Satbayev University
A. Burkitbayev Institute of Industrial Automation and Digitalization
The Department "Robotics and Engineering Tools of Automation"

CURRICULUM PROGRAM

"ROBOTICS AND MECHATRONICS"
Master of engineering and technology
of the educational program "7M07135-Robotics and mechatronics"

on the basis of the vitiated Specialty Classifier: 6M071600 - Instrumentation

1st edition
in accordance with the State Educational Standard of Higher Education 2018

Almaty 2020

The program is drawn up and signed by the parties:

from Satbayev University:

1. Head of the Department of Robotics and Engineering Tools of Automation (R&ETA), Ph.D. K. Ozhikenov

2. Director of the Institute of Industrial Automation and Digitalization, PhD B. Omarbekov

3. Chairman of the Educational and Methodological Group of the Department of "R&ETA", Ph.D, Associate Professor Zh. Ualiyev

From the employer:
Director of LLP "MedRemZavodHolding" A. K. Dzhumagulov
Deputy Director for IIT of LLP "Saiman Corporation" K. I. Baibekov

Approved at the meeting of the Educational and Methodological Council of the Satbayev University, (Protocol #3 of 19.12.2018)

Qualification:
Level 7 of the National Qualifications Framework:
7M07 Engineering and Engineering (Master's degree):
7M071 Robotics and Mechatronics

Professional competencies: in the field of research methodology; in the field of scientific activity in higher educational institutions; in matters of modern production technologies; in the implementation of scientific projects and research in the professional field; in the field of information analysis.

Brief description of the program:

1 Objectives of the educational program

The objectives of the educational program (EP) "Robotics and Mechatronics" are:

meeting the needs of students in intellectual, creative and professional development by acquiring knowledge and skills in the field of robotic and mechatronic systems;

organization of master's training, allowing all graduates to continue their education in the field of robotic and mechatronic systems, and with the aim of further self-improvement in order to successfully build a career in production.

meeting the needs of the Republic of Kazakhstan in qualified personnel by training specialists in the use and maintenance of robotic and mechatronic complexes and specialists with the skills of designing computer-controlled equipment due to industrialization and digitalization of industry.

2 Types of work

The types of professional activities for which graduates who have mastered the master's program are preparing:

- research;
- design and engineering;
- organizational and managerial;
- installation and commissioning;
- service and operational.

The master's degree in the direction of training "Robotics and mechatronics" should be prepared for solving professional problems in accordance with the profile direction of the master's program and types of professional activity:

research activities:

- analysis of scientific and technical information, domestic and foreign experience in the development and research of robotic and mechatronic systems; study of new methods of control theory, artificial intelligence technologies and other scientific areas that make up the theoretical basis of robotics and mechatronics, compilation and publication of reviews and abstracts;

- carrying out theoretical and experimental research in the field of developing new samples and improving existing robotic and mechatronic systems, their modules and subsystems, searching for new ways to control and process information using artificial intelligence methods, fuzzy logic, multi-agent control methods, artificial neural and neuro-fuzzy networks;

- carrying out patent research, accompanying the development of new robotic and mechatronic systems, in order to protect intellectual property objects, the results of research and development;

- carrying out the development of experimental samples of robotic and mechatronic systems, their modules and subsystems in order to verify and substantiate the basic

theoretical and technical solutions to be included in the terms of reference for the implementation of experimental design work;

- organizing and conducting experiments on existing robotic and mechatronic systems, their subsystems and individual modules in order to determine their effectiveness and determine ways to improve, processing the results of experimental research using modern information technologies;

- preparation of reports, scientific publications and reports at scientific conferences and seminars, participation in the implementation of research and development results into practice;

design and engineering activities:

- preparation of a feasibility study for projects of new robotic and mechatronic systems, their individual subsystems and modules;

- calculation and research of robotic and mechatronic systems, control, information-sensor and executive subsystems using methods of mathematical modeling, prototyping and testing of existing systems, processing of experimental data using modern information technologies;

- development of special software for solving problems of designing robotic and mechatronic systems, development of technical specifications and direct participation in the design of mechanical, mechatronic and robotic modules, design of mechatronic and robotic devices, control systems and information processing;

organizational and management activities:

- development of organizational and technical documentation (work schedules, instructions, plans, estimates) and established reporting on approved forms;

- organization of the work of small groups of performers involved in research, design and construction work and in experimental research;

