Institute of Automation and Information Technology
Department of Electronics, Telecommunication and Space Technologies

EDUCATIONAL PROGRAM
Telecommunication

Code and classification of the field of education: B059 Communications and communication technologies
Code and classification of training areas: 6B06201 "Telecommunications"
Group of educational programs: B059 Communications and communication technologies
NQF level: 6
SQF level: 6
Duration of study: 4 years
Amount of credits: 240

Almaty 2025

NON-COMMERCIAL JOINT-STOCK COMPANY "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATPAYEV"

Educational program 6B06201- "Telecommunication" was approved at a meeting of the Academic Council of KazNRTU named after K.I. Satbayev.

Protocol №10 dated "06" March 2025

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of KazNRTU named after K.I. Satbayev.

Protocol №4 dated "26" December 2024

Educational program 6B06201 – "Telecommunications" developed by the academic committee for the B059 "Communications and Communication Technologies" course.

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KazNRTU 703-05 Educational program

Content

List of abbreviations and designations

EP- Educational program
NQF– National Qualifications Framework
SQF– Sectoral qualifications framework
IC- Individualized curriculum
SDG– Sustainable Development Goals
TETRA– Terrestrial Trunked Radio (Open standard for digital trunked radio communications)
DMR– Digital Mobile Radio (Digital Radio Communication Standard)
VHF- Ultrashort waves
IoT– Internet of Things (Internet of Things)
Wi-Fi– Wireless Fidelity (Wireless Network)
LoRa– Long Range (Long Range Technology)
NB-IoT– Narrowband IoT (Narrowband Internet of Things)

1. Description of the educational program

The professional activities of graduates of this program cover modern areas of radio engineering, electronics, information and communication technologies, digital and wireless communication systems, as well as intelligent solutions in telecommunications infrastructure.

The training of specialists is carried out within the framework of the educational program "Telecommunications", developed taking into account international standards, the experience of leading world universities and the recommendations of the international classifier of professions.

The types of professional activity are: production and technological; service and operational; organizational and managerial; installation and adjustment; calculation and design; experimental and research.

The objects of professional activity are systems that include:development and operation of telecommunications systems, radio communications, television, radio broadcasting, radar and navigation, radio control, mobile communications, radio transmission and radio reception of television and sound signals, electronic and computer systems and systems controlled by microcontrollers and microcomputers.

The goal of the educational program (EP) is to train in-demand, highly qualified engineers with modern knowledge and practical skills, capable of effective professional activity in the rapidly developing telecommunications industry.

The objective of the educational program is:

- training a new competitive generation of technical specialists in the field of radio engineering, electronics and telecommunications for the labor market, proactive, able to work in a team, possessing high personal and professional competencies;
- integration of educational and scientific activities;
- establishing partnerships with leading universities in the near and far abroad with the aim of improving the quality of education and supporting technical and cultural ties;
- expanding relations with customers of educational services and employers in order to determine requirements for the quality of training specialists, conducting courses, seminars, master classes, internships, and industrial practices.

The program content is built in accordance with the principles of credit technology and is implemented in Kazakh and Russian languages of instruction. The program is fully adapted to the requirements of the Bologna process - students independently create an individual curriculum (IEP) with the help of an advisor, choosing elective disciplines from the catalog.

The educational program includes the following disciplines:"Fundamentals of Radio Engineering and Telecommunications", "Theory of Electrical Circuits", "Physical Fundamentals of Electronics", "Modern Technologies of Electronics in Telecommunications", "TETRA Trunking Radio Communication", "Digital Mobile Radio Communication - DMR", "Digital Devices in Telecommunications", "Digital Automatic Switching", "Components of Fiber-Optic Transmission Systems", "Mobile Communication Systems", "Design of Radio Engineering and Telecommunication Systems", "Design of Communication Systems in MATLAB

and Simulink", "Fundamentals of Scientific Research Methods", "Theory of Electrical Communication", "Theory of Signal Transmission", "Networks and Information Transmission Systems", "Structured Cabling System", "Guide Telecommunication Environments", "Linear Cable Communication Structures", "Network Technologies", "Telecommunication Equipment of a Computer Network", "VHF Antenna-Feeder Devices", "Modeling of Communication Systems", "Modern Broadcasting Technologies", "Radio Engineering Equipment" transmission, reception and processing of signals", "Digital communication technology", "Transmission of discrete messages", "Digital switching systems", "Information security and data protection in telecommunications", "Inclusive technologies and universal design in engineering systems", "Modern wireless technologies and standards", "Artificial intelligence in telecommunications", "Optical communication technologies", "Transport communication networks", "Multichannel telecommunication transmission systems", "Multiservice NGN networks", "Subscriber access networks", "Digital television and radio broadcasting systems", "Ground and space communication and television and radio broadcasting systems", "Electronic sensors and converters", "Measuring and control devices in communication systems", "Electromagnetic compatibility of radio electronic equipment", "Noise immunity and security of infocommunication systems", "Using IoT for monitoring electromagnetic pollution", "M2M networks and the Internet of things", "Wireless sensor network and IoT", "Design of modern telecommunication systems and networks", "Scientific research of telecommunication technologies".

