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

CURRICULUM PROGRAM

"BIOMEDICAL ENGINEERING"
Master of Engineering Science of the educational program "7M07106- Biomedical Engineering"

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 Biomedical Engineering

Professional competencies: in the field of research methodology; in the field of scientific and scientific-pedagogical activity in higher educational institutions; in matters of modern educational 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 Goals of the educational program

1 Objectives of the educational program

The objectives of the Biomedical Engineering Educational Program are:

to meet the needs of students for intellectual, creative and professional development by acquiring knowledge and skills in the field of biomedical technology and systems;

organization of master's training that allows all graduates to continue their education with the aim of obtaining a PhD in the field of new high-tech biomedical engineering for diagnostics, therapy and surgery, operation and maintenance of medical systems, complexes and devices;

meeting the needs of the Republic of Kazakhstan in qualified personnel by training specialists to conduct new medical and biological research using technical and computer tools, creating structures of problem-oriented systems, creating and switching to new software for processing diagnostic information in real time, complexes for collecting, analyzing, processing and storing medical and biological information; databases and knowledge, forecasting and decision-making systems, and biological experiments using tools and hardware and software.

2 Types of employment

Types of professional activities that graduates who have mastered the master's program are preparing for:

- research organization;
- design Department;
- organizational and managerial structure;
- installation and commissioning;
- service and operational documentation;
- project-technological;

Master's degree in the field of training "Biomedical Engineering" should be prepared to solve professional tasks in accordance with the profile of the master's program and the types of professional activities:

research activities:

-development of programs for scientific research and technical development, preparation of individual tasks for performers;

- collection, processing and systematization of scientific and technical information on the topic of planned research, selection of methods and tools for solving formulated tasks, preparation of tasks for performers;

- mathematical modeling of research technologies for biological objects and biotechnical systems for various purposes using standard software tools;

- development of physical, phenomenological, mathematical and information-structural models of biological objects and processes, assessment of their adequacy, determination of a set of independent indicators that characterize the studied biological object and process;

- organization and participation in conducting biomedical, environmental and ergonomic experiments, collection, processing, systematization and analysis of research results;

- preparation of scientific and technical reports in accordance with the requirements of regulatory documents, preparation of reviews and preparation of publications based on the results of conducted biomedical and environmental studies;

- analysis of patent materials and preparation of applications for inventions and industrial designs;

design and development activities:

- analysis of the state of scientific and technical problems by selecting, studying and analyzing literary and patent sources in the field of biotechnical systems and technologies;

- determination of the purpose, setting of design tasks, preparation of technical specifications for the performance of design works in the field of biotechnical systems and technologies;

- design of devices, devices, systems and complexes for biomedical and environmental purposes taking into account the specified requirements;

- development of design documentation in accordance with methodological and regulatory requirements.

organizational and managerial activities:

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

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

- control over the implementation of measures to prevent industrial injuries, occupational diseases, and prevent environmental violations in the process of research and operation биofbiological medical systems;

design and technological activities:

- development of technical specifications for the design of technological processes and production schemes for biomedical and environmental equipment using automated systems of technological pre-production;

- design of technological processes for the production of biomedical and environmental equipment using automated systems of technological pre-production;

- development of technological documentation for designed devices, devices, systems and complexes for biotechnical, medical and environmental purposes;

- ensuring the manufacturability of products and manufacturing processes, assessing the economic efficiency of manufacturing processes for biomedical and environmental equipment, as well as biotechnical systems in other areas;

- author's support of the developed devices, devices, systems and complexes at the design and production stages;

installation and commissioning activities:

- participation in verification, adjustment, adjustment, evaluation of equipment condition and configuration of biomedical systems for various purposes, including both technical means and software control systems;

- participation in interfacing software and hardware complexes with technical objects as part of biomedical systems, in conducting tests and commissioning prototypes of such systems;

service and maintenance activities:

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

- preventive control of technical condition and functional diagnostics of biomedical systems for various purposes, as well as their individual subsystems;

- preparation of operating instructions for biomedical systems and their hardware and software, development of routine testing 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 the graduate are:

- biomedical engineering, including information-sensory, Executive and control modules, their mathematical, algorithmic and software, methods and means of their design, modeling, experimental research and design;

- theoretical and experimental studies, analysis of signals, analytical relation for the optimum processing of multidimensional signals, mathematical foundations of pattern recognition, processing, identification and synthesis of speech signals, problem-oriented software systems in biomedical practice, the kinds of provisions for biomedical research, tprinciple that gainss structuress the problem-oriented system, pmessenge processing of diagnostic information in real time, toomplex for the collection, analysis, processing and storage of biomedical information; data and knowledge bases, systems of forecasting and decision-making software systems, health-technical support of medical institutions.

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 scientific and pedagogical magistracy, at least 120 academic credits for the entire period of study, including all types of educational and scientific activities of the master student.

Planning of the content of education, the way of organizing and conducting the educational process is carried out by the University and scientific organization independently on the basis of credit technology of training.

The master's program in the relevant field implements educational programs of postgraduate education for the training of managerial personnel, with in-depth professional training.

The contents the master's program consists of:

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

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

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

4)final certification.

The content of the OP "Biomedical Engineering" within the specialtyей 6M071600 -Instrument engineering, 6M073200-Standardization and certification, 6M072200 - Polygraphy is implemented in accordance with the credit technology of training and is carried out in the state and Russian languages.

Educational program" Biomedical Engineering» identifies the full range of academic disciplines, grouped in cycles: basic (BD) and majors (PD), indicating the complexity of each subject in academic hours and credits established by the State compulsory standards of higher and postgraduate education approved by order of MES RK №604 dated October 31, 2018.

The DB cycle includes studying academic subjects and passing professional practice. The PD cycle includes academic disciplines and types of professional practices. The programs of disciplines and modules of the DB 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;

- using highly professional experience of teaching undergraduates in various educational environments;

- training a new competitive generation of technical specialists for the labor market;

- developing an environment that welcomes and supports people from different cultures, and creating an atmosphere of striving for knowledge, academic integration and intellectual motivation;

- conducting research, conducting educational activities based on world best practices, and developing their own brand 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 for the economy and business sector;

- development of additional educational and training programs using multimedia, new teaching technologies for organizing learning based on the principle of lifelong learning;

- establishing partnerships with other universities and organizations to improve the quality of education, to support technical and cultural ties.

1 Requirements for applicants

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

The procedure for admitting citizens to the master's program is established in accordance with the "Standard rules for admission to study in educational organizations that implement educational programs of postgraduate education".

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

At the" entrance", the master's student must have all the prerequisites necessary to master the relevant educational program of the master's degree. The list of necessary prerequisites is determined by the higher educational 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 training and obtaining a diploma

Degree/ qualifications awarded: the Graduate of this educational program is awarded the academic degree "master of engineering and technology» in the direction of.

A graduate who has completed a master's degree program must possess the following General professional competencies:

- ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities;
- ability to independently formulate research goals, establish a sequence of solving professional tasks;
- the ability to apply in practice knowledge of fundamental and applied sections of disciplines that determine the direction (profile) of the master's program;
- ability to choose professionally and creatively use modern scientific and technical equipment for solving scientific and practical problems;
- ability to critically analyze, present, protect, discuss and disseminate the results of their professional activities;
- proficiency in the preparation and execution of scientific and technical documentation, scientific reports, reviews, reports and articles;
- willingness to lead the team in the sphere of their professional activities, tolerant of social, ethnic, confessional and cultural differences;
- readiness to communicate in oral and written forms in a foreign language to solve the problems of professional activity.

A graduate who has completed a master's degree program must possess professional competencies that correspond to the types of professional activities that the master's degree program focuses on:

research activities:

- ability to create mathematical models, mathematical foundations of pattern recognition, processing, identification and synthesis of speech signals, typical structures of a problem-oriented system, software tools for processing diagnostic information in real time;
- conduct optimal processing of multidimensional signals, types of medical and biological research supplies;
- ability to develop and apply new high-tech biomedical engineering in diagnostics, therapy and surgery, operation and service of medical systems, complexes and machines systems for collecting, analyzing, processing and storing biomedical information; data and knowledge bases, systems of forecasting and decision-making software systems, health-technical support of medical institutions;
- ability to develop methods of conducting experiments and conduct experiments on existing models and samples of biomedical systems and their subsystems, process results using modern information technologies and technical means;
- willingness to prepare analytical reviews and scientific and technical reports based on the results of work performed, to prepare publications on the results of research and development;
- ability to analyze scientific and technical information, generalize domestic and foreign experience in the field of biomedical systems, conduct patent search;

- the ability to implement in 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 development activities:

- readiness to lead and participate in the preparation of a feasibility study of projects to create biomedical systems, their subsystems and individual modules;

- ability to prepare technical specifications for the design of biomedical systems, their subsystems and individual devices using standard Executive and control devices, automation tools, measuring and computer technology, as well as new devices and subsystems;

- the ability to participate in the development of design and project documentation of biomedical systems, in accordance with existing standards and specifications;

- willingness to develop methods for conducting experimental research and testing of biomedical systems, the ability to participate in conducting such tests and processing their results;

organizational and managerial activities:

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

- willingness to develop technical documentation (work schedules, instructions, plans and estimates) in accordance with approved forms;

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

design and technological activities:

- ability to develop technical specifications for designing technological processes and production schemes of biomedical and environmental equipment using automated systems of technological pre-production;

- ability to design technological processes for the production of biomedical and environmental equipment using automated systems of technological pre production;

- development of technological documentationю for designed devices, devices, systems and complexes for biotechnical, medical and environmental purposes;

- ability to ensure the manufacturability of products and processes of their manufacture, assessment of the economic efficiency of technological processes for manufacturing biomedical and environmental equipment, as well as biotechnical systems in other areas;

- right to author's support of developed devices, devices, systems and complexes at the design and production stages;

scientific and pedagogical activity:

- willingness to take a direct part in educational and educational-methodical work on the profile of the direction of training, to participate in the development of programs of academic disciplines and courses;

- the ability to conduct training sessions, laboratory work, to ensure practical and research work of students;

- the ability to apply and develop new educational technologies, problem-oriented software systems in medical and biological practice.

When developing a master's program, all general cultural and general professional competencies, as well as professional competencies related to those types of professional activities that the master's program is focused on, are included in the set of required results of mastering the master's program.

4 Working curriculum of the educational program

4.1. The term of study is 2 years

MODULAR CURRICULUM

Education program *7M07106 - Biomedical engineering*

Form of study: *full* Duration of training: *2 years* *Academic degree: Master of Technical Sciences*

The cycle	Code	Name of disciplines	Semester	Acad. credits	lec.	lab.	Tutorial	IWD	Type of Final assessment	Department
Profile training module (18 credits)										
Mandatory disciplines										
BD 1.2.1	HUM201	History and philosophy of science	1	4	1	0	1	2	Exam	SD
BD 1.2.2	HUM207	Higher school pedagogy	1	4	1	0	1	2	Exam	SD
BD 1.2.3	LNG202	Foreign language (professional)	2	6	0	0	3	3	Exam	EL
BD 1.2.4	HUM204	Management psychology	2	4	1	0	1	2	Exam	SECPM
Module of biotechnical systems (18 credits)										
Elective disciplines										
BD 1.2.6	ROB240	Biotechnical systems and technologies	1	6	2	0	1	3	Exam	RaETA
BD 1.2.6.1	ROB232	Information devices and systems	1	6	2	0	1	3	Exam	RaETA
BD 1.2.7	ROB257	Biotechnical control systems	2	6	2	0	1	3	Exam	RaETA
BD 1.2.7.1	ROB256	The dynamics of robots	2	6	2	0	1	3	Exam	RaETA
Mandatory disciplines										
PS 1.3.1	ROB245	Computer technologies in biomedical research	1	6	2	0	1	3	Exam	RaETA
Module of biotechnical control systems (24 credits)										
Elective disciplines										
BD 1.2.8	ROB230	Microprocessor control systems	2	6	2	0	1	3	Exam	RaETA
BD 1.2.8.1	ROB237	Control of mobile robots in an unknown environment	2	6	2	0	1	3	Exam	RaETA
PS 1.3.2	ROB225	Intelligent control technology	2	6	2	0	1	3	Exam	RaETA
PS 1.3.3	ROB243	Biomedical measuring information systems	2	6	2	0	1	3	Exam	RaETA
PS 1.3.3.1	ROB233	Robot Navigation Systems	2	6	2	0	1	3	Exam	RaETA
PS 2.3.4	ROB244	Detection and filtering of biomedical signals	3	6	2	0	1	3	Exam	RaETA
PS 2.3.4.1	ROB259	Deep learning for robots	3	6	2	0	1	3	Exam	RaETA
Elective disciplines										
Module for designing biotechnical systems (18 credits)										
PS 2.3.5	ROB242	Mathematical modeling of biological processes and systems	3	6	2	0	1	3	Exam	RaETA

PS 2.3.5.1	ROB234	Mathematical modeling and optimization of motion of multi-tier systems	3	6	2	0	1	3	Exam	RaETA
PS 2.3.6	ROB248	Verification, safety and reliability of medical equipment	3	6	2	1	0	3	Exam	RaETA
PS 2.3.6.1	ROB238	Designing special purpose robotic systems	3	6	2	1	0	3	Exam	RaETA
PS 2.3.7	ROB252	Automated design of medical equipment	3	6	2	0	1	3	Exam	RaETA
PS 2.3.7.1	ROB235	Digital processing of measurement information	3	6	2	0	1	3	Exam	RaETA
Practice-oriented module (11 credits)										
BD 1.2.5	AAP244	Pedagogical practice	2	4	0	0	0	2	Report	RaETA
PS 2.3.8	AAP236	Research scientific training	4	7					Report	RaETA
Research Module (24 credits)										
MSSR	AAP242	Master's student scientific research, including an internship and a master's thesis.	1	6					Report	RaETA
MSSR	AAP242	Master's student scientific research, including an internship and a master's thesis.	2	6					Report	RaETA
MSSR	AAP242	Master's student scientific research, including an internship and a master's thesis.	3	6					Report	RaETA
MSSR	AAP242	Master's student scientific research, including an internship and a master's thesis.	4	6					Report	RaETA
Module of final attestation (12 credits)										
FA	ECA205	Registration and defense of the master's thesis	4	12					Defense of dissertation	RaETA
Total				**125**						

5 Descriptors of the level and scope of knowledge, skills, skills and competencies

The requirements for the master's degree level are determined on the basis of the Dublin descriptors of the second level of higher education (master's degree) and reflect the mastered competencies expressed in the achieved learning results.

Learning outcomes are formulated at the level of the entire master's degree program, as well as at the level of individual modules or academic disciplines.

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

1) demonstrate developing knowledge and understanding in the field of biomedical engineering under study, based on advanced knowledge of this field of biomedical engineering, when developing and / or applying ideas in the context of research;

2) apply their professional knowledge, understanding and abilities to solve problems in a new environment, in a broader interdisciplinary context;

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

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

5) training skills necessary for independent continuation of further training in the field of biomedical engineering under study.

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 manufactured biomedical products
S-4	Readiness to lead and participate in the preparation of a feasibility study for projects to create biomedical 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	Ability to analyze literature data and, based on the analysis, be able to identify and experimentally implement possible ways to improve biomedical systems
PC-2	Ability to conduct professional written and oral communication with all stakeholders in the field of biomedical engineering
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 biomedical engineering and modernize existing biomedical 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 biomedical devices and devices
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	The ability to create adaptive and robust control systems of biotechnical objects
PC-9	Ability to implement scientific results in the production of biomedical products

The matrix of competencies of the educational program "Biomedical engineering"

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							
HUM201	History and philosophy of science		x			x				x	x	x				x	x				x
HUM205	Pedagogy of higher education			x	x		x	x							x	x					
HUM204	Management psychology			x	x		x	x	x		x			x	x	x					
ROB240	Biotechnical systems and technologies												x				x	x	x		
ROB245	Computer technologies in biomedical research												x				x	x	x	x	
ROB258	Management in biotechnical and medical systems												x				x	x		x	
ROB230	Microprocessor control and monitoring systems												x				x	x	x		
ROB244	Detection and filtering of biomedical signals												x				x			x	
ROB241	Clinical, laboratory and environmental analytical equipment												x				x	x	x	x	
ROB243	Biomedical measurement information systems												x				x	x	x	x	
ROB242	Mathematical modeling of biological processes and systems									x			x				x	x		x	x
ROB225	Intelligent control technology												x				x	x	x	x	
ROB248	Verification, safety and reliability of medical equipment									x			x				x	x	x	x	x
ROB253	Medical information system												x				x	x	x	x	
ROB252	Computer-aided design of medical equipment												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	Research work of a master's student									x	x		x				x	x	x	x	x
AAP244	Pedagogical practice							x							x	x					
AAP236	Research practice							x	x	x	x	x	x				x	x	x	x	x

7 Appendix to the ECTS diploma

The application is developed according to the standards of the European Commission, the Council of Europe and UNESCO/Sepes. This document serves only for

academic recognition and is not an official confirmation of a document of education. It is not valid without a higher education diploma. The purpose of completing the European application is to provide sufficient data on the holder of the diploma, the qualification they have obtained, the level of this qualification, the content of the training 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 for translating grades uses the European credit transfer or transfer transfer system (ECTS).

The European diploma Supplement allows you to continue your education at foreign universities, as well as confirm your national higher education for foreign employers. When traveling abroad for professional recognition, additional legalization of the diploma of education will be required. The European diploma Supplement is completed in English upon individual request and is issued free of charge.

8 Brief description of courses

Foreign language (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.

History and philosophy of science
CODE - HUM201
CREDIT - 4
PREREQUISIT - HUM124

GOALS AND OBJECTIVES OF THE COURSE - to reveal the connection between philosophy and science, to highlight the philosophical problems of science and scientific knowledge, the main stages of the history of science, the leading concepts of philosophy of science, modern problems of the development of scientific and technical reality
BRIEF DESCRIPTION OF THE COURSE - the subject of philosophy of science, the dynamics of science, the specifics of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, technology and technology, the specificity of engineering sciences, ethics of science, social and moral responsibility of a scientist and engineer
KNOWLEDGE, ABILITY, SKILLS ON COMPLETION OF THE COURSE - to know and understand the philosophical issues of science, the main historical stages of the development of science, the leading concepts of the philosophy of science, be able to critically evaluate and analyze scientific and philosophical problems, understand the specifics of engineering science, possess the skills of analytical thinking and philosophical reflection, be able to substantiate and defend their position, master the techniques of conducting discussion and dialogue, possess the skills of communication and creativity in their professional activities.

Higher education pedagogy
CODE - HUM205
CREDIT - 4
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE The course is aimed at studying the psychological and pedagogical essence of the educational process of higher education; formation of ideas about the main trends in the development of higher education at the present stage, consideration of the methodological foundations of the learning process in higher education, as well as psychological mechanisms affecting the success of learning, interaction, management of subjects of the educational process. Development of psychological and pedagogical thinking of undergraduates.
BRIEF DESCRIPTION OF THE COURSE in the course of studying the course, undergraduates get acquainted with the didactics of higher education, the forms and methods of organizing education in higher education, psychological factors of successful learning, features of psychological influence, mechanisms of educational influence, pedagogical technologies, characteristics of pedagogical communication, mechanisms of managing the learning process. Analyze organizational conflicts and ways to resolve them, psychological destruction and deformation of the teacher's personality.
KNOWLEDGE, SKILLS FOR COMPLETION OF THE COURSE - at the end of the course, the master student must know the features of the modern system of higher professional education, the organization of pedagogical research, the characteristics of the subjects of the educational process, the didactic foundations of the organization of the learning process in higher education, pedagogical technologies, patterns of pedagogical communication, features of educational influences on students, as well as problems of pedagogical activity.

Management psychology
CODE - HUM205
CREDIT - 4
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

The main goal of the course is aimed at studying the characteristics of the behavior of individuals and groups of people within organizations; determining psychological and social factors influencing the behavior of workers. Also, great attention will be paid to the issues of internal and external motivation of people.

The main goal of the course is to apply this knowledge to improve the efficiency of the organization.

SHORT DESCRIPTION OF THE COURSE

The course is designed to provide balanced coverage of all the key elements that make up the discipline. It will briefly examine the origins and development of the theory and practice of organizational behavior, followed by a review of the main roles, skills and functions of management with a focus on management effectiveness, illustrated with real-life examples and case studies.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, students will know: the basics of individual and group behavior; basic theories of motivation; basic leadership theories; concepts of communication, management of conflicts and stress in the organization.

will be able to define the different roles of leaders in organizations; look at organizations from the point of view of managers; understand how effective management contributes to an effective organization.

Biotechnical systems and technologies
CODE - ROB240
CREDIT - 5
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE
The main objective of the course - generating e theoretical and practical knowledge about the current level of electronic materials science; formation of knowledge, abilities, skills and competencies in biotechnical systems management systems; the formation of a belief about the need to develop automatic biotechnical systems to ensure human life; use of information tools necessary for future professional activities.
SHORT DESCRIPTION OF THE COURSE
The discipline "Biotechnical systems and technologies" is devoted to the study of methods and techniques of analysis and creation of biotechnical systems and technologies. The processes of interaction of biological and technical parts of such systems are considered in detail. The objectives of the discipline are to show the possibility of using biotechnical systems and technologies in various fields of biology and medicine.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline, the master student must:
know:
- basic concepts and principles of classification of biotechnical systems and technologies, methods of interaction of various biological and technical links in a single control loop, the main properties and characteristics of biotechnical systems;
- classification of biotechnical systems, purpose, composition and principles of operation of the main types of medical devices, apparatus, systems and complexes, their main technical characteristics;
- features of displaying information about the state of the body and the parameters of impacts as part of biotechnical systems, the main modern trends in the development of biotechnical technologies;
be able to:
- apply the principles and methods of building models, methods of analysis, synthesis and optimization in the creation and research of biotechnical systems;
- to formulate initial data for the choice of biotechnical systems, taking into account the physiological characteristics of the objects of research and specific medico-biological tasks;
- to apply systemic principles using examples of the functioning of biotechnical devices and systems in interaction with biological subsystems of the body;
own:
- principles and methods of modeling, analysis, synthesis and optimization of biotechnical systems;

- skills in working with modern hardware and software for the design of biotechnical systems;
- general ideas about the main technological processes of servicing complex medical equipment.

Mathematical modeling of biological processes and systems
CODE - ROB242
CREDIT - 5
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

The main goal of the course: to form undergraduates' systems of views on the correct use of existing mathematical methods and algorithms for the analysis of experimental information of various physical nature; teach to independently use the available mathematical apparatus for evaluating measurement results, the optimal choice of theoretical and technical means for evaluating measurement results. And Learn the mathematical laws of bio-physical processes and systems. Four tasks are considered, describing examples of modeling the vocal tract, hearing aid, heart electric generator and competitive selection.

Course objectives: to give an understanding of the subject of mathematical modeling of biological processes as a necessary system of knowledge in the biological cycle of sciences; to form a general idea of the content, tasks and methods of scientifically substantiated assessments of measurement results in the field of biomedical research.

SHORT DESCRIPTION OF THE COURSE

Concept, essence and principles of modeling, types of models and their classification. Mathematical models of signals and methods for their construction. Deterministic and statistical mathematical models. Optimization of the model structure. Assessment of the adequacy of mathematical models. Physical modeling as a basis for experimental studies of dynamic systems. Simulation models, methods and means of their machine implementation. Digital, analog and digital-to-analog simulation. Mathematical models of biotechnical systems and methods for their construction. Application areas of models of biotechnical systems. Examples of modeling transient processes in a biological object under the influence of external factors. Communication of modeling with related disciplines.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

As a result of mastering the discipline, the master student must:

know:

- basic mathematical models of models of biological signals and systems;
- basic concepts and modern principles of working with biomedical information, as well as have an idea of modeling methods as methods of implementing systemic principles for studying complex systems, the role of computers in the implementation of modeling methods, mathematical apparatus and methods for optimizing models;

be able to:

- solve typical mathematical problems used in modeling biological processes and systems;
- be able to use the main classes of models and modeling methods, principles

building models of processes and objects, methods of formalization, algorithmization and implementation of models by means of IT;
- simulate and process empirical and experimental data;
- apply methods and tools of information technology to solve problems of modeling biological processes and systems;
own:
- mathematical, statistical and quantitative methods for solving modeling problems;
- software for working with medical information;
- experience in calculating the parameters of models of various biological processes and systems using computers;
- skills in using professional terminology in the field of modeling biological processes and biotechnical systems.

Medical information systems
CODE - ROB253
CREDIT - 4
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

The main goal of this course is to study the ability of modern organizations to use the achievements of the theory and practice of modern management. The course is aimed at developing effective management skills and the ability to make informed management decisions in the management of healthcare organizations.

Course objectives :

The main tasks are:

1. Study of the main functions and principles of modern practice of managing healthcare institutions;
2. Development of skills for assessing the external and internal environment of the organization, using modern methods of diagnostics of healthcare organizations;
3. Development of communication skills and interpersonal communication in the business environment;

SHORT DESCRIPTION OF THE COURSE

Fundamentals of Service Management and the Service Sector: The Service Revolution and the Change of Management Paradigms. Management paradigms and paradigm shift. Service orientation and the new configuration of modern organizations: networking and virtual corporations. The essence and content of service sector management. Social problems of management in healthcare. Service infrastructure.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

1. Must know: the essence and significance of information in the development of a modern information society, comply with the basic requirements of information security; know and take into account the basic psychological characteristics of the consumer of health services;
2. Must be able to: carry out activities related to the leadership or actions of individual employees; plan the production and economic activities of a medical institution, depending on changes in the market conditions for educational services and consumer demand;
3. Must possess: basic methods, methods and means of obtaining, storing, processing information, have skills in working with a computer as a means of information management; work with information in global computer networks.