- control over the implementation of measures for the prevention of industrial injuries, occupational diseases, the prevention of environmental violations in the process of research and operation of robotic and mechatronic systems;

installation and commissioning activities:

- participation in verification, commissioning, adjustment, assessment of the state of equipment and adjustment of robotic and mechatronic systems for various purposes, including both technical means and software control systems;

- participation in the interface of software and hardware systems with technical objects as part of robotic and mechatronic systems, in testing and commissioning of prototypes of such systems;

service and operational activities:

- participation in the verification, commissioning, adjustment and assessment of the state of robotic and mechatronic systems for various purposes, as well as their individual subsystems, in setting up control hardware and software systems;

- preventive monitoring of the technical condition and functional diagnostics of robotic and mechatronic systems for various purposes, as well as their individual subsystems;

- preparation of operating instructions for robotic and mechatronic systems and their hardware and software, development of routine test programs;

- preparation of applications for equipment and components, preparation of technical documentation for equipment repair.

3 Objects of professional activity

The objects of professional activity of a graduate are:

- robotic and mechatronic systems, including information-sensory, executive and control modules, their mathematical, algorithmic and software, methods and tools for their design, modeling, experimental research and design;

- theoretical and experimental studies of robotic and mechatronic systems for various purposes.

PASSPORT OF THE EDUCATIONAL PROGRAM

1 Scope and content of the program

The term of study in the master's program is determined by the amount of acquired academic credits. Upon mastering the established amount of academic credits and achieving the expected learning outcomes for obtaining a master's degree, the master's educational program is considered fully mastered. In the specialized master's program, at least 60 academic credits with a term of study of 1.0 year.

The planning of the content of education, the way of organizing and conducting the educational process is carried out by the university and the scientific organization independently on the basis of the credit technology of education.

The master's degree in the profile direction implements educational programs of postgraduate education for the training of management personnel with in-depth professional training.

The content of the Master's degree (magistracy) EP consists of:

1) theoretical training, including the study of cycles of basic and major disciplines;

2) practical training of undergraduates: various types of practices, scientific or professional internships;

3) experimental research work, including the implementation of a master's thesis (project) - for a specialized master's degree

4) final certification.

The content of the EP "Robotics and Mechatronics" in the framework of specialty 6M071600 - Instrumentation is implemented in accordance with the credit technology of education and is carried out in the state and Russian languages.

The educational program "Robotics and Mechatronics" contains a complete list of academic disciplines, grouped into cycles: basic (BD) and profiling disciplines (PD), both for university components (UC) and optional components (OC), indicating the complexity of each academic discipline in academic credits and hours established by the State Compulsory Standards of Higher and Postgraduate Education, approved by order of the Ministry of Education and Science of the Republic of Kazakhstan No. 604 dated October 31, 2018.

The BD cycle includes the study of academic disciplines and the passage of professional practice. The PD cycle includes academic disciplines and types of professional practices. The programs of disciplines and modules of the BD and PD cycles are interdisciplinary and multidisciplinary in nature, providing training at the junction of a number of areas of knowledge.

Final certification is carried out in the form of writing and defending a master's thesis.

Objectives of the educational program:

- development of students through research activities, critical thinking,

development of professionally oriented skills and abilities;

- the use of highly professional training of undergraduates in a different educational environment;
- training a new competitive generation of technical specialists for the labor market;
- developing an environment that supports people of different cultures and creating an atmosphere of pursuit of knowledge, academic integration and intellectual motivation;
- carrying out research work, educational activities based on the best world experience, the development of its own methodology and style of training specialists;
- development of cooperation "university-industry" to meet the requirements of the labor market for technical specialists, to improve the quality of educational programs for training specialists;
- development of additional educational and training programs using multimedia, new teaching technologies for organizing training on the principle of lifelong learning;
- establishing partnerships with other universities, organizations in order to improve the quality of education, to support technical and cultural ties.

2 Requirements for applicants

The previous level of education of applicants is higher professional education (bachelor's degree). The applicant must have a diploma of the established sample and confirm the level of knowledge of the English language with a certificate or diplomas of the established sample.

The procedure for admitting citizens to the magistracy is established in accordance with the «Standard rules for admission to training in educational organizations that implement educational programs of postgraduate education»"

The formation of a contingent of a master's students is carried out by placing a state educational order for the training of specialized personnel, as well as paying for training at the expense of citizens' own funds and other sources. The state provides citizens of the Republic of Kazakhstan with the right to receive, on a competitive basis, in accordance with the state educational order, free postgraduate education, if they receive education of this level for the first time.

