

**MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN  
KARAGANDY UNIVERSITY OF THE NAME OF ACADEMICIAN E.A. BUKETOV**

«APPROVED»

By decision of the Board  
NJSC «Karaganda University  
named after academician E.A. Buketova»

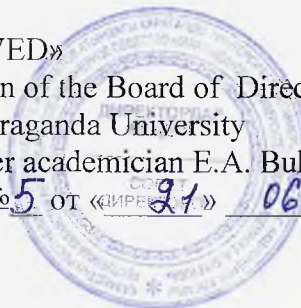
Protocol No. 5 of «20» 05 2024 г.  
Prof. Dulatbekov N.O.



«APPROVED»

By decision of the Board of Directors  
NJSC «Karaganda University  
named after academician E.A. Buketova»

Protocol No. 5 of «21» 06 2024 г.



**EDUCATIONAL PROGRAM**

**Level: Master**

**Degree: master of science in education program 7M07105 – Electronics of communication systems and telecommunication technologies**

Karaganda,  
2024

## APPROVAL SHEET

### EDUCATIONAL PROGRAM «7M07105 – Electronics of communication systems and telecommunication technologies»

«AGREED»

Director of the branch of «Kazteleradio» JSC  
Karaganda ODRT



\_\_\_\_\_ A.K. Zhumabaev

\_\_\_\_\_ 2024 y.

«AGREED»

Director of the Representative Office  
JSC «National Information  
Technologies» in the Karaganda region



\_\_\_\_\_ T.A. Kulbaev

\_\_\_\_\_ 2024 y

**The educational program «7M07105 – Electronics of communication systems and telecommunication technologies» was developed on the basis of:**

- Law of the Republic of Kazakhstan dated July 27, 2007 No. 319-III "On Education";
- Law of the Republic of Kazakhstan dated July 11, 1997 No. 151-I. "About languages in the Republic of Kazakhstan";
- State Mandatory Standards of Higher and Postgraduate Education No. 2 dated July 20, 2022.
- The National Qualifications Framework dated March 16, 2016 by the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations.
- Order of the Ministry of Education and Science of the Republic of Kazakhstan "On approval of the Rules for the organization of the educational process in credit technology" dated April 20, 2011 No. 152 (with amendments and additions dated 07/25/2023 No. 334).
- Classifier of areas of training with higher and postgraduate education dated October 13, 2018 No. 569.

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### Passport of the educational program

1. **Code and name of the educational program:** "7M07105 – Electronics of communication systems and telecommunication technologies"
  2. **Code and classification of the field of education, training areas:** 7M07 Engineering, manufacturing and construction industries, 7M071 Engineering and Engineering work
  3. **Group of educational programs:** M099- Energy and electrical engineering
  4. **Volume of credits:** 120 ECTS.
  5. **Form of study:** full-time
  6. **Language of instruction:** Kazakh, Russian
  7. **Degree awarded** Master of Technical Sciences in the educational program 7M07105- Electronics of communication systems and telecommunication technologies
  8. **Type of EP:** the current EP is an educational program, according to which training is carried out at the university.
  9. **ISCE level** (International Standard Classification of Education) – level 7.
  10. **The level of the NQF** (National Qualifications Framework) - level 7.
  11. **IQF level** (Industry Qualifications Framework) – level 7.
  12. **Distinctive features of EP:** - no
  13. **Number of the appendix to the license for the direction of personnel training:** №016 KZ 83LAA00018495 dated 05/30/2019.
  14. **The name of the accreditation body and the validity period of the accreditation of the EP:** Certificate of international accreditation of educational programs of NAOKO SA-A No. 0174/2 dated December 23, 2019-December 20, 2024.
  15. **The purpose of the EP:** Training of highly qualified and competitive specialists for the development of the economy, industry and culture of the Republic of Kazakhstan, providing conditions for obtaining a full-fledged education, professional competence in the field of electronics of communication systems and telecommunication technologies.
    - a) **Qualification characteristics of the graduate:** the graduate of the master's degree is awarded the degree of Master of Technical Sciences in the educational program "7M07104-Heat Power Engineering".
    - b) **List of graduate positions:** The graduate the graduate is awarded the degree "Master of science in education program 7M07105 - Electronics of communication systems electronics and telecommunication technologies".
    - c) **The scope and objects of professional activity of graduates** methods and techniques of human activity aimed at creating conditions for the exchange of information at a distance, the transformation of information by electronic means.