These disciplines cover the full range of knowledge needed to achieve the Sustainable Development Goals, in particular SDG 9 – building resilient infrastructure, promoting inclusive and sustainable industrialization and implementing innovation.

2. The purpose and objectives of the educational program

The purpose: The aim of the educational program "Telecommunications" is to train highly qualified specialists in the field of telecommunications technologies, capable of designing, analyzing, implementing and supporting modern communication systems. The program is aimed at developing professional competencies in the field of digital and wireless communications, fiber-optic and satellite systems, network technologies, as well as intelligent and integrated solutions in telecommunications infrastructure.

Graduates of the program will be able to carry out engineering and scientific research in the field of telecommunications, including the development and modeling of communication systems, equipment setup, traffic analysis, cybersecurity, and the implementation of modern ICT solutions. The educational process is organized in accordance with international standards, which opens up opportunities for graduates to work in telecommunications companies, research centers, digital economy enterprises, and international projects.

Responsibilities of the EP:

- Formation of a social and humanitarian knowledge base, including the fundamentals of law, economics, history, state, Russian and foreign languages, necessary for successful professional and social activities.

- Study of basic disciplines that form the basis of technical thinking and engineering approach in the field of natural, general technical and information sciences.

- Acquisition of theoretical and applied knowledge in the field of telecommunication systems, including analog and digital communications, circuit design, signal theory, antenna technology and electromagnetic compatibility.

- Development of practical skills in working with microprocessor and microcontroller devices, telecommunications equipment, digital data transmission systems and wireless networks.

- Training of specialists capable of developing, maintaining and optimizing communication networks of various scales – from local to global, including mobile, satellite and fiber-optic technologies.

- Formation of competencies necessary for successful activity in research organizations, telecommunications enterprises, innovative engineering centers, as well as in the field of technical education.

- Developing students' abilities to analyze, model, manage and monitor telecommunication processes and systems in real time.

- Providing knowledge on the design of intelligent communication systems that ensure high throughput, resilience and cybersecurity in the context of digital transformation.

Students undergo practical training in companies such as JSCKazakhtelecom, JSC Transtelecom, RTeL LLP, Jusan Mobile, ALTEL JSC, KazTransCom JSC, Kar-Tel LLP, Kazteleradio JSC, Kazpost JSC, etc., as well as at telephone exchanges of large enterprises.

Under the academic mobility program, the best students can study at leading foreign universities in the relevant program.

The educational program is aimed at training professionals who can successfully work in domestic companies, as well as in international corporations working in the field of communications and ICT. Graduates will be able to design and implement modern telecommunications solutions, develop energy-efficient networks, participate in scientific developments and the implementation of new communication standards (5G/6G), and conduct scientific and pedagogical activities in the field of telecommunications.

3. Requirements for the assessment of learning outcomes of the educational program

Educational program 6B06201 – "Telecommunications" ensures that students achieve all planned learning outcomes necessary for successful professional activity in the field of modern telecommunication systems and technologies.

Upon completion of the educational program, students acquire the necessary social and humanitarian knowledge, including the basics of the socio-economic development of society, history, state, Russian and foreign languages, as well as

modern information and communication technologies.

Students also master a cycle of basic disciplines that form the basis of engineering training, including natural science and general technical knowledge necessary for understanding the processes occurring in telecommunication systems.

As part of professional training, students receive fundamental theoretical knowledge and practical skills in the field of construction, operation and modernization of telecommunication systems. They master the principles of operation of digital and analog communication systems, methods of transmitting and receiving signals, designing data transmission networks, principles of operation of wireless, mobile, satellite and fiber-optic communications.

During training, special attention is paid to acquiring skills in working with microprocessor and microcontroller systems, antenna devices, telecommunications equipment and measuring instruments. Students learn to perform engineering calculations, model and analyze telecommunications systems using specialized software and modern ICT platforms.