At the "entrance", a master's student must have all the prerequisites necessary for mastering the corresponding educational master's program. The list of required prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, the master's student is allowed to master them on a paid basis.

3 Requirements for completing studies and obtaining a diploma

Awarded degree / qualifications: The graduate of this educational program is awarded the academic degree "Master of Engineering and Technology" in the direction.

A graduate who has mastered master's programs must have the following general professional competencies:

- the ability to independently acquire, comprehend, structure and use new

knowledge and skills in professional activity, develop their innovative abilities;

- the ability to independently formulate research goals, establish a sequence for solving professional problems;
- the ability to apply in practice knowledge of fundamental and applied disciplines that determine the focus (profile) of the master's program;
- the ability to professionally choose and creatively use modern equipment for solving scientific and practical problems;
- the ability to critically analyze, represent, defend, discuss and disseminate the results of their professional activities;
- possession of the skills of compiling and preparing scientific and technical documentation, scientific reports, reviews, reports and articles;
- willingness to lead a team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences;
- readiness for communication in oral and written forms in a foreign language to solve problems of professional activity.

A graduate who has mastered the master's program must have professional competencies corresponding to the types of professional activities that the master's program is focused on:

research activities:

- the ability to compose mathematical models of robotic and mechatronic systems, their subsystems, including executive, information-sensory and control modules, using formal logic methods, finite state machine methods, Petri nets, artificial intelligence methods, fuzzy logic, genetic algorithms, artificial neural and neuro -fuzzy networks;
- the ability to use existing software packages and, if necessary, develop new software required for information processing and control in robotic and mechatronic systems, as well as for their design;
- the ability to develop experimental models of control, information and executive modules of robotic and mechatronic systems and conduct their research using modern information technologies;
- the ability to analyze scientific and technical information, to generalize domestic and foreign experience in the field of robotics and mechatronics, automation and control equipment, to conduct a patent search;
- the ability to develop methods for conducting experiments and conduct experiments on existing models and samples of robotic and mechatronic systems and their subsystems, to process the results using modern information technologies and technical means;
- readiness to draw up analytical reviews and scientific and technical reports on the results of the work performed, in the preparation of publications based on the results of research and development;
- the ability to put into practice the results of research and development carried out individually and as part of a group of performers, to ensure the protection of intellectual

property rights;

design and engineering activities:

- willingness to lead and participate in the preparation of a feasibility study for projects to create robotic and mechatronic systems, their subsystems and individual modules;

- the ability to prepare technical specifications for the design of robotic and mechatronic systems of their subsystems and individual devices using standard executive and control devices, automation equipment, measuring and computing equipment, as well as new devices and subsystems;

- the ability to participate in the development of design and project documentation for robotic and mechatronic systems in accordance with existing standards and specifications;

- willingness to develop a methodology for conducting experimental research and testing of a mechatronic or robotic system, the ability to participate in conducting such tests and processing their results;

organizational and management activities:

- the ability to organize the work of small groups of performers;

- willingness to develop technical documentation (work schedules, instructions, plans, estimates) according to approved forms;

- willingness to apply methods of prevention of industrial injuries, occupational diseases, prevention of environmental violations;

installation and commissioning activities:

- the ability to carry out commissioning, adjustment and tuning of robotic and mechatronic systems for various purposes;

- willingness to debug hardware and software systems and their interface with technical objects as part of robotic and mechatronic systems;

- willingness to participate in testing and putting into operation prototypes of robotic and mechatronic systems;

service and operational activities:

- willingness to participate in the development of routine testing programs, verification and assessment of the state of robotic and mechatronic systems for various purposes, as well as their individual subsystems;

- the ability to carry out preventive monitoring of the technical condition and functional diagnostics of robotic and mechatronic systems for various purposes, as well as their individual subsystems;

- the ability to draw up instructions for the operation of robotic and mechatronic systems and their hardware and software;

- willingness to draw up applications for equipment and components, to participate in the preparation of technical documentation for equipment repair.

