of the organization of industrial networks on programmable logic controllers; comparative analysis of various protocols of industrial networks; Design and modeling of computer and network control systems. Classification of information and computing networks. Switching methods. The main types of industrial robots and their functions. Modernization and mechanization of equipment, automation of technological processes on the basis of local means.

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.

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
Discipline component	Electives
SubjectID	32976 (3010956)
Course	1
Term	2
Credits count	5
Lections	15hours
Practical and seminar classes	30hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
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.

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
Discipline component	Electives
SubjectID	32975 (3010955)
Course	1
Term	2
Credits count	5
Lections	15hours
Practical and seminar classes	30hours
Independent work of a student under the guidance of a teacher	35hours
Independent work of the student	70hours
Total	150hours
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. Applications, properties and architecture of neural networks. Algorithms of learning of neural networks. Fundamentals of genetic algorithms. Development, creation and research of expert control systems and neural networks using modern software products. 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.

Prerequisites

Servo systems

Postrequisites

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

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

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	32978 (3010947)
Course	2
Term	1
Credits count	20
The research work	600hours
Total	600hours
Knowledge control form	Total mark on practice

Short description of discipline

Research practice of the doctoral student is conducted to study the latest theoretical, methodological and technological achievements of domestic and foreign science, as well as to consolidate practical skills, application of modern methods of scientific research, processing and interpretation of experimental data in the thesis study.

Purpose of studying of the discipline

To prepare a doctoral student, who possesses the methodology of scientific knowledge and is able to apply scientific methods in the study of problems of modern science and education.

Learning Outcomes

ON5 Analyze the organizational structure and develop proposals for its improvement, use methods to optimize the production process, organize programs to improve management systems.
ON6 Possess knowledge on the implementation and configuration of a control system based on a mathematical model of a mechatronic system.

Prerequisites

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

Postrequisites

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

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

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	32979 (3010948)
Course	2

Term	2
Credits count	30
The research work	900hours
Total	900hours
Knowledge control form	Total mark on practice

Short description of discipline
The research work of the doctoral student is focused on professional practical training of the student. The researcher should be able to properly use information, logically build the text, apply terminology, present thoughts and draw conclusions.

Purpose of studying of the discipline
To prepare a doctoral student, who possesses the methodology of scientific knowledge and is able to apply scientific methods in the study of problems of modern science and education.

Learning Outcomes
ON7 Choose systems of complete energy-saving electric drive and its correct operation.
ON8 Knowledge of mechatronic systems and complexes, their capabilities, scope of their application; fundamentals of design and operation of mechatronic systems and complexes.

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

Postrequisites
Research work of the doctoral student, including internship and doctoral dissertation V

Research practice

Discipline cycle	Basic disciplines
Discipline component	University component
SubjectID	32980 (3010944)
Course	3
Term	1
Credits count	10
Working practice	300hours
Total	300hours
Knowledge control form	Total mark on practice

Short description of discipline
Conducting experimental studies on the developed program, taking into account the requirements of the doctoral thesis. Development of skills of carrying out scientific and experimental works in accordance with the requirements of the level of training of doctor PhD.

Purpose of studying of the discipline
Research practice of the doctoral student is carried out with the aim of studying the latest theoretical, methodological and technological achievements of domestic and foreign science, as well as strengthening practical skills, application of modern methods of scientific research, processing and interpretation of experimental data in the thesis study

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.

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Research work of the doctoral student, including internship and doctoral dissertation V

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

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	32981 (3010949)
Course	3
Term	1
Credits count	20
The research work	600hours
Total	600hours
Knowledge control form	Total mark on practice

Short description of discipline
The research work of the doctoral student is focused on professional practical training of the student. The researcher should be able to properly use information, logically build the text, apply terminology, present thoughts and draw conclusions.

Purpose of studying of the discipline
To prepare a doctoral student, who possesses the methodology of scientific knowledge and is able to apply scientific methods in the study of problems of modern science and education

Learning Outcomes
ON4 Develop and improve existing structures, mechanisms and dynamic control systems model by solving research.
ON8 Knowledge of mechatronic systems and complexes, their capabilities, scope of their application; fundamentals of design and operation of mechatronic systems and complexes.

Prerequisites

Research practice

Postrequisites

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

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

Discipline cycle	Profiling discipline
Discipline component	University component
SubjectID	32983 (3010950)
Course	3
Term	2
Credits count	18
The research work	540hours
Total	540hours
Knowledge control form	Total mark on practice

Short description of discipline

The role of the state of science and technology in the Republic of Kazakhstan at the present stage. Methodology of scientific research. Scientific knowledge. Planning and organization of scientific research. Various scientific information search systems. Methods and means of research. Registration of the results of scientific work and transfer of information.

Purpose of studying of the discipline

To prepare a doctoral student, who possesses the methodology of scientific knowledge and is able to apply scientific methods in the study of problems of modern science and education

Learning Outcomes

ON4 Develop and improve existing structures, mechanisms and dynamic control systems model by solving research.
ON6 Possess knowledge on the implementation and configuration of a control system based on a mathematical model of a mechatronic system.
ON7 Choose systems of complete energy-saving electric drive and its correct operation.
ON8 Knowledge of mechatronic systems and complexes, their capabilities, scope of their application; fundamentals of design and operation of mechatronic systems and complexes.

Prerequisites

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

Postrequisites

Final examination

Final assessment

Doctoral dissertation

Credits count	12

4.Summary table on the scope of the educational program «8D07102 - Automation and control»

Name of discipline	Cycle/ Component	Term	Number of credits	Total hours	Lec	SPL	LC	IWST	IWS	Knowledge control form
Research in scientific and pedagogical activities										
Academic writing	BS/US	1	5	150	30	15		35	70	Examination
Research methods	BS/US	1	5	150	30	15		35	70	Examination
Pedagogical practice	BS/US	3	10	300						Total mark on practice
Control of mechatronic, robotic and intellectual systems										
Servo systems	BS/US	1	5	150	30	15		35	70	Examination
Research work of the doctoral student, including internship and doctoral dissertation I	AS/US	1	15	450						Total mark on practice
Analysis of reliability of robotic systems	AS/CCh	2	5	150	15	30		35	70	Examination
Embedded and distributed mechatronics systems	AS/CCh	2	5	150	15	30		35	70	Examination
Artificial intelligence and neural network control	AS/CCh	2	5	150	15	30		35	70	Examination
Research work of the doctoral student, including internship and doctoral dissertation II	AS/US	2	20	600						Total mark on practice
Industrial and computer networks in robotics	AS/CCh	2	5	150	15	30		35	70	Examination
Synthesis of optimal control systems	AS/CCh	2	5	150	15	30		35	70	Examination
Managing complex objects based on neural network technologies	AS/CCh	2	5	150	15	30		35	70	Examination
Research work of the doctoral student, including internship and doctoral dissertation III	AS/US	3	20	600						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation IV	AS/US	4	30	900						Total mark on practice
Research practice	BS/US	5	10	300						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation V	AS/US	5	20	600						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation VI	AS/US	6	18	540						Total mark on practice
Final assessment										
Doctoral dissertation		10	12	360						