Practical training of students includes familiarization with key stages of design, setup, maintenance and monitoring of telecommunications infrastructure. Students undergo industrial training in specialized communications companies, where they master real processes of operating telecommunications equipment, testing communications systems, setting up network solutions, as well as ensuring sustainability and cybersecurity.

Graduates of the educational program can work professionally in engineering and technical departments of telecommunications companies, at communications enterprises, in design and engineering organizations, research institutes, data centers, as well as in companies specializing in the development and implementation of solutions in the field of digital transformation. Their activities will be related to the design, operation and maintenance of telecommunications networks, digital platforms, data transmission and processing systems, as well as the implementation of intelligent solutions in the communications industry.

4. Passport of the educational program

4.1. General information

No.	Field name	Note
1	Code and classification of the educational field	6B06 "Information and Communication Technologies"
2	Code and classification of training areas	6B062 "Telecommunications"
3	Group of educational programs	B59 "Communications and communication technologies"
4	Name of the educational program	6B06201 “Telecommunications”
5	Brief description of the educational program description	The educational program 6B06201 "Telecommunications" provides training for specialists in the field of telecommunication systems and technologies, including digital, fiber-optic, mobile, wireless communication networks and modern Internet of Things (IoT) technologies.
6	Purpose	The goal of the educational program "Telecommunications" is to

		train highly qualified specialists in the field of telecommunications technologies, capable of designing, analyzing, implementing and maintaining modern communication systems.
7	Type of OP	New
8	Level according to NQF	6
9	Level according to SQF	6
10	Distinctive features of the OP	No
11	List of competencies of the educational program:	Professional competencies; Research competencies; Basic competencies and knowledge; Communicative competencies; General human competencies; Cognitive competencies; Creative competencies; Information and communication competencies. The content of the educational program "Telecommunications" is implemented in accordance with the credit technology of education and is carried out in Kazakh and Russian languages.
12	Results of the implementation of the educational program:	PO1 - Apply basic mathematical, physical and other natural scientific knowledge, as well as software tools necessary in engineering practical activities. PO2 - Apply modern software for modeling telecommunication networks and methods of their protection; calculate the parameters of system and network nodes, switching systems, transmission, reception and processing of information, and also carry out diagnostics of IoT devices. PO3 - Use various types of information and communication technologies in professional activities: Internet resources, cloud and mobile services for searching, storing, processing, protecting and distributing information. PO4 - Use the basic principles of constructing antenna-feeder technology and wireless systems, mobile communication systems and broadband radio access, satellite communication systems. PO5 - Apply knowledge of Kazakh, Russian and foreign languages to solve problems of interpersonal, intercultural and professional communication. Work in a team of developers and users of engineering telecommunications systems; possess moral, communicative, organizational and managerial skills. PO6 - Use the basic principles of constructing terrestrial and space digital television and radio broadcasting systems. PO7 - Apply the theoretical foundations of electrical engineering, electrical circuits and electromagnetic waves in an interdisciplinary context to solve problems. PO8 - Apply basic knowledge in the field of ecology and life safety, the fundamentals of anti-corruption culture, entrepreneurship and leadership, and receptivity to innovation in various types of professional and socio-political activities. PO9 - Apply skills in developing design and working technical documentation, and prepare completed design and engineering works in accordance with norms and standards. Analyze the results of the production unit's activities, develop organizational, technological and reporting documentation, and prepare

		presentations of the results using modern technical means. PO10 - Apply knowledge of the electronic and microprocessor base in telecommunication and radio engineering systems; select measuring instruments and automation equipment, configure and operate automation elements and devices. PO11 - Apply modern technologies of fiber-optic communication, wireless and satellite communication to create multi-service and intelligent systems and networks; establish communication of sensors and reading devices with mobile devices, Wi-Fi, server. PO12 - Apply basic knowledge of the formation and transmission of telecommunication signals, control systems to solve professional problems in the field of radio engineering and telecommunications.
13	Form of study	Full-time
14	Duration of study	4 years
15	Volume of loans	240 credit
16	Languages of instruction	Kazakh, Russian, English
17	Academic degrees awarded	Bachelor of Science in Information and Communication Technology
18	Developer and authors:	Tashtay Y., Kengesbaeva S.S.