4 Working curriculum of the educational program
4.1. The term of study is 1 year

MODULAR CURRICULUM

Education program *7M07135 - Robotics and Mechatronics*

Form of study: *full* Duration of training: *1 years* *Academic degree: Master of Technical and Technological*

The cycle	Code	Name of disciplines	Semester	Acad. credits	lec.	lab.	Tutorial	IWD	Type of Final assessment	Department
Profile training module (16 credits)										
Mandatory disciplines										
BD 1.2.1	LNG209	Foreign language (professional)	1	6	0	0	2	2	Exam	EL
BD 1.2.2	MNG274	Management	1	6	2	0	1	3	Exam	SD
BD 1.2.3	HUM204	Management psychology	1	4	1	0	1	2	Exam	SECPM
Module of robotic systems (22 credits)										
Elective disciplines										
BD 1.2.4	ROB254	Information devices of robots	1	4	1	0	1	2	Exam	RaETA
BD 1.2.4.1	ROB255	Biotechnical systems	1	4	1	0	1	2	Exam	RaETA
PS 1.3.1	ROB236	Multi-agent robotic systems	1	6	2	0	1	3	Exam	RaETA
PS 1.3.1.1	ROB246	Quality management of medical equipment service	1	6	2	0	1	3	Exam	RaETA
PS 1.3.2	ROB251	Organization and planning of production of mechatronic equipment	1	6	2	0	1	3	Exam	RaETA
PS 1.3.2.1	ROB243	Biomedical measuring information systems	1	6	2	0	1	3	Exam	RaETA
PS 1.3.3	ROB202	Diagnostics and reliability of technical systems and devices	1	6	2	0	1	3	Exam	RaETA
PS 1.3.3.1	ROB247	Organization and planning of the production of medical equipment	1	6	2	0	1	3	Exam	RaETA
Practice-oriented module (7 credits)										
PS 1.3.4	AAP248	Work placement	2	7					Report	RaETA
Experimental research module (13 credits)										
MSERW	AAP207	Master's student experimental research work, including internship and master's project implementation	2	13					Report	RaETA
Module of final attestation (12 credits)										
FA	ECA205	Registration and defense of the master's thesis	2	12					Defense of dissertation	RaETA
Total				**70**						

5 Descriptors of the level and amount of knowledge, abilities, skills and competencies

The requirements for the level of preparation of a master's student are determined on the basis of the Dublin descriptors of the second level of higher education (master's degree) and reflect the acquired competencies, expressed in the achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire educational program of the master's program, and at the level of individual modules or academic discipline.

Descriptors reflect learning outcomes that characterize the student's abilities:

1) demonstrate developing knowledge and understanding in the field of study of robotics and mechatronics, based on the advanced knowledge of this field of robotics and mechatronics in the development and application of ideas used in research;

2) apply at a professional level their knowledge, understanding and ability to solve problems in a new environment, in a wider interdisciplinary context;

3) collect and interpret information to form judgments, taking into account social, ethical and scientific inferences;

4) clearly and unambiguously communicate information, ideas, conclusions, problems and solutions, both to specialists and non-specialists;

5) learning skills necessary for independent continuation of further education in the studied field of robotics and mechatronics.

6 Competencies for completing training

Universal, social and ethical competencies (USEC)	
U-1	Ability to communicate orally and in writing in the state, Russian and foreign languages to solve problems of interpersonal and intercultural interaction
U-2	The ability to assess the surrounding reality based on worldview positions formed by knowledge of the basics of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical knowledge
U-3	Develop an environment that welcomes and supports people from different cultures, and create an atmosphere of striving for knowledge, academic integration, and intellectual motivation
U-4	Have the skills of social design and methods of forming and maintaining the socio-psychological climate in the organization
U-5	Ability to critically use the methods of modern science in practice
U-6	Awareness of the need and ability to learn and improve their skills independently throughout their working life
Special and managerial competencies (SMS)	
S-1	Independently manage and control the processes of work and training activities within the framework of the strategy, policy and goals of the organization, discuss problems, argue conclusions and correctly operate with information
S-2	Organize the activities of the production team, make organizational and managerial decisions in the context of different opinions and evaluate the consequences of decisions
S-3	Organize work in the division to improve, modernize, and unify the manufactured robotic and mechatronic systems