The objects of professional activity of masters in the educational program are:

      - enterprises, complexes, institutions, educational organizations and other objects on which technological systems are operated, technical means providing any transmission, radiation and reception of signs, signals, written text, images, sounds, wired, radio, optical, as well as the conversion of information by electronic means or the following other systems:
- communication networks and switching systems;
  - multichannel telecommunication systems, including optical band systems;
  - radio communication systems and devices, including satellite, radio relay and mobile communication systems;
  - systems and devices of sound and television broadcasting, electroacoustics and speech Informatics, multimedia equipment;
  - data transmission systems and devices;
  - electronic, including computer systems of management of objects, transformation of information;
  - means of information security in telecommunication systems;
  - means of metrological support of telecommunication systems and networks;
  - management and marketing in telecommunications;
  - management of operational and service maintenance of telecommunication devices.

**d) Types of professional activities** for which graduates who have mastered the educational program in the direction of training "7M07105 – Electronics of communication systems and telecommunication technologies " are preparing

- industrial-technological; service and operational; organizational and managerial; installation and adjustment; settlement and design; experimental research. telecommunications'; Radiocommunications; broadcastings; radar and navigation; radio control, transmitting and receiving radio centers, television centers; mobile communication; devices of radio engineering; electronic and computer; controlled by microcontrollers and microcomputers; carries out maintenance and quality control of functioning, improvement, modernization and improvement of technical and economic indicators of switching systems, multichannel transmission systems and communication networks, optical communication, systems and means of mobile radio communication, television systems, radio navigation and radar systems, electronic systems and products of electronic equipment, radio systems.

#### **16. Functions of the graduate's professional activity**

Under the guidance of a leading (senior) engineer, a responsible executor or the head of the topic (task), a master's student performs: participates in learning activities:

- under the guidance of a mentor, determines the content and selects the forms, methods and means of training sessions (seminars, practical, laboratory) in accordance with the objectives of the course;
- plans and organizes independent work of students under the guidance of a mentor;
- under the guidance of a mentor, develops the EMC of the disciplines to be read;
- author's courses under the guidance of a mentor in accordance with the mission and goals of the organization of education.

#### **17. Formulation of learning outcomes based on competencies**

Type of competencies	Learning result code	Learning result (according to Bloom's taxonomy)
1. Behavioral skills and personal qualities: ((Soft skills))	LR 10	To analyze the modern paradigm of higher education and its content; to identify the features of modern didactic concepts in higher education; to demonstrate knowledge in the field of modern educational technologies; to choose the optimal and most effective modern educational technologies and forms of organization of the educational process in higher education.
	LR 1	Able to use in cognitive and professional activities basic knowledge in the areas of commercialization of innovations and assessment of the commercial potential of innovations. Possesses basic theoretical knowledge about the organization of innovation activities, basic theoretical knowledge about the use of information technology in innovation risk management.
	LR 12	Able to use knowledge of traditional and modern problems of the history and philosophy of science in research activities in the professional direction. He owns the basic concepts and categories of the philosophy of science for setting and solving urgent problems in his own field of scientific research.
	LR 14	Has the skills to use the knowledge, positions and methods of the psychological science of management obtained in the process of mastering the psychology of management in professional activity. Knows the basic psychological methods and techniques of conflict management in the organization. Demonstrates knowledge in the field of modern educational technologies and selects the optimal and most effective forms of organization of the educational process in higher education.
	LR 15	Able to apply methodological and methodological knowledge in conducting scientific research, pedagogical and educational work, in writing scientific articles, abstracts, for speaking at conferences, symposiums, round tables, discussions and disputes.
2. Digital competencies: (Digital skills):	LR 13	Fluent in foreign languages at a level that allows you to effectively interact in a professional and scientific environment; possesses skills that allow to carry out further education and development of a linguistic personality with a high degree of independence and self-regulation.