4.2 The relationship between the attainability of the learning outcomes formed under the educational program and academic disciplines

No.	Name of disciplines	Description of disciplines	Number of credits	Formed learning outcomes (codes)											
				RO1	PO2	PO3	PO4	RO5	RO6	RO7	RO8	RO9	RO10	RO11	RO12
Cycle of general education disciplines Required component															
1	Foreign language	English is a general education subject. After determining the level (according to the results of diagnostic testing or IELTS results), students are divided into groups and subjects. The name of the subject corresponds to the level of English proficiency. When moving from level to level, prerequisites and postrequisites of the subjects are observed.	**10**			V		V							
2	Kazakh (Russian) language	The course examines socio-political, socio-cultural spheres of communication and functional styles of the modern Kazakh (Russian) language. The course covers the specifics of scientific style in order to develop and activate students' professional and communicative skills and abilities. The course allows students to practically master the basics of scientific style and develops the ability to perform structural and semantic analysis of the text.	**10**			V		V							
3	Physical culture	The aim of the discipline is the practical use of skills in performing the basic elements of track and field techniques, sports games, gymnastics and a set of standards for general physical training, including professional and applied physical training or one of the sports, methods for	**8**					V			V				

		conducting independent physical exercise classes.													
4	Information and Communication Technologies (MOOC)	The objective of studying the discipline is to acquire theoretical knowledge about information processes, new information technologies, local and global computer networks, methods of information protection; to acquire skills in using text editors and spreadsheet processors; to create databases and various categories of application programs.	**5**		V	V								V	
5	History of Kazakhstan	The course studies historical events, phenomena, facts, processes that took place on the territory of Kazakhstan from ancient times to the present day. The sections of the discipline include: introduction to the history of Kazakhstan; steppe empire of the Turks; early feudal states on the territory of Kazakhstan; Kazakhstan during the Mongol conquest (13th century); medieval states in the 14th-15th centuries. The main stages of the formation of Kazakh statehood are also considered: the era of the Kazakh Khanate of the 15th-18th centuries; Kazakhstan as part of the Russian Empire; Kazakhstan during the period of civil confrontation and under a totalitarian system; Kazakhstan during the Great Patriotic War; Kazakhstan during the period of independence and at the present stage.	**5**					V			V				
6	Philosophy	Philosophy forms and develops critical and creative thinking, worldview and culture, provides knowledge about the most general and fundamental problems of existence and provides them with a methodology for solving various theoretical practical issues. Philosophy expands	**5**					V			V				

		the horizon of vision of the modern world, forms civic consciousness and patriotism, promotes the development of self-esteem, awareness of the value of human existence. It teaches how to think and act correctly, develops skills of practical and cognitive activity, helps to seek and find ways and means of life in harmony with oneself, society, and the world around us.													
7	Module of socio-political knowledge (sociology, political science) (MOOC)	The discipline is designed to improve the quality of both general humanitarian and professional training of students. Knowledge in the field of sociology and political science is the key to effective professional activity of a future specialist, as well as for understanding political processes, for the formation of a political culture, development of a personal position and a clearer understanding of the extent of one's responsibility.	**3**								V				
8	Module of socio-political knowledge (cultural studies and psychology) (MOOC)	The socio-political knowledge module (cultural studies, psychology) is designed to familiarize students with the cultural achievements of mankind, to understand and assimilate the basic forms and universal patterns of formation and development of culture, to develop their desire and skills for independent comprehension of the entire wealth of values of world culture for self-improvement and professional growth. During the course of cultural studies, the student will consider general problems of the theory of culture, leading cultural concepts, universal patterns and mechanisms of formation and development of culture, the main historical stages of formation and development of Kazakhstani culture, its most	**5**								V				

		important achievements. During the course, students acquire theoretical knowledge, practical skills and abilities, forming their professional focus from the standpoint of psychological aspects.													
Cycle of general education disciplines Component of choice															
9	Fundamentals of anti-corruption culture and law	Objective: to increase public and individual legal awareness and legal culture of students, as well as to form a system of knowledge and civic position on combating corruption as an antisocial phenomenon. Contents: improving the socio-economic relations of Kazakhstani society, psychological characteristics of corrupt behavior, forming an anti-corruption culture, legal responsibility for corrupt acts in various spheres.	**5**			V					V				
10	Fundamentals of scientific research methods	Objective: to develop knowledge about scientific research, methods and methodology of scientific research, methods of collecting and processing scientific data in modern science. Contents: fundamentals of the theory of solving inventive problems, with algorithmic methods of searching for technical solutions and their optimization, basic mathematical methods of optimization, application of artificial intelligence capabilities to solve optimization problems, issues of searching, accumulating and processing scientific information.	**5**										V		V
11	Basics of financial literacy	Objective: developing students' financial literacy based on establishing a direct link between the knowledge they gain and its practical application. Contents: practical use of all kinds of financial	**5**											V	V