S-4	Readiness to lead and participate in the preparation of a feasibility study of projects for the creation of robotic and mechatronic systems, their subsystems and individual modules
S-5	Ability to critically analyze, present, defend, discuss and disseminate the results of their professional activities
Professional competencies (PC)	
PC-1	The ability to analyze literature data and, based on the analysis, be able to determine and experimentally implement possible ways to improve the quality of robotic systems
PC-2	Ability to conduct professional written and oral communication with all stakeholders in the field of robotics and mechatronics
PC-3	The ability to demonstrate a sustained interest in self-study and training of both wards and colleagues, to guide and advise them throughout the entire period of professional activity
PC-4	Ability to demonstrate a high level of professional activity while solving industrial and / or scientific tasks, observing all the principles of legal and ethical standards
PC-5	Ability to conduct independent research in the field of robotics and mechatronics and modernize existing robotic and mechatronic systems, introduce new methods of digital signal processing with elements of artificial intelligence
PC-6	Ability to design modern and reliable blocks and devices, intelligently controlled Executive, information-sensor and navigation modules of robotic and mechatronic systems
PC-7	Ability to apply modern software products and the latest technologies to solve and manage interdisciplinary engineering problems in various fields of science and technology
PC-8	Ability to create adaptive and robust control systems for multi-agent robotic systems and special-purpose object systems in an unknown environment, taking into account their dynamic characteristics
PC-9	Ability to implement scientific results in the production of robotic and mechatronic systems, their subsystems and individual modules

The matrix of competencies of the educational program “Robotics and mechatronics”

Discipline index	Name of the discipline	Universal, social and ethical						Special and managerial					Professional								
		U-1	U-2	U-3	U-4	U-5	U-6	S-1	S-2	S-3	S-4	S-5	PC-1	PC -2	PC -3	PC -4	PC -5	PC -6	PC -7	PC -8	PC -9
Required component																					
LNG205	Foreign language (professional)	x											x	x							
ROB232	Information devices and systems												x				x	x	x		
ROB236	Multi-agent robotic systems												x				x	x	x	x	
ROB202	Diagnostics and reliability of technical systems and devices												x				x			x	

ROB233	Robot navigation systems												x				x	x	x	x	
ROB250	Information topologies and networks												x				x	x	x	x	
ROB234	Mathematical modeling and optimization of multi-link systems movement									x			x				x	x		x	x
ROB238	Design of special-purpose robotic systems									x			x				x	x	x	x	x
ROB235	Digital processing of measurement information												x				x	x	x	x	
State final attestation																					
ECA205	Preparation and defense of a master's thesis (PDMT)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Additional types of training																					
AAP242	Experimental research work of a master student									x	x		x				x	x	x	x	x
AAP244	Internship	x	x	x	x	x	x	x	x	x	x	x			x	x					

7 ECTS Diploma Supplement

The application was developed according to the standards of the European Commission, Council of Europe and UNESCO / CEPES. This document is for academic recognition only and is not an official proof of education. Not valid without a university degree. The purpose of completing the European Supplement is to provide sufficient information about the holder of the diploma, the qualification obtained, the level of this qualification, the content of the study program, the results, the functional purpose of the qualification, as well as information about the national education system. The application model that will be used to translate grades uses the European Credit Transfer or Transfer System (ECTS).

The European Diploma Supplement provides an opportunity to continue education at foreign universities, as well as to confirm national higher education for foreign employers. When going abroad for professional recognition, additional legalization of the educational diploma is required. The European Diploma Supplement is completed in English upon individual request and is issued free of charge.

8 Brief description of courses

English (professional)
CODE - LNG205
CREDIT - 5
PREREQUISIT - Academic English, Business English, IELTS 5.0-5.5

PURPOSE AND OBJECTIVES OF THE COURSE
Thanks to this course, you will master specific terminology, be able to read specialized literature, gain the knowledge necessary to implement effective oral and written communications in a foreign language in your professional activities.
SHORT DESCRIPTION OF THE COURSE
In the process of training, students acquire knowledge of a foreign language, including mastery of specialized vocabulary, necessary for the implementation of effective oral and written communications in a foreign language in their professional activities. Practical tasks and methods for developing the required language skills in the learning process include: case method and role-playing games, dialogues, discussions, presentations, listening tasks, working in pairs or in groups, completing various written tasks, grammar tasks and explanations.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline, the student expands the professional lexical vocabulary, possess the skills of effective communication in a professional environment, the ability to competently express thoughts in oral and written speech, understand specific terminology and read specialized literature.