	LR 2	Uses the acquired knowledge of modern areas of science in solving professional problems. Knows modern information technologies, methods of processing scientific information; software development technologies; principles of building database systems, data presentation models; basic data operations; basic methods and algorithms of relation theory, combinatorics related to modeling and optimization of systems of various nature.
	LR 11	Knows modern trends in electronics of communication systems and telecommunication technologies for the successful application of knowledge in solving practical problems. He has an understanding of the installation and operation of digital and cable data transmission systems, the operation of multichannel systems and the skills of working to ensure the information security of networks, measuring equipment performance.
	LR 3	Possesses the skills to freely navigate in fundamental and applied issues of the field of physics, in which specialization is carried out within the framework of the educational program of the magistracy. Knows foreign terminology in radio electronics. Able to demonstrate foreign language competence when working in an interdisciplinary team. Applies knowledge of foreign terminology in radio electronics at a professional level when reading foreign literature.
	LR 4	Knows the basics of building information and communication systems and networks, software data encryption technology to protect important information. He is able to process the results obtained, analyzes and comprehends them taking into account the available data. He has the skills of independent research and pedagogical activity, methods of designing, organizing, implementing and evaluating the results of scientific research in the field of primary education methodology using modern scientific methods.
3. Professional competencies: (Hard-skills)	LR 9	Knows the physical essence of the influence of surface states on the characteristics of micro- and nanoelectronic devices; possibilities of beam technologies; the quantum nature of the size limitation effect in the creation of micro- and nanoelectronic devices; technological aspects of high-temperature semiconductor electronics, is able to assess the state of various areas of development of electronics; see the future in the development of various areas of electronics.
	LR 5	Knows how to use methods of protection against computer viruses, protection against information leakage through technical channels. Formulates the requirements for the designed network, taking into account the analysis of threats and unauthorized influences; draw up functional diagrams of the designed systems and telecommunications networks. Analysis of the main characteristics and capabilities of telecommunication systems for the transmission of operational and special messages.
	LR 8	He has the ability to read structural and functional diagrams of elements and devices of mobile and satellite communication systems built on the basis of modern technologies; skills in designing networks of mobile and satellite communication systems of various standards and calculating their basic parameters in standard ones, optimization of information transmission systems and communication networks.
	LR 7	Has the skills of designing electronic digital devices, including those based on MP and MK; software development of MP and MK; setting up and debugging digital information, searching for information about the properties of integrated circuits; information about the technical parameters of semiconductor devices used in the design of power plants; skills of applying the information received.
	LR 6	He knows the basics of designing the main components and blocks of radio-electronic means; the basics of implementing electromagnetic compatibility of radio-electronic equipment components. Has the skills to develop and execute design and working technical documentation based on computer-aided design systems; control of compliance of developed projects and technical documentation with standards, specifications and other regulatory documents. Applies modern tools in the development of design documentation.

### 18. Determination of modules of disciplines in accordance with the results of training

Learning result code	Name of the module	Name of disciplines	Volume (ECTS)
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LR 12	Philosophical and historical aspects of social and humanitarian knowledge	History and philosophy of science	4
LR 10		Higher School Pedagogy	4
LR 14		Psychology of management	4
LR 13, LR 3	Professional Languages	Foreign language (professional)	4
LR 13, LR 3		Professional foreign terminology in radio electronics	5
LR 15, LR 12, LR 3		Theory and methodology of preparation of a scientific publication in a foreign language	
LR 2	The innovation process the organization of scientific research	Advanced technologies in micro and nanoelectronics	5
LR 15, LR 1		Commercialization of the results of scientific and technical activities	
LR 8		Functional electronics	5
LR 15, LR 2, LR 1		Innovation in natural-scientific, technical and technological research	
LR 6	Fundamental principles of electronics and telecommunications	Scientific and technical problems of radio engineering, electronics and telecommunications	4
LR 4		Theory of construction of infocommunication networks and systems	4
LR 6		Theory of electromagnetic compatibility of radio-electronic means and systems	4
LR 8	Current state of electronics and telecommunications	Organizational and technical methods of protection of communication systems	4
LR 5, LR 4		Methods of designing secure communication systems	
LR 8		Satellite and mobile communication systems	4
LR 5		Data transmission systems and networks	
LR 9		Microelectronics and basics of nanoelectronics	4
LR 7		Digital electronics and microprocessors	
LR 8		Design of radio communication elements and devices	5
LR 6, LR 8		The circuitry of the communication devices	
LR 7		Semiconductor electronics	4
LR 9		Molecular electronics	





[illegible]