		management tools, preserving and increasing savings, competent budget planning, acquiring practical skills in calculating and paying taxes and correctly filling out tax reports, analyzing financial information and navigating financial products to select an adequate investment strategy.													
12	Fundamentals of Economics and Entrepreneurship	Objective: To develop basic knowledge of economic processes and business skills. Content: The course is studied to develop skills in analyzing economic concepts such as supply and demand, market equilibrium. It includes the basics of creating and managing a business, developing business plans, assessing risks, and making strategic decisions.	**5**								V	V			
13	Ecology and life safety	Objective: formation of ecological knowledge and consciousness, acquisition of theoretical and practical knowledge on modern methods of rational use of natural resources and environmental protection. Contents: study of the tasks of ecology as a science, laws of functioning of natural systems and aspects of environmental safety in working conditions, environmental monitoring and management in the field of its safety, ways of solving environmental problems; life safety in the technosphere, emergency situations of natural and man-made nature.	**5**								V	V			
Cycle of basic disciplines University component															
14	Engineering and computer graphics	Objective: To develop students' knowledge of drawing construction and skills in developing graphic and text design documentation in accordance with the requirements of standards.	**5**	V		V									

		Contents: Students will study the Unified System for Design Documentation (ESKD) standards, graphic primitives, geometric constructions, methods and properties of orthogonal projection, Monge diagrams, axonometric projections, metric problems, types and features of connections, creating sketches of parts and assembly drawings, detailing, and creating 3D complex solid objects in AutoCAD.													
15	Mathematics I	Objective: to introduce students to the fundamental concepts of linear algebra, analytical geometry and mathematical analysis. To develop the ability to solve typical and applied problems of the discipline. Contents: Elements of linear algebra, vector algebra and analytical geometry. Introduction to analysis. Differential calculus of a function of one variable. Study of functions using derivatives. Functions of several variables. Partial derivatives. Extremum of a function of two variables.	**5**	V								V	V		
16	Mathematics II	Objective: To teach students integration methods. To teach how to choose the right method for finding the antiderivative. To teach how to apply the definite integral to solving practical problems. Contents: integral calculus of functions of one and two variables, theory of series. Indefinite integrals, methods of their calculation. Definite integrals and applications of definite integrals. Improper integrals. Theory of numerical and functional series, Taylor and Maclaurin series, application of series to approximate calculations.	**5**	V								V	V		
17	Mathematics III	Objective: To teach students integration methods.	**5**	V								V	V		

		To teach how to choose the right method for finding the antiderivative. The course is a continuation of Mathematics II. The course includes the following sections: ordinary differential equations and elements of probability theory and mathematical statistics. The courses cover differential equations with separable variables, homogeneous, in total differentials, linear non-homogeneous differential equations with constant coefficients, systems of linear differential equations with constant coefficients, finding the probability of events; calculating the numerical characteristics of random variables; using statistical methods to process experimental data.													
18	Physics I	Objective: study of the basic physical phenomena and laws of classical and modern physics; methods of physical research; influence of physics on the development of technology; connection of physics with other sciences and its role in solving scientific and technical problems of the specialty. Contents: mechanics, dynamics of rotational motion of a solid, mechanical harmonic waves, fundamentals of molecular-kinetic theory and thermodynamics, transport phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell's equations.	**5**	V						V					
19	Physics II	Objective: to develop students' knowledge and skills in using fundamental laws, theories of classical and modern physics, as well as methods of physical research as the basis of a professional activity system. Contents: harmonic oscillations,	**5**	V						V					

		damped oscillations. alternating current, wave motion, laws of refraction and reflection of light, quantum optics. laws of thermal radiation, photons, their characteristics, wave function, electrical conductivity of metals, atomic nucleus, its structure and properties, binding energy, radioactivity.													
20	Fundamentals of Radio Engineering and Telecommunications (Introduction to the Specialty)	Objective: construction of information systems and devices for the formation, transmission, reception and processing of signals. Contents: general principles of radio engineering, ranges of frequencies used, fundamentals of antenna-feeder technology, principles of construction of radio communication devices and systems. Purpose, operating conditions, principles of construction, structural diagrams of telecommunication systems and networks. Principles of construction and features of multichannel telecommunication systems; basic concepts of digital systems and subscriber access networks. Technical support of radio engineering and telecommunications systems, general principles of construction of new generation networks.	**4**	V		V						V		V
21	Theory of electrical circuits	Basic laws, elements and parameters of electric circuits. Transformation of circuits. Methods of calculating complex DC circuits. Nonlinear DC electric circuits. Introduction to the theory of AC electric circuits. Sinusoidal currents and voltages. Resonance phenomena in AC circuits. Circuits with mutual induction. