

Satbayev University

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

CURRICULUM PROGRAM

**“BIOMEDICAL ENGINEERING”
Master of engineering and technology
of the educational program “7M07133-Biomedical Engineering”
Master of engineering and technology**

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

1st edition




in accordance with the State Educational Standard of Higher Education 2018

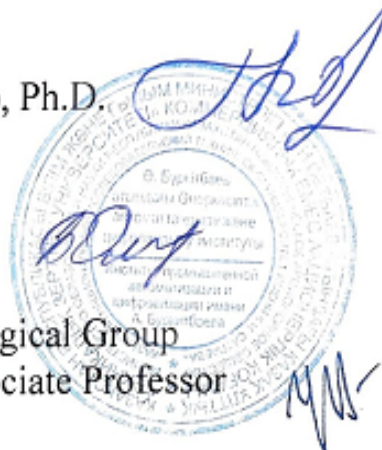
Almaty 2020

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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 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 Objectives of the educational program

The objectives of the educational program (EP) "Biomedical Engineering" are: meeting 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, allowing all graduates to continue their education in the field of new science-intensive 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 in conducting new biomedical research using technical and computer tools, creating structures for problem-oriented systems, creating and switching to new software tools for processing diagnostic information in real time, complexes for collecting, analysis, processing and storage of medical and biological information; databases and knowledge, forecasting and decision-making systems, and biological experiment using instrumental and hardware-software tools.

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;
- design and technological;

Master in the direction of training "Biomedical Engineering" should be prepared for solving professional problems in accordance with the profile of the master's program and 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, the choice of methods and means for solving the formulated problems, preparation of tasks for performers;

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

- development of physical, phenomenological, mathematical and information-structural models of biological objects and processes, assessment of the degree of their

adequacy, determination of a set of independent indicators that characterize the biological object and process under study;

- organization and participation in the conduct of 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 biomedical and environmental research;

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

design and engineering activities:

- analysis of the state of a scientific and technical problem through the selection, study and analysis of literary and patent sources in the field of biotechnical systems and technologies;

- definition of the goal, formulation of design tasks, preparation of technical specifications for the implementation of design work 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 management activities:

- development of organizational and technical documentation (work schedules, instructions, plans and 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 biomedical systems;

design and technological activities:

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

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

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

- ensuring the manufacturability of products and their manufacturing processes, assessing the economic efficiency of technological processes for the manufacture of biomedical and environmental technology, 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, commissioning, adjustment, assessment of the state of equipment and adjustment of biomedical systems for various purposes, including both technical means and software control systems;

- participation in the interface of hardware and software systems with technical objects as part of biomedical 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 biomedical 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 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 a graduate are:

- biomedical engineering, 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 research, signal analysis, analytical relationships for optimal processing of multidimensional signals, mathematical foundations of pattern recognition, processing, identification and synthesis of speech signals, problem-oriented software systems in medical and biological practice, types of medical and biological research, typical problem structures -oriented system, 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, software for systems of medical and 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 profile 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 method of organizing and conducting the educational process is carried out by the university and the scientific organization independently on the basis of 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 Program 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 "Biomedical Engineering" within the framework of specialties 6M071600 - Instrumentation, 6M073200 - Standardization and certification, 6M072200 - Polygraphy is implemented in accordance with the credit technology of education and is carried out in the state and Russian languages.

The educational program "Biomedical Engineering" contains a complete list of academic disciplines, grouped into cycles: basic (DB) and major disciplines (PD), indicating the labor intensity of each academic discipline in academic credits and hours established by the State Compulsory Standards of Higher and Postgraduate Education, approved by the order of the Ministry of Education and Science of the Republic of Kazakhstan No. 604 dated October 31, 2018.

The DB 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 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 dissertation.