[illegible]



	cess in higher education.		
LR 1	Able to use in cognitive and professional activities basic knowledge in the areas of commercialization of innovations and assessment of the commercial potential of innovations. Possesses basic theoretical knowledge about the organization of innovation activities, basic theoretical knowledge about the use of information technology in innovation risk management.	Interactive lecture, experimental works intended for scientific research	Project preparation
LR 12	Able to use knowledge of traditional and modern problems of the history and philosophy of science in research activities in the professional direction. He owns the basic concepts and categories of the philosophy of science for setting and solving urgent problems in his own field of scientific research.	Interactive lecture, experimental works intended for scientific research	Written work
LR 14	Has the skills to use the knowledge, positions and methods of the psychological science of management obtained in the process of mastering the psychology of management in professional activity. Knows the basic psychological methods and techniques of conflict management in the organization. Demonstrates knowledge in the field of modern educational technologies and selects the optimal and most effective forms of organization of the educational process in higher education.	Round table	Portfolio
LR 15	Able to apply methodological and methodological knowledge in conducting scientific research, pedagogical and educational work, in writing scientific articles, abstracts, for speaking at conferences, symposiums, round tables, discussions and disputes.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Written work
LR 13	Fluent in foreign languages at a level that allows you to effectively interact in a professional and scientific environment; possesses skills that allow to carry out further education and development of a linguistic personality with a high degree of independence and self-regulation.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Testing
LR 2	Uses the acquired knowledge of modern areas of science in solving professional problems. Knows modern information technologies, methods of processing scientific information; software development technologies; principles of building database systems, data presentation models; basic data operations; basic methods and algorithms of relation theory, combinatorics related to modeling and optimization of systems of various nature.	Analysis of conducted experiments, analysis of scientific literature, presentation of reports	Report, presentation
LR 11	Knows modern trends in electronics of communication systems and telecommunication technologies for the successful application of knowledge in solving practical problems. He has an understanding of the installation and operation of digital and cable data transmission systems, the operation of multichannel systems and the skills of working to ensure the information security of networks, measuring equipment performance.	Monitoring of the implementation by doctoral students of an individual research plan (publication of scientific results, preparation of a dissertation).	Report, presentation
LR 3	Possesses the skills to freely navigate in fundamental and applied issues of the field of physics, in which specialization is carried out within the framework of the educational program of the magistracy. Knows foreign terminology in radio electronics. Able to demonstrate foreign language competence when working in an interdisciplinary team. Applies knowledge of foreign terminology in radio electronics at a professional level when reading foreign literature.	Interactive lecture, experimental works intended for scientific research	Project preparation
LR 4	Knows the basics of building information and communication systems and networks, software data encryption technology to protect important information. He is able to process the results obtained, analyzes and comprehends them taking into account the available data. He has the skills of independent research and pedagogical activity, methods of designing, organizing, implementing and evaluating the results of scientific research in the field of primary education methodology using modern scientific methods.	Interactive lecture, experimental works intended for scientific research	Written work
LR 9	Knows the physical essence of the influence of surface states on the characteristics of micro- and nanoelectronic devices; possibilities of beam technologies; the quantum nature of the size limitation effect in the creation of micro- and nanoelectronic devices; technological aspects of high-temperature semiconductor electronics, is able to assess the state of various areas of development of electronics; see the future in the development of various areas of electronics.	Round table	Portfolio
LR 5	Knows how to use methods of protection against computer viruses, protection against information leakage through technical channels. Formulates the requirements for the designed network, taking into account the analysis of	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Written work

	threats and unauthorized influences; draw up functional diagrams of the designed systems and telecommunications networks. Analysis of the main characteristics and capabilities of telecommunication systems for the transmission of operational and special messages.		
LR 8	He has the ability to read structural and functional diagrams of elements and devices of mobile and satellite communication systems built on the basis of modern technologies; skills in designing networks of mobile and satellite communication systems of various standards and calculating their basic parameters in standard ones, optimization of information transmission systems and communication networks.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Testing
LR 7	Has the skills of designing electronic digital devices, including those based on MP and MK; software development of MP and MK; setting up and debugging digital information, searching for information about the properties of integrated circuits; information about the technical parameters of semiconductor devices used in the design of power plants; skills of applying the information received.	Analysis of conducted experiments, analysis of scientific literature, presentation of reports	Report, presentation
LR 6	He knows the basics of designing the main components and blocks of radio-electronic means; the basics of implementing electromagnetic compatibility of radio-electronic equipment components. Has the skills to develop and execute design and working technical documentation based on computer-aided design systems; control of compliance of developed projects and technical documentation with standards, specifications and other regulatory documents. Applies modern tools in the development of design documentation.	Analysis of the results of the intermediate and final certification of the research work of PhD students. Organization and monitoring of the defense of doctoral dissertations.	Protection

