THE MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN

KARAGANDA UNIVERSITY NAMED AFTER ACADEMICIAN Y. A. BUKETOV

«AGREED»
Director of the branch of JSC «Kazteleradio»
of the Karaganda ODRT
_____ Zhumabayev A.K.
«_19_» _03_ 2023y.

«AGREED»
National Information Technologies JSC
Karaganda region
Director of the Representative Office
_____ Kulbayev T. A.
«_14_» _03_ 2023y.

«APPROVED»
Chairman of the Board-Rector of Karaganda
University named after academician Y.A. Buketov
_____ Dulatbekov N.O
«_30_» _05_ 2023 y .

EDUCATIONAL PROGRAM
in the field of training "7M071 Engineering and engineering»

Level: Master

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

Karaganda, 2023

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 № 319-III "On education" (with amendments and additions as of July 11, 2017).),

– Law of the Republic of Kazakhstan dated July 11, 1997 № 151-I. "On languages in the Republic of Kazakhstan" (as amended on 24.05.2018.),

– The state obligatory standard of postgraduate education of education of 31 August 2018 No. 604

– National qualifications framework of March 16, 2016 by the Republican tripartite Commission on social partnership and regulation of social and labor relations.

– Order of MES of RK "On approval of Rules of organization of educational process on credit technology" from October 2, 2018 No. 152 (with changes and additions from 12.10.2018, No. 563)

– Classifier of areas of training with higher and postgraduate education from October 13, 2018. No. 569.

Recommended by the decision of the Academic Council of the University to enter into force on September 1, 2021.

Content:

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 1	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.
	LR 2	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 3	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 4	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 5	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 6	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 7	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 8	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 9	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 10	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 11	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 12	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 13	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 14	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 15	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)
LR 1	Philosophical and historical aspects of social and humanitarian knowledge	History and philosophy of science	4
		Higher School Ppedagogy	4
		Psychology of management	4
		Teaching practice	4
LR 2	Professional Languages	Foreign language (professional)	4
		Professional foreign terminology in radio electronics Theory and methodology of preparation of a scientific publication in a foreign language	5
LR 3	The innovation process the organization of scientific research	Advanced technologies in micro and nanoelectronics Commercialization of the results of scientific and technical activities	5
		Functional electronics Innovation in natural-scientific, technical and technological research	5
LR 4	Fundamental principles of electronics and telecommunications	Scientific and technical problems of radio engineering, electronics and telecommunications	4
		Theory of construction of infocommunication networks and systems	4
		Theory of electromagnetic compatibility of radio-electronic means and systems	4
LR 5	Current state of electronics and telecommunications	Organizational and technical methods of protection of communication systems Methods of designing secure communication systems	4
		Satellite and mobile communication systems Data transmission systems and networks	4
		Microelectronics and basics of nanoelectronics Digital electronics and microprocessors	4
		Design of radio communication elements and devices The circuitry of the communication devices	5
		Semiconductor electronics Molecular electronics	4
		Optical communication and information processing systems Optoelectronic active and passive components of optical systems	4
		Methods of teaching the basics of electronics Methods of teaching special disciplines in higher education	4
LR 6	Research work	Research practice	12
		The scientific research work of the undergraduate, including the performance of the master (RWMS)	24
LR 7	Final examination	Formalization and defense of the master's thesis	8

19. Matrix of achievability of learning outcomes

NN	Name of disciplines	Brief description of the discipline	Number of credits	Generated learning results (codes)								
				LR 1	LR 2	LR 3	LR 4	LR 5	LR 6	LR 7	LR 8	LR 9
Cycle of basic disciplines University component												
D 1	History and philosophy of science	The purpose of the discipline is to form undergraduates" knowledge about the general laws of scientific knowledge in its historical development and changing socio-cultural context. Updating knowledge on the basics of philosophy of science and methodology of science.	4	+								
D 2	Higher School Ppedagogy	Pedagogy of higher education, its specifics and categories. Modern educational paradigms. The essence and objectives of higher and postgraduate professional education. Characteristics of Kazakhstan's system of higher and postgraduate professional education. Didactics of higher education. Objectives, content and regulatory framework of higher professional education. Competence-based approach in the training of professionals. The concept and structure of pedagogical communication.	4	+								
D 3	Psychology of management	The discipline examines the basics of the organizational structure of management and understanding of the nature of management processes, ways to improve management efficiency and means of communication, selection and training of specialists capable of implementing management functions.	4	+								
D 4	Teaching practice	To know the current trends of communication systems electronics and telecommunication technologies for the successful application of knowledge in solving practical problems. To be able to consolidate and improve the experience gained in the learning process of practical activities in the field of the studied profession. Adapts to the specific conditions of organizations of different organizational and legal forms. Forms, strengthens and develops teaching skills in higher education institutions.	4	+								
D 5	Foreign language (professional)	Purpose: to increase the level of proficiency of undergraduates in a foreign language to solve social and communicative tasks. Tasks: mastery of the skills of expressing opinions, argumentation of decisions and actions, analysis of socially significant processes and problems; free use of three main components: the sphere of communication and topics; socio-cultural cognition; linguistics.	4		+							
D 6	Professional foreign terminology in radio electronics	In the process of studying the discipline considered foreign terminology in radio electronics when reading foreign literature. Collects information during the literary review on the research topic. It is able to transmit the results of the research in the form of specific recommendations in terms of communication systems electronics and telecommunication technologies. Clearly formulates ideas, conclusions, problems on the subject of scientific research.	5					+				

	Theory and methodology of preparation of a scientific publication in a foreign language	Preparation is underway to write a scientific article on the profile for submission to journals in a foreign language, including journals included in the Scopus, Thomson Reuters databases. The specifics of the preparation of the article, the compilation of the glossary, the algorithm of writing the publication, the formulation of conclusions.	5										
D 7	Advanced technologies in micro and nanoelectronics	The purpose of the discipline: to study the theoretical foundations of various types of micro- and nanoelectronics devices, to develop skills in applying the principles of micro- and nanoelectronics to automate process control. Tasks: to use micro- and nanoelectronics methods that allow solving specific practical tasks; skills in interpreting physical ideas, their quantitative formulation and solving physical problems; knowledge of the theoretical foundations of micro- and nanoelectronics, analysis of various dependencies, principles of functioning of micro- and nanoelectronics devices.	5						+				
	Commercialization of the results of scientific and technical activities	Legal basis of commercialization of the results of scientific and technical activities. Legal mechanisms of intellectual property protection. Determination of the optimal legal form of a legal entity for a startup company and its creation. Technology of commercialization of the results of scientific and technical activities. Content and objectives of business planning of the project of commercialization of the results of scientific and technical activities.	5										
D 8	Functional electronics	In the process of studying the discipline discusses the basics of electronics, including the device and the principle of electronic components; methods and means of computer-aided modeling and design of electronic circuits; physical phenomena in electronic circuits.	5						+				
	Innovation in natural-scientific, technical and technological research	Innovative processes, methods of processing research results into popular technologies and developments, formation of basic theoretical knowledge about innovations, their attributes and attributes, functions and forms of implementation, their stages and specific features, understanding of the basic laws and patterns of innovation, driving forces and key success factors	5										
Cycle of basic disciplines Component of choice													
D 9	Scientific and technical problems of radio engineering, electronics and telecommunications	In the process of studying the discipline are considered related to the transmission and transformation of information through the use of radio frequency electromagnetic oscillations based on the generation of their electronics devices. Be able to use practical knowledge for mastering the subject, providing a deep understanding of the essence of the technical problems facing electronics and telecommunications and the appropriateness of the methods used to solve them.	4		+								
D 10	Theory of construction of infocommunication networks and systems	In the process of studying the discipline discusses the basics of building infocommunication systems and networks,mastering a set of facts, events of interest, and therefore subject to any kind of processing and registration, as well as all forms of information, including character, text, graphics, determine options for restoring the functioning of emergency equipment. Be able to study the technology of data encryption software to protect important in-	4			+							

		formation.											
D 11	Theory of electromagnetic compatibility of radio-electronic means and systems	Forms the study of laws and processes occurring in electronic means and systems due to the electromagnetic interaction of elements in the presence of interference, as well as methods and techniques to ensure electromagnetic compatibility (EMC) equipment and its components. Be able to understand the effective use of radio frequency resource, the methods of management in the complexes of RES in order to ensure compatibility; organizational aspects, standards of foreign documents.	4			+						
D 12	Organizational and technical methods of protection of communication systems	In the process of studying the discipline examines the main directions of information leakage (reading residual information, copying files from sources of information, the use of program traps, the use of computer viruses, etc.); organizational and organizational and technical measures to protect information; regulatory framework in the field of information protection. Be able to use methods of protection against computer viruses, protection against information leakage through technical channels.	4				+					
	Methods of designing secure communication systems	Methods of solving research and production tasks using modern equipment and research methods, methods and methods for evaluating and improving the quality of communication services provided, compliance with technical regulations, international and national standards and other regulatory documents					+					
D 13	Satellite and mobile communication systems	Study of the fundamental principles of the functioning of modern data transmission systems and networks; study of the characteristics and parameters of technologies used to build data transmission networks	4				+					
	Data transmission systems and networks	In the process of studying the discipline discusses the principles and basic laws of information transmission through communication channels; know the physical properties of messages, signals, interference and communication channels, be able to make their mathematical models and use them in calculations; know and be able to apply in practice the methods of formation, transformation and processing of signals in electrical circuits and devices.					+					
D 14	Microelectronics and basics of nanoelectronics	In the process of studying the discipline examines the main sources of scientific and technical information on materials in the field of integrated circuit; the main types of integrated circuits; sources of scientific and technical information (magazines, Internet sites) on integrated electronics and electronic automation.	4						+			
	Digital electronics and microprocessors	Familiarity with the modern element base of digital devices, study of the principles, methods and techniques of programming microcontrollers.							+			
D 15	Design of radio communication elements and devices	Principles and methods underlying the design of digital electronic devices, radio communication devices, design methods, methods for calculating radio communication nodes.	5						+			
	The circuitry of the communication devices	In the process of studying the discipline examines the types of information and ways of its representation in computer algorithms of digital circuitry. Be able to use standard means of computer equipment and software; - to carry out control and analysis of the process of functioning of digital circuit devices according to functional schemes.	5						+			
D 16	Semiconductor electronics	In the course of studying the discipline considered the principles of the most	4							+		

		important semiconductor devices; mathematical models of semiconductor devices to determine their characteristics and basic parameters, as well as the construction of equivalent circuits for different modes of operation.											
	Molecular electronics	Polymers, low molecular weight compounds, biomaterials. Supramolecular and intramolecular architecture of organic compounds, differences from traditional inorganic materials for electronics. Phthalocyanins. The possibilities of fine organic synthesis.								+			
D 17	Optical communication and information processing systems	The purpose of teaching the discipline is to study the theoretical foundations of optical information processing; principles of construction and operation, as well as the characteristics of the main components of optical systems; the physical basis of the propagation of radiation through the optical fiber, the main characteristics of sources and receivers of optical radiation, the principles of construction of fiber-optical information transmission systems	4							+			
	Optoelectronic active and passive components of optical systems	Measurement of the characteristics of the photodetector, optical guide systems and passive components of the fiber optic system, methods for monitoring the reliability parameters of fiber-optic components								+			
D 18	Methods of teaching the basics of electronics	The purpose of the discipline: to prepare students of the course to teach the main sections of semiconductor physics, the basics of the theory of circuits and signals and the basics of electronics. The use of visual material and laboratory equipment in the process of preparing for classes of modern literature. Understanding of current trends in electronics, the use of software at all stages of design and modeling of electronic circuits and the use of this knowledge in the process of teaching subjects related to the basics of electronics.	4							+			
	Methods of teaching special disciplines in higher education	It is studied in order to form knowledge about the totality of means, methods and forms of teaching special disciplines and the acquisition by undergraduates of the necessary practical skills in organizing the educational process for the study of disciplines of a special cycle, preparing methodological support for the educational process of training specialists.								+			
D 19	Research practice	Research practices are organized in accordance with the profile of the master's program and include the formation of the required competencies of undergraduates. When checking, there is an individual educational trajectory, the topic of the master's dissertation, as well as the type of professional activity chosen by the magician. The practice includes the implementation of a list of tasks by a master student on the profile of his future activity. It requires the study, collection, processing and systematization of materials for writing magic.	12								+		
D 20	The scientific research work of the undergraduate, including the performance of the master	The main purpose of the research work (RWMS) is the study by undergraduates of the current state of the scientific and practical problem on the topic of the master's thesis. Research work for the preparation of a master's thesis was carried out simultaneously with the educational process during the duration of the master's degree and in the form of a scientific seminar.	24								+		
D 21	Formalization and defense of the master's thesis	The purpose of the problem investigated in the work should be in demand and relevant. The ways to solve it and the methods used are innovative and previously unexplored. A master's student should rely on new inventions in her work and have suggestions for solving the problem.	8										+

20. Coordination of the planned learning outcomes with the methods of teaching and evaluation within the module

Learning results	Planned learning results for the module	Teaching methods	Assessment methods
LR 1	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.	Interactive lecture, case-methods, round table, analysis of publications, demonstration of speech	Colloquium, testing
LR 2	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 3	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 4	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 5	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 6	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 7	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 8	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 9	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 10	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,	Interactive lecture, experimental works intended for scientific research	Written work

	methods of designing, organizing, implementing and evaluating the results of scientific research in the field of primary education methodology using modern scientific methods.		
LR 11	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 12	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.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Written work
LR 13	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 14	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 15	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. 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:
Members of the working group:

Head of the Department of Radiophysics and Electronics _____ G.K. Alpyssova

Agreed:
Chairman of the Quality Commission of the faculty of physics and technology _____ A.S. Utegenova

Undergraduate group M2-NN-22-1k _____ A.M. Abdigaliyeva

Notes.
The educational program is considered and recommended at the faculty Council from 16.03.2023 Protocol no. 8
The educational program is considered at the meeting of the NMS and recommended for approval from 28.04.2023 Protocol no. 5
The educational program is considered and approved at the meeting of the Academic Council 30.05.2023 Protocol no. 12

Member of the Board "Vice-Rector" for Academic Affairs **T.Z. Zhussipbek**

Director of the Department for Academic Work **S.A. Smailova**

Dean of the faculty of physics and technology **A.K. Zeinidenov**