Biomedical Measurement Information Systems
CODE - ROB243
CREDIT - 4
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

The main goal of the course: obtaining new knowledge through the development of fundamental and applied scientific research in the field of biomedical engineering; preparation for research activities, the objects of which are devices, systems and complexes of medical and biological purposes, methods and technologies for performing medical, biological, environmental research; automated systems for processing biomedical information; biotechnical control systems.

SHORT DESCRIPTION OF THE COURSE

Purpose and main functions of measuring information systems. Basic structures, blocks of technological medical information system. Automatic control systems. Separation of measuring channels and methods of countering interference. Biomedical signals and their origins. Electrodes for picking up biomedical signals. Biomedical signal sensors. Bridge circuits for measuring biomedical signals. Measurement compensation principle. Design of information and measuring systems. Metrological characteristics of sensors, measuring instruments. Bioimpedance measurement. Biopotential enhancers. Coordination of biopotential sensors with the measuring circuit. Differential amplifiers for biomedical signals. Electrocardiographic amplifiers

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

of nat: Measurement methodology with more sensors; principles of organizing the synchronization of the transmitting and receiving parts of the measuring systems; methods of increasing the noise immunity of IMS.

at the Met: perform calculations measuring system parameters; select and calculate the error of measuring transducers; make a choice of normalizing converters, measuring switches; calculate the variances of the error of the functional blocks of the measuring system.

own: the methodology for calculating the parameters of IMS according to the criterion of the minimum total error that fit into the confidence interval, the methodology for performing diagnostic procedures using technical diagnostics systems when troubleshooting complex systems according to the criterion of minimum labor costs.

Clinical laboratory and environmental analytical technology
CODE - ROB241
CREDIT - 4
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

The main goal of the course: the formation and improvement of professional competencies of a specialist in medical diagnostic profile to ensure the laboratory component of the process of providing specialized, high-tech, medical engineering, technical assistance, metrological control of devices and equipment in laboratories.

SHORT DESCRIPTION OF THE COURSE

Biotechnical systems for laboratory analysis. The structure and functions of laboratory services in medicine and ecology. Methods for optimizing technological schemes of laboratory experiments. Informational approach to substance analysis. Devices and complexes for laboratory analysis based on physical and physicochemical methods for studying biosubstrates. Methods on the phenomena of nuclear magnetic resonances. Electron microscopy. Hardware methods of immunological studies; analytical equipment for laboratories of sanitary-epidemiological stations. Methods for designing analytical and environmental engineering. Measuring transducers for laboratory technology. Means for displaying results. Analytical technique design. Information support for laboratory medical research. The structure of information flows in a clinical laboratory. Survey databases and knowledge bases. Information flow optimization methods. Issues of standardization and metrology in analytical instrumentation. Standards and measurement standards, calibration charts and stands.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Master's student should know:

in External Expansion quality control of laboratory tests: the order of implementation, assessment of results. The main issues of planning, management, material and technical equipment of the laboratory. The principles of selection and calculation of the need for laboratory equipment and reagents. Calculation of the cost of laboratory research. Rates of time and consumption rates for laboratory tests. Principles for evaluating laboratory performance. Financial support of the laboratory.

should be able to:

use modern analytical technologies and equipment; the use of information technologies to solve problems of clinical medicine and scientific research.

Computer technologies in biomedical research
CODE - ROB245
CREDIT - 5
PREREQUISIT - Information and Communication Technologies

PURPOSE AND OBJECTIVES OF THE COURSE

The main objective of the course: the shape of Rowan needed for hardware and software for the medical - biological research, create algorithms of biosignals, presentation of the methods and technologies of processing of physical information obtained from a biological object, a computer system as a tool to work with information on the automation methods creation and software maintenance.

Discipline objectives: to establish the role of technical means and computer technology in the receipt, storage, transmission, processing of data necessary for the implementation of medical technologies, biomedical research; to study various methods of constructing information-structural models of biomedical research; to familiarize with the concept and implementation of databases, study decision support systems and expert systems as the most important tool in the work of a doctor, accumulating the experience of other specialists; to acquaint with the methods of algorithmic support, automate the creation and maintenance of software ann a ture for biomedical research.

SHORT DESCRIPTION OF THE COURSE

Research automation. Development of a medical consultative and diagnostic system using VBA. Examples of practical implementation of computer technology in biomedical practice. Development of a graphical interface in the MATLAB package. Computer technology in receiving, storing, transmitting, processing data necessary for the implementation of medical technologies. Various methods for constructing information and structural models of biomedical research. The concept and implementation of databases as the main information structure for storing and using data about a biological object. Problems related to data security, protection from unauthorized access. Decision support systems and expert systems as the most important tool in the work of a doctor, accumulating the experience of other specialists; M enu s algorithmic support, automation of I create and maintain software equipment for biomedical research.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

As a result of mastering the discipline, the master student must:

know:

- features of biological objects;
- the main directions in the practice of using computer technologies in modern medicine; terminology that is used in the measurement of physiological indicators by medical devices and apparatus, converters of physiological indicators into electrical signals, amplification and processing units of signals and basic display facilities;
- structural diagrams and main characteristics of medical devices for various purposes; fundamentals of algorithmization and programming;

- methods and means of using computer technologies both in the traditionally well-known fields of medical diagnostics and therapy, such as cardiography, encephalography, electromyography, medical analytical equipment, electrocardiostimulation and electrical stimulation of neuromuscular structures, as well as in relatively new areas of diagnostics and therapy associated with the use of complex medical technology such as tomography, ultrasound echoscanography, laser and optoelectronic endoscopy and modern analytical technology.

be able to:

- use the results of mastering the fundamental and applied disciplines of the master's program to select the optimal methods and means of conducting research using computer technology;
- draw up, submit and report the results of the work performed;
- to analyze the state of scientific and technical problems by selecting, studying and analyzing literary and patent sources in the field of biotechnical systems and technologies.

own:

- the skills of choosing the best methods and techniques for studying the properties of biological objects and formulating research programs;
- skills in the use of computer technology for biomedical research; practical skills in working with applied software packages for research in biomedical practice;
- skills in the development of information consulting and diagnostic systems.

Intelligent control technologies
CODE - ROB 225
CREDIT - 5
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

Studying the theoretical foundations of artificial intelligence, neural network technologies of intelligent systems, technologies for constructing control systems with fuzzy logic, rules of fuzzy logic, technologies for creating a knowledge base, expert control systems, adaptive control systems, problems of the theory and technology of intelligent systems, etc. This knowledge is necessary for further understanding of the principles of building biomedical systems.

SHORT DESCRIPTION OF THE COURSE

This course examines the theoretical foundations of artificial intelligence, neural network technologies of intelligent systems, technologies for constructing control systems with fuzzy logic, rules of fuzzy logic, technologies for creating rules for a knowledge base, expert control systems, adaptive control systems, technologies of multilevel information processing, optimal control problems, of Adachi theory and technology of intelligent systems and others.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

As a result of studying the discipline, the undergraduate must know:

- neural network technologies of intelligent systems, technologies for constructing systems with fuzzy logic, with a knowledge base, expert systems, adaptive systems, etc.;

be able to:

- to develop control systems with fuzzy logic, using neural networks, expert control systems, adaptive control systems, etc.;

own:

- skills in the development of intelligent control systems, including expert control systems, systems with fuzzy logic, adaptive systems, etc.

Microprocessor control and monitoring systems
CODE - ROB230
CREDIT - 5
PREREQUISIT - Integrated and microprocessor circuitry

PURPOSE AND OBJECTIVES OF THE COURSE
The aim of the course is to teach the basic principles of biotechnical system management. Acquisition of skills in controlling various sensors and solving the problem of microprocessor control.
Objectives of the course - Studying the basic principles of building information-measuring systems and control systems based on open platforms of microcontrollers, developing skills in developing hardware and software for automated control systems and control of a biotechnical system.
SHORT DESCRIPTION OF THE COURSE
The discipline " Microcontroller control systems " is a fundamental discipline for the study of microcontroller control of a biotechnical system.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline, the master student must:
know: At the end of this course, undergraduates must have the basics of programming microcontrollers, algorithms for microprocessor devices, the use of libraries, and the creation of their own libraries.
be able to: use the knowledge gained in solving practical problems in the design and operation of microcontroller controls. Be able to program microcontrollers, be able to connect various sensors and devices, and be able to calculate control algorithms for a biotechnical system.

Detection and filtering of biomedical signals
CODE - ROB244
CREDIT - 5
PREQUISIT - Fundamentals of Information and Measurement Technologies

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of the discipline is to study methods and algorithms for processing biomedical signals and data used in the creation of biotechnical and medical systems. Studying the discipline provides undergraduates with the basics of engineering and theoretical skills in the processing and analysis of biomedical information.
SHORT DESCRIPTION OF THE COURSE
Computer technologies for the analysis of simultaneous and paired correlated processes. Application of computer technology to filter and remove artifacts. Computer technologies for event detection (identification of discrete epochs of a biomedical signal). Computer technologies for analyzing waveforms and their complexity. Computer technologies for studying the characteristics of signals and systems in the frequency domain. Computer technologies for modeling processes and systems that generate biomedical signals. Computer technologies for analysis of non-stationary signals. Computer technologies for image classification and diagnostic decision making.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline, the master student must:
know:
- features of biological objects; methods of processing and analysis of medical and biological data; the main directions in the practice of using computer technologies in modern medicine;
- principles of computer diagnostics and therapy based on the analysis of biomedical signals and data; difficulties encountered in the removal and analysis of biomedical signals;
- advantages of using computer technologies for processing and analyzing biomedical signals and data;
- the basics of algorithmization and programming.
be able to:
- to adequately define goals and set tasks for the analysis of medical and biological data using computer technology;
- to carry out the choice of methods and means of processing and analysis of biomedical signals and data; select literature in Russian and foreign languages;
- make adequate decisions based on the results of computer analysis of biomedical data.
own:
- skills in the use of computer technology for processing and analysis of biomedical signals and data;

- practical skills in working with packages of applied programs for processing and analysis of biomedical information;
- skills in preparing technical specifications for the performance of work in the field of biotechnical systems and technologies.

Computer-aided design of medical equipment
CODE - ROB252
CREDIT - 4
PREREQUISIT - Integrated and microprocessor circuitry

PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to study the methodology of modern methods of designing medical technology. The objective is to organize, consolidate and deepen the theoretical knowledge and skills, the use of this knowledge in the technical design stage, the development of skills for independent work, carrying out theoretical and experimental research with the assistance of means and methods of micro process of molecular techniques.

SHORT DESCRIPTION OF THE COURSE

With Creating tools of diagnosis, treatment, rehabilitation and prevention of human diseases, intended for use in diagnostic and therapeutic medical centers, hospitals, clinics, polyclinics. P azrabotka automation equipment Medical and biological systems. P azrabotka software to solve practical problems of medicine, including on those issues listed above. P azrabotka structural and functional circuits of radio systems, and systems and concepts device using computer aided design tools. M Modeling the objects and processes for their analysis and optimization of parameters using available studies means including standard software packages.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

As a result of studying the discipline, the undergraduate must:

know:

developed means for metrological support of diagnostics and repair of biomedical equipment; design and production of equipment;

be able to:

take part in the adjustment, testing and commissioning of prototypes of devices and systems; build mathematical models of objects and processes, choose methods of their research and develop an algorithm for its implementation; analyze the state of a scientific and technical problem based on the selection and study of literary and patent sources;

own:

programs for the implementation of experimental research, including the choice of technical means and processing of results.

Verification, safety and reliability of medical technology
CODE - ROB248
CREDIT - 4
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE
Formation of knowledge about the operation and maintenance of medical devices, biotechnical systems and devices in the conditions of biomedical organizations, training in the principles of ensuring safe living conditions in the development, production and operation of biomedical devices, complexes and systems, training in the use of methods for organizing routine maintenance, verification and certification of medical equipment.
SHORT DESCRIPTION OF THE COURSE
Modern approach, problems and trends in ensuring electrical safety in medical institutions (MU). The effect of electric current on the human body. Protection against touching live parts. Leakage current in medical devices. Classification of medical equipment (MT) by electrical safety. Electrical installation rules. Electrical equipment of medical institutions. MU emergency power supply system. Protection of an electrically vulnerable patient. Main characteristics and parameters of reliability. Methods for increasing the reliability of MT. General questions of verification of measuring instruments for medical purposes Method of verification of electrocardiographs. Testing MT. MT service. Maintenance MT. Troubleshooting and repair of MT.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline, the master student must
know:
- basic requirements and rules for ensuring the safety and reliable operation of technical equipment in medical institutions of various profiles;
- fundamentals of the organization of maintenance, service and repair of MT;
- normative documentation in the field of safety, reliability, maintenance, service and repair of MT;
be able to:
- to ensure the safe and reliable operation of MT in MU;
- carry out verification of measuring instruments for medical purposes;
- to carry out maintenance and service of MT.
own:
- MT repair skills;
- the skills to organize safe and reliable operation of technical equipment in the MU.
- skills in designing non-standard equipment and fixtures.

Biotechnical systems s from Regents of I
CODE - ROB 257
CREDIT - 5
PREREQUISIT - physics, chemistry, mathematics

PURPOSE AND OBJECTIVES OF THE COURSE
Objectives of mastering the discipline: the formation of knowledge, abilities, skills and competencies in management systems for biotechnical systems; the formation of a belief about the need to develop automatic biotechnical systems to ensure human life; use of information tools necessary for future professional activities.
SHORT DESCRIPTION OF THE COURSE
Course content: Basic concepts of the theory of automatic control. Classification of automatic control systems. Linear automatic control systems. Non-linear automatic control systems. Optimization of the control strategy. Observability and manageability. Quality criteria. Passive and active control in living systems. Biofeedback and biofeedback.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline " Management in biotechnical and medical systems ", students must:
know:
- tasks of a controlled biomedical experiment, solved with the use of modern technical means; principles, technical means and methods of organizing a medical and biological experiment; methods of organizing the collection, processing of biomedical information, control and management of the experiment; hardware and software for automation systems for biomedical research in physiological, biophysical and neurophysiological experiments;
be able to:
- to use the acquired knowledge when organizing a medical experiment using technical means; effectively organize the processing and presentation of experimental data;
own:
- the skills of using standard devices and programs for automating research in a controlled medical and biological experiment.

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's student, the ability to independently conduct scientific research, testing 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.
Master's thesis is the result of the research / experimental research work of the master's student, carried out during the entire period of study of the master's student.
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:
- the work should conduct research or solve urgent problems in the field of biomedical engineering;
- 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
«7М07106 Биомедицинская инженерия»

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.

Продолжительность освоения образовательной программы магистратуры составляет 2 года.

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.

Директор ТОО «MedrRemZavod Holding» **Джумагулов А.К.**