## 21. Criteria for assessing the achievability of learning outcome

PO 1	Knows: the main theoretical provisions, principles, terms, concepts, processes, methods, technologies, tools, operations of scientific activity, procedures for setting and solving scientific problems, theoretical foundations of various types of micro- and nanoelectronic devices, and the formation of skills in applying the principles of micro- and nanoelectronics for the automation of process control.
	Is able to: apply methods of planning and organizing scientific research, methods of scientific knowledge in the field of innovation in energy and physical research; apply standards and regulations for the presentation of research results, preparation of scientific reports, and publications for seminars and conferences; correctly model physical processes, as well as develop methods and algorithms for their solution; accurately relate the content of specific problems to the general laws of physics; effectively apply the general laws of physics to solve problem-oriented tasks; use basic physical instruments, solve simple experimental tasks, process, analyze, and evaluate the obtained results; utilize reference and educational literature, find other necessary sources of information, and work with them.
	Possesses: the methodology of scientific conception and creativity, the general scheme of organizing scientific research, the practice of use, mechanisms of scientific search, analysis, conducting experiments, organizing surveys, preparing questionnaires, etc.; skills in selecting a research topic and compiling the necessary bibliographic publications and informational materials related to the research topic; skills in computer modeling in physics to master basic numerical methods, methods of measuring and assessing measurement errors of the main operating characteristics of energy equipment; skills in experimental work; understanding the principles of automating physical experiments; expressing physical ideas; evaluating the order of physical quantities; and using computer technology to solve specific problems.
PO 2	Knows: the fundamentals of the historical development of institutional forms of scientific activity, the main theoretical provisions, principles, terms, concepts, processes, methods, technologies, tools, operations of scientific activity, and procedures for formulating and solving scientific problems.
	Is able to: apply methods for planning and organizing scientific research, methods of scientific knowledge in the field of innovation in energy and physical research, apply standards and regulations for presenting research results, and prepare scientific reports and publications for seminars and conferences.
	Possesses: the methodology of scientific design and creativity, the general framework for organizing scientific research, practical applications, mechanisms of scientific inquiry, analysis, conducting experiments, organizing surveys, designing questionnaires, etc.; abilities in selecting

	research topics and finding necessary bibliographic publications and informational materials related to the research subject.
PO 3	Knows: the fundamental theoretical foundations, principles, terms, concepts, processes, methods, technologies, tools, operations for conducting scientific activities, and the procedures for formulating and solving scientific problems.
	Is able to: apply methods for planning and organizing scientific research, methods of scientific knowledge in the field of innovation in thermal power engineering and physical research, and apply standards and regulations for presenting the results of scientific research, as well as for preparing scientific reports and publications for seminars and conferences.
	<b>Possesses:</b> the methodology of scientific conception, creativity, the general scheme of organizing scientific research, the practice of usage, mechanisms of scientific search, analysis, conducting experiments, organizing surveys, compiling questionnaires, etc.; skills in selecting scientific research topics and finding the necessary bibliographic publications and informational materials related to the research topic.
PO4	Knows: principles of information transmission and processing using the elemental base of optoelectronic devices; optoelectronic devices as means for controlling operating modes, protecting, and regulating parameters of electrical engineering and power engineering objects; physical phenomena in optoelectronic devices and the fundamentals of electronic device theory; tasks of experimental research; theory and techniques of experimentation in the design, testing, and production of optoelectronic devices; principles and methods of studying modern infocommunication systems; methodology for conducting a comprehensive analysis of the security of automated systems.
	Is able to: applying the theory and techniques of experimentation in the design, testing, and production of optoelectronic devices; evaluating the advantages and disadvantages of systems for transmitting, distributing, processing, and storing information; conducting an analysis of the throughput of single-stage and multi-stage switching systems under fully accessible and partially accessible line connections; developing communication organization schemes and justifying the choice of communication network parameters; calculating the throughput of communication networks; utilizing analytical and computer models of automated systems and information protection systems; analyzing, assessing, and mitigating vulnerabilities in information security within automated systems; applying automated tools for monitoring, auditing, and analyzing the security of data systems.
	Possesses: skills in analyzing and calculating simple electronic circuits; methods of experimental research; the theory and techniques of experimentation; methods for modeling infocommunication systems and networks; and methods for calculating their throughput, as well as assessing the effectiveness of information protection measures applied in automated systems.
PO5	Knows: the purpose and principles of operation of the main components of data transmission systems; the reference model for open system interconnection; methods of switching and routing, and network protocols.
	Is able to: select network protocols; build models of networks at various levels of network interaction; investigate network behavior using simulation and analytical methods.
	Possesses: skills in selecting effective codecs and modems for telecommunications systems; skills in comparative assessment of various methods for constructing multi-channel digital systems and networks.
PO6	Knows: the laws of electrodynamics and optics in their relationship with the entire spectrum of physical laws and the limits of their applicability; the main radio measurement devices (circuit analyzers, spectrum analyzers, microwave generators); how to analyze the obtained experimental data and use it to calculate the characteristics of telecommunications systems; the causes of electromagnetic compatibility (EMC) problems and interference resistance of integrated systems (IS); the basics of EMC theory and interference resistance of IS; measures to improve EMC conditions and interference resistance of IS; types of approximations for the characteristics of nonlinear elements; the design of modulators, detectors, mixers, and the influence of feedback on amplifier parameters.
	Is able to: apply in practice the principles and methods for solving scientific and technical problems; solve electrodynamic problems related to EMC issues; analyze and synthesize the interference environment; understand the criteria for evaluating EMC and interference resistance; apply the acquired knowledge in the development of radio-electronic systems and calculate the main parameters of cascades.
	Possesses: skills in applying the provisions of technical electrodynamics to the scientific analysis of situations that engineers face when designing and operating new equipment and technologies; the main approaches for describing electrodynamic phenomena in nature and in solving