Project management
CODE - MNG230
CREDIT - 3
PREREQUISIT - The discipline "Project Management" is based on the knowledge gained as a result of studying disciplines for undergraduate courses

PURPOSE AND OBJECTIVES OF THE COURSE
The aim of teaching the discipline "Project Management" is to master the methodology of project management in various fields of activity, to foster a culture adequate to modern project management and information technology, to create conditions for the introduction of new information technologies in the implementation of projects. The course is based on international guidelines for project management (Project Management Body of Knowledge).
BRIEF DESCRIPTION OF THE COURSE The content of the discipline is aimed at studying modern concepts, methods, project management tools in order to apply them in further practical activities of a specialist to solve problems of planning and executing projects.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
be able to:
- prepare documents for the initialization phase of the project, such as a feasibility study, project charter, etc.
- develop and analyze documents related to the planning of project activities, apply various methods of decision support;
- operatively control the execution of work and track the deadlines;
- select personnel, resolve contradictions between team members;
- to manage the risks arising from the implementation of projects.
knowledge gained during the course:
- Modern standards in the area of project management and their characteristics;
- PMI approach to project management;
- Investment planning;
- Accounting for project risks;
- Methods for optimizing the use of available resources;
- Ways of resolving conflict situations;
- Analysis of actual indicators for timely adjustment of the progress of work.
skills:
- conducting projects in accordance with modern requirements of project management; - apply in the process of project management using MS Project software.

Robot information devices
CODE - ROB254
CREDIT - 4
PREREQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE
The objectives of mastering the discipline "Information devices of robots" is to study the principles of building information systems of robots, their sensitive elements, measuring circuits and amplifiers; the physical principles used in the creation of various sensors are considered, mathematical dependences are studied, which make it possible to calculate the basic parameters of the sensitive elements. SHORT DESCRIPTION OF THE COURSE
Introduction. Elements of information systems. Measurement of kinetic and dynamic quantities. Location information systems. Technical vision systems. Tactile type systems.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of studying the discipline, a master student must:
know:
- modern research methods;
- stages of implementation of projects in the field of robotics and mechatronics;
- the basic principles of searching for scientific and technical information.
be able to:
- study independently using modern information technologies;
- use new knowledge and skills in practice;
- use existing software packages and, if necessary, develop new software;
have :
- skills of work distribution;
- skills in implementing the acquired knowledge in the practical implementation of projects;
- skills in working with modern tools for researching robotic systems.

Mathematical modeling and optimization of the movement of multi-link systems
CODE - ROB234
CREDIT - 5
PRE-REQUISIT - понет

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of teaching the discipline is to study the principles of modeling the movement of multi-link systems, which are the majority of mechatronic systems that are multi-link, such as manipulators of industrial robots, construction automobile cranes, single-bucket excavators, etc., at the design stage. Exploring the basic elements of the SimMechanics library. and the principles of forming models of spatial mechanisms and machines in the SimMechanics environment, visualization of the movements of spatial mechanisms and machines using the built-in SimMechanics tools.
SHORT DESCRIPTION OF THE COURSE
The course "Mathematical modeling and optimization of the movement of multi-link systems" is intended to study the principles of design and analysis of mechanical systems (for example, various kinematic links) using the developed special physical and mathematical apparatus SimMechanics, an extension package for the Simulink system for physical modeling. This is the technical design and modeling of mechanical systems (within the framework of the laws of theoretical mechanics). SimMechanics allows you to simulate translational and rotational motion in three planes. SimMechanics contains a set of tools for setting the parameters of links (mass, moments of inertia, geometric parameters), kinematic constraints, local coordinate systems, methods of defining and measuring movements.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of studying the discipline, a master student must:
know:
- functional purposes of methods of mathematical modeling and optimization of the movement of multi-link mechatronic systems.
be able to:
- develop new approaches to mathematical modeling and optimization of the movement of multi-link mechatronic systems.
have:
- skills in the implementation of the acquired knowledge in the practical implementation of projects.

Multi-agent robotic systems
CODE - ROB236
CREDIT - 5
PREREQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE
The study of multi-agent systems, which are one of the new promising areas of artificial intelligence, which was formed on the basis of the results of research in the field of distributed computer systems, network technologies for solving problems in parallel computing, in which the principle of autonomy of individual parts of the program, functioning together in a distributed system, where many interconnected computational processes take place simultaneously using programs called multiagents.
SHORT DESCRIPTION OF THE COURSE
This discipline provides the study of a wide range of problems associated with the use of special programs for multi-agent systems that allow solving artificial intelligence problems in modern conditions. Provides a complete understanding of the content of the multi-agent approach, the order of its implementation and the use of analysis results in management processes. We consider new models in the form of distributed dynamic environments and intelligent agents that provide an adequate reflection of the increasing complexity of decision-making on business management in conditions of uncertainty and conflict, eventfulness, situationality, high connectivity with the use of multi-agent robotic systems.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline, the undergraduate must:
know:
- general principles of building multi-agent robotic systems;
- methodology, methods and models for the formation of multi-agent robotic systems;
be able to:
- to carry out the synthesis of multi-agent robotic systems.
be master of:
- methods of using multi-agent robotic systems.

Diagnostics and reliability of technical systems and devices
CODE - ROB202
CREDIT - 5
PREREQUISIT - physics, chemistry, mathematics, electronics

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of the discipline is to study methods for assessing the reliability of technical systems at the design stage, study methods for assessing the reliability of technical systems in operation, the use of probability theory to predict and prevent equipment failures, study methods for diagnostics of operating equipment.
SHORT DESCRIPTION OF THE COURSE
The discipline includes the following main areas. Modern scientific concepts in the development of safety assessment of technical systems. The theory of the reliability of devices, machines and structures. Reliability indicators, mathematical models of reliability and survivability. Mathematical expectations of the number of failures and application of the theory of reliability and survivability to the design conditions of machines and structures. The theory of survivability. Damage accumulation models. Fatigue Fracture Mechanics. Forecasting at the design stage. Monitoring the destruction of machines and mechanisms. Maintenance planning.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
After studying this discipline, the undergraduate must:
know and be able to:
- apply in practice the main provisions of the theory of reliability, to evaluate the reliability of technical systems, the theory of reliability in any industry that relies on mathematics and technical disciplines.
correctly represent:
- man-made risk inherent in the proposed project, submitted for technical expertise and be competent in the implementation of measures designed to minimize damage in the event of industrial accidents, evaluate methods for their prediction and prevention,
skills:
- assessing the reliability and technogenic risk of technical systems under construction and modernization.

Registration and defense of a master's thesis
CODE - ECA501
CREDIT - 12

The purpose of the master's thesis is:
demonstration of the level of scientific / research qualifications of a master student, the ability to independently conduct scientific research, test the ability to solve specific scientific and practical problems, knowledge of the most general methods and techniques for their solution.
SHORT DESCRIPTION
A master's thesis is a final qualifying scientific work, which is a generalization of the results of an independent study by a master student of one of the urgent problems of a specific specialty of the corresponding branch of science, which has internal unity and reflects the course and results of the development of the chosen topic.
The master's thesis is the result of the research / experimental research work of the master student, carried out during the entire period of the master's student's training.
The defense of a master's thesis is the final stage of the master's preparation. A master's thesis must meet the following requirements:
- research should be carried out in the work or actual problems in the field of robotics and mechatronics should be solved;
- work should be based on the definition of important scientific problems and their solution;
- decisions must be scientifically grounded and reliable, have internal unity;
- the thesis should be written individually.

Content

РЕЦЕНЗИЯ

на образовательную программу
«7М07107 Робототехника и мехатроника»

Срок обучения – 2 года.

Содержание образовательной программы магистратуры разработано на основе принципов непрерывности и преемственности с предыдущим уровнем образования - бакалавриат. Все дисциплины являются логическим продолжением дисциплин бакалавриата, их содержание носит более углубленный характер.

Образовательная программа построена таким образом, чтобы обеспечивалась целостность образования, сочетание фундаментальной подготовки с междисциплинарным характером профессиональной деятельности специалиста и полностью соответствует требованиям Типового учебного плана по специальности высшего образования.

Содержание и объем учебных курсов по базовым дисциплинам являются достаточными для последующего изучения профилирующих дисциплин.

Структура образовательной программы основана на модульном принципе, при составлении которой соблюдается комплексный подход.

Образовательная программа специальности нацелена на достижение определенного образовательного результата, от фундаментальных и общих профессиональных до специальных узко прикладных.

Виды профессиональных практик, диссертационные работы включаются в соответствующие модули образовательной программы в зависимости от взаимосвязи и единства целей с учебными дисциплинами.

Программа обеспечивает изучение и исследование всех видов современных информационно-измерительных систем и комплексов.

Программа обеспечивает магистрантам возможность проходить стажировку за рубежом и проводить различные исследовательские работы. Развивает у магистрантов способности к пониманию современных достижений в области проблем развития приборостроения.

Заместитель директора по ИиИТ ТОО «Корпорация Сайман» Корпорация Сайман **Байбеков К.И.**