Objectives of the educational program:

- development of students through research activities, critical thinking, development of professionally oriented skills and abilities;

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- use of highly professional experience in 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 pursuit of knowledge, academic integration and intellectual motivation;
- carrying out research work, conducting educational activities based on the best world practice, and developing its brand of training specialists;
- development of cooperation "university-industry" to meet the labor market requirements 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 on the basis 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 the admission of citizens to the magistracy is established in accordance with the "Standard rules for admission to training in educational institutions that implement educational programs of postgraduate education."

The formation of a contingent of undergraduates 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 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:

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- the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities;
- the ability to independently formulate research goals, establish a sequence for solving professional problems;
- the ability to apply in practice the 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 scientific and technical 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 activity that the master's program is focused on:

research activities:

- the ability to draw up mathematical models, the mathematical foundations of pattern recognition, processing, identification and synthesis of speech signals, typical structures of a problem-oriented system, software for processing diagnostic information in real time;
- to carry out optimal processing of multidimensional signals, types of medical and biological research;
- the ability to develop and apply new science-intensive biomedical engineering for diagnostics, therapy and surgery, operation and maintenance of medical systems, complexes and apparatus complexes for collecting, analyzing, processing and storing biomedical information; databases and knowledge, forecasting and decision-making systems, software for systems of medical and technical support of medical institutions;
- the ability to develop methods for conducting experiments and conduct experiments on existing models and samples of biomedical 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 analyze scientific and technical information, generalize domestic and foreign experience in the field of biomedical systems, conduct a patent search;

- 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 biomedical systems, their subsystems and individual modules;

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

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

- the willingness to develop a methodology for conducting experimental research and testing of biomedical systems, the ability to participate in such tests and the processing of 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 and estimates) according to approved forms;

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

design and technological activities:

- the ability to develop technical specifications for the design of technological processes and schemes for the production of biomedical and environmental technology using automated systems for technological preparation of production;

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

- to develop technological documentation for the designed devices, devices, systems and complexes for biotechnical, medical and environmental purposes;

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

- the ability to provide authoring support for devices, devices, systems and complexes under development at the design and production stages;

4 Working curriculum of the educational program

4.1. Study period 1.0 year

MODULAR CURRICULUM

Education program 7M07133 - Biomedical engineering

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 (6 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 (24 credits)										
Elective disciplines										
BD 1.2.4	ROB255	Biotechnical systems	1	4	1	0	1	2	Exam	RaETA
BD 1.2.4.1	ROB254	Information devices of robots	1	4	1	0	1	2	Exam	RaETA
PS 1.3.1	ROB246	Quality management of medical equipment service	1	6	2	0	1	3	Exam	RaETA
PS 1.3.1.1	ROB236	Multi-agent robotic systems	1	6	2	0	1	3	Exam	RaETA
PS 1.3.2	ROB243	Biomedical measuring information systems	1	6	2	0	1	3	Exam	RaETA
PS 1.3.2.1	ROB251	Organization and planning of production of mechatronic equipment	1	6	2	0	1	3	Exam	RaETA
PS 1.3.3	ROB247	Organization and planning of the production of medical equipment	1	6	2	0	1	3	Exam	RaETA
PS 1.3.3.1	ROB202	Diagnostics and reliability of technical systems and devices	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 studied field of biomedical engineering, based on the advanced knowledge of this field of biomedical engineering in the development and / or application of ideas in the context of 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 considerations;

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 biomedical engineering.

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

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.

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.

Biotechnical systems
 CODE - ROB255
 CREDIT - 4
 PREREQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

The main goal of the course is the formation of theoretical and practical knowledge about the modern 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" 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 undergraduate 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 parameters of impacts
- as part of biotechnical systems, the main modern trends in the development of biotechnological 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 problems;
- to apply systemic principles on 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.