	modern and future technological challenges; methods for solving electrodynamic problems in the fields of EMC and interference resistance; methods for computer modeling of electromagnetic fields; skills in working with educational and scientific literature, and creating basic devices from triggers.
PO7	Knows: the operating principles of major semiconductor devices, the physical processes occurring in electrical junctions, and models of semiconductor devices for various purposes; the basic principles of constructing block diagrams of telecommunication systems, the characteristics of multichannel systems, digital networks with integrated services and intelligent networks, and the operation features of multichannel systems and digital networks with integrated services and intelligent networks.
	Is able to: work with modern measuring instruments and devices, as well as electronic devices of various technical functional purposes.
	Possesses: the basic principles of constructing block diagrams of telecommunication systems and semiconductor devices for various purposes.
PO 8	Knows: the design, parameters, characteristics, and areas of application of functional electronics devices and instruments; the construction of modern satellite systems; types of satellite orbits and their features; types and purposes of satellite communication services; general structures of earth stations and spacecraft; multi-station access methods used in satellite communication systems; modulation and error-correcting coding methods; parameters and characteristics of mobile satellite communication systems; parameters and characteristics of satellite TV and radio broadcasting systems; features of the most well-known domestic and international satellite communication systems; and prospective satellite communication technologies.
	Is able to: apply the acquired knowledge in theoretical analysis, computer modeling, and experimental research of physical processes underlying the principles of functional electronics devices, energy calculations, and general design of satellite communication systems and broadcasting systems; use antenna theory to calculate the operational parameters of a satellite communication channel; analyze the parameters and characteristics of existing satellite communication systems.
	Possesses: information about the areas of application and prospects for the development of functional electronics devices and instruments, as well as the devices and equipment used for the configuration and technical operation of satellite systems; able to formulate requirements for advanced telecommunication systems and their components; possesses skills in developing strategies and methodologies for researching radio engineering devices and systems.
PO9	Knows: the structure of solid matter, defects in the crystalline structure, and their role in determining material properties; the basics of phase equilibrium theory, which allows determining and modifying the phase state of a system depending on external parameters; the fundamentals of the electronic structure of solids, enabling the explanation of the complex electrical properties of metals, semiconductors, and dielectrics, and the development of methods for controlling them; the latest advancements in physics and chemistry, thermal and non-thermal physico-chemical processes that occur during the production of solid-state electronic components in the substrate or on its surface when semiconductors, metals, and dielectrics interact.
	Is able to: use the fundamental laws of physics, chemistry, and mathematics in the design, manufacturing technology, and operation of micro- and nanoelectronic structures; apply methods for numerically estimating the magnitude of quantities relevant to the creation and operation of specific products; develop technology for producing monocrystalline materials, which form the basis of modern microelectronics, optoelectronics, laser technology, etc.; develop technology for producing nanocrystalline, amorphous, and composite structures, which are among the most promising modern materials.
	Possesses: the methodology for determining and calculating the key characteristics of materials for micro- and nanoelectronic structures; the methodology for calculating the parameters of oxide, diffusion, and ion-implanted layers and thin metallic films; and the methodology for calculating sputtering coefficients and metal-semiconductor contact parameters.
PO 10	Knows: the methodology of teaching specialized subjects, the forms and methods of organizing student learning activities, scientific and methodological work, and ways to improve practical teaching skills.
	Is able to: solve higher education problems in the field of physics and physics education, justify the requirements for the modern educational process and identify its patterns, plan, forecast, and analyze the key components of the learning and educational process in higher education.



	Possesses: skills that allow for a high degree of independence and self-regulation in further learning and the development of language, scientific knowledge, and scientific methodology; management skills; and methods for evaluating the effectiveness of management activities.
PO 11	Knows: theoretical foundations of optical information processing; the principles of design and operation, as well as the characteristics of the main functional units of optical systems: spectroanalyzer, matched filter, correlator; physical principles of radiation propagation through optical fibers, the main characteristics of optical radiation sources and receivers, and the principles of constructing fiber-optic information transmission systems.
	Is able to: determine and justify the feasibility of using optical information processing methods for solving specific radio engineering tasks, select the most appropriate processing algorithm and implement its schemes; design fiber-optic systems for transmitting analog and digital signals and evaluate their performance.
	Possesses: methods for calculating and analyzing the characteristics of basic optical and optoelectronic elements of optical information processing devices, as well as optical communication systems.
PO 12	Knows: general patterns of scientific knowledge in its historical development and changing socio-cultural context, the basics of philosophy and the methodology of science, the features of scientific knowledge, and the functions of science in society.
	Is able to: apply knowledge of traditional and modern issues in the history and philosophy of science to research activities in a professional field.
	Possesses: skills in scientific knowledge and scientific methodology.
PO 13	Knows: professional physical terminology, the basics of vocabulary and grammar of a foreign language.
	Is able to: apply basic translation techniques when working with foreign texts of both general and specialized topics, in oral and written speech in English, at a level sufficient for communication on general and professional topics; correctly express physical ideas in a foreign language.
	Possesses: a foreign language as a means of intercultural and professional communication, skills in writing articles in a foreign language.
PO 14	Knows: the psychological foundations of managerial activity, the main concepts, theoretical principles, and current issues in management psychology.
	Is able to: solve psychological and pedagogical problems in the educational process of higher education, plan, forecast, and analyze the main components of the teaching and educational process in higher education.
	Possesses: skills that enable a high degree of independence and self-regulation in further learning and development of scientific knowledge and methodology, managerial skills, and methods for assessing the effectiveness of managerial activities.
PO 15	Knows: the basics of the commercialization process of scientific and intellectual activity results, attracting investments, implementing developments in production and their further support, as well as the legal foundations of the Republic of Kazakhstan and foreign countries in the field of intellectual property protection (inventions, utility models, industrial designs, trademarks, etc.).
	Is able to: apply basic knowledge in the fields of innovation commercialization and innovation potential assessment in cognitive and professional activities.
	Possesses: basic theoretical knowledge of organizing innovation activities, and basic theoretical knowledge of using information technologies in innovation risk management.

## 22. The graduate model of the educational program

Attributes:


- deep professional knowledge in their field of study;
- interest in mastering trends in education and science;
- ability to collaborate in the professional community;
- independence in the search for opportunities for professional and personal development;
- sociability;
- tolerance and good manners;
- academic integrity;
- willingness to participate in solving state tasks and strategies of Kazakhstan.

Types of competencies	Description of competencies
1. Behavioral skills and personal qualities (Soft skills)	Knows about the main epistemological models, about the nature of the transformation of the concept of rationality; about the forms and methods of pre-scientific, scientific and extra-scientific knowledge, about modern approaches to socio-humanitarian and natural science knowledge and their commensurability. Able to use in cognitive and professional activities basic knowledge in the areas of commercialization of innovations and assessment of the commercial potential of innovations. Possesses basic theoretical knowledge about the organization of innovation activities, basic theoretical knowledge about

	the use of information technology in innovation risk management. Has the skills to use the knowledge, positions and methods of the psychological science of management obtained in the process of mastering the psychology of management in professional activity. Knows the basic psychological methods and techniques of conflict management in the organization. Demonstrates knowledge in the field of modern educational technologies and selects the optimal and most effective forms of organization of the educational process in higher education.
2. Digital competencies (Digital skills):	Uses the acquired knowledge of modern areas of science in solving professional problems. Knows modern information technologies, methods of processing scientific information; software development technologies; principles of building database systems, data presentation models; basic data operations; basic methods and algorithms of relation theory, combinatorics related to modeling and optimization of systems of various nature. Knows modern trends in electronics of communication systems and telecommunication technologies for the successful application of knowledge in solving practical problems. He has an understanding of the installation and operation of digital and cable data transmission systems, the operation of multichannel systems and the skills of working to ensure the information security of networks, measuring equipment performance. Possesses the skills to freely navigate in fundamental and applied issues of the field of physics, in which specialization is carried out within the framework of the educational program of the magistracy. Knows foreign terminology in radio electronics. Able to demonstrate foreign language competence when working in an interdisciplinary team. Applies knowledge of foreign terminology in radio electronics at a professional level when reading foreign literature.
3. Professional competencies (Hard skills)	Knows how to use methods of protection against computer viruses, protection against information leakage through technical channels. Formulates the requirements for the designed network, taking into account the analysis of threats and unauthorized influences; draw up functional diagrams of the designed systems and telecommunications networks. Analysis of the main characteristics and capabilities of telecommunication systems for the transmission of operational and special messages. He has the ability to read structural and functional diagrams of elements and devices of mobile and satellite communication systems built on the basis of modern technologies; skills in designing networks of mobile and satellite communication systems of various standards and calculating their basic parameters in standard ones, optimization of information transmission systems and communication networks. He knows the basics of designing the main components and blocks of radio-electronic means; the basics of implementing electromagnetic compatibility of radio-electronic equipment components. Has the skills to develop and execute design and working technical documentation based on computer-aided design systems; control of compliance of developed projects and technical documentation with standards, specifications and other regulatory documents. Applies modern tools in the development of design documentation.

#### Developers:


Head of the Department of Radiophysics and Electronics, PhD  
Professor, Candidate of Physical and Mathematical Sciences  
Associate Professor, PhD

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#### Notes.

The educational program was reviewed by the faculty council from 25.04.24 Protocol no. 9  
The educational program was reviewed at the meeting of the Academic Council from 29.04.24 Protocol no. 5  
The educational program was reviewed and approved at the meeting of the University Board from 24.05.24 Protocol no. 8

Board Member-Vice-Rector for Academic Affairs

 M.M. Umurkulova

Director of the Academic Work Department

 T.M. Khasanova

Dean of the Faculty of Physics and Technology

 A.K. Zeinidenov

**EDUCATIONAL PROGRAM DEVELOPMENT PLAN**  
**7M07105 – Electronics of communication systems and telecommunication technologies**

**The purpose of the Plan** - is to contribute to improving the quality of the conditions for the implementation of the educational program, taking into account the current requirements of the labor market and the achievements of modern science.

**Target indicators**

№	Indicators	Unit of measurement	2024-2025 (plan)	2025-2026 (plan)	2026-2027 (plan)	2027-2028 (plan)
<b>1</b>	<b>Human resources development</b>					
1.1	The increase in the number of teachers with academic degrees	Number of people	1	1	1	1
1.2	Advanced training in the field of teaching	Number of people	1	1	1	1
1.3	Involvement of practitioners in teaching	Number of people	1	1	1	1
1.4	Other	Number of people				
<b>2</b>	<b>Promotion of Educational Programs in the ratings</b>					
2.1	IQAA	Position	50	70	80	100
2.2	IAAR	Position	500	700	800	1000
2.3	Atameken	Position	-	-	-	-
<b>3.</b>	<b>Development of educational and scientific-methodical literature, electronic resources</b>					
3.1	Textbooks	Quantity	1			
3.2	Tutorials	Quantity	1	1	1	1
3.3	Methodological recommendations/instructions	Quantity	1	1	1	1
3.4	Electronic book	Quantity	1	1	1	1
3.5	Video/audio lectures	Quantity	1	1	1	1
3.6	Other	Quantity				
<b>4.</b>	<b>Development of educational and laboratory base</b>					
4.1	Purchase of software products	Quantity		1	1	1
4.2	Purchase of equipment	Quantity	1	2	2	1
4.3	Other	Quantity				

5.	Actualization the content of Educational Programs		5%	5%	5%	5%	
5.1	Updating the results of training and the list of disciplines, taking into account the requirements of the labor market, scientific achievements, professional standards	Year	5%	5%	5%	5%	
5.2	Introduction to Educational Programs of academic disciplines in foreign languages*	Year	-	1	1	1	1
5.3	Introduction of new teaching methods	Year	1	1	1	1	1
5.4	Opening of a joint/double degree program based on Educational Programs	Year	-	-	1	1	1
5.5	Other	Year					

Head of the Department of Radiophysics and Electronics

Alpyssova G.K.