Quality management of medical equipment service

CODE - ROB246

CREDIT - 5

PREREQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

To study the model for assessing the quality of the process for the repair and maintenance of medical equipment. Highlight the signs of quality assessment at enterprises for the repair and maintenance of medical equipment. Studying the quality management system of processes in industrial, commercial and educational spheres ":

Objectives: Principles of product quality management in production. Total quality management. Operational quality management in ISO international standards is defined by the term quality management - these are methods and activities of an operational nature used to fulfill quality requirements. Long-term management of quality and the organization as a whole in the international ISO standards is defined by the term overall quality management.

SHORT DESCRIPTION OF THE COURSE

The product quality management system is a set of management bodies and management objects, activities, methods and means aimed at establishing, ensuring and maintaining a high level of product quality.

The development of a quality system basically consists in first, taking into account the recommendations of ISO 9000 standards, to determine the composition of the necessary functions of the quality system, and then the structures that perform or will perform these functions. After that, new regulatory documents are developed, revised or used to perform all functions.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

know: rules, order of maintenance. Nomenclature and procedure for registration of technical documentation. The quality management system of enterprises for the production and maintenance of medical equipment.

be able to: conclude and execute contracts for the maintenance of medical equipment

Organization and planning of production of medical equipment

CODE - ROB247

CREDIT - 5

PREREQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of the discipline is to study, in interrelation, the most important issues and factors of the science of organizing production, ensuring the effective functioning of an industrial enterprise - the primary link of material production.

Discipline objectives:

- master the basics of organizing production;
- to comprehensively study the organization of production processes;
- to study the basics of organizing production infrastructure and auxiliary shops that provide services to the enterprise;
- to study the organization, planning and management of the preparation and development of new technology at the enterprise.

SHORT DESCRIPTION OF THE COURSE

General characteristics of the production process and its structure. Principles of organization of production processes. Indicators of the organization of the production process. The concept of the organizational type of production and its defining characteristics. Classification and technical and economic characteristics of the types of production. Technological preparation of production, tasks, content and procedure for its implementation. Selection and optimization of technological solutions. Organizational and economic training, its content, tasks and procedure. Determination of the critical program of technological processes by graphic and graphic-analytical methods. Organization of research and development work. Technical training planning. Network planning method Plotting sequential, parallel and serial-parallel methods of transition to new products.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

know: master the basics of organizing production; comprehensively study the organization of production processes; to study the basics of organizing production infrastructure and auxiliary workshops that provide services to the enterprise; study the organization, planning and management of the preparation and development of new technology at the enterprise.

Computer technologies in biomedical research

CODE - ROB245

CREDIT - 5

PREREQUISIT - Information and Communication Technologies

PURPOSE AND OBJECTIVES OF THE COURSE

The main goal of the course: to form the necessary hardware and software for biomedical research, to create algorithms for processing biosignals, ideas about methods and technologies for processing physical information received from a biological object, about computer systems as a tool for working with information, about methods of automating the creation and software maintenance.

Discipline objectives: to establish the role of technical means and computer technology in receiving, storing, transferring, processing data necessary for the implementation of medical technologies, biomedical research; to study various methods of constructing information and structural models of biomedical research; to acquaint with the concept and implementation of databases, to 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, automation of creation and maintenance of software for medical and biological 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; Methods of algorithmic support, automation of creation and maintenance of software for medical and biological research.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

As a result of mastering the discipline, the undergraduate 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 signal processing units and main display facilities;

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- structural diagrams and basic 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:

- 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.

Registration and defense of a master's thesis

CODE - ECA501

CREDIT - 12

The purpose of the master's dissertation 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:

- the work should conduct research or solve topical 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

- 1 Scope and content of the program
- 2 Requirements for applicants
- 3 Requirements for completing studies and obtaining a diploma
- 4 Working curriculum of the educational program
- 5 Descriptors of the level and amount of knowledge, abilities, skills and competencies
- 6 Competencies on completion of training
- 7 ECTS Diploma Supplement
- 8 Brief description of courses

РЕЦЕНЗИЯ

на образовательную программу
«7M07133 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 1 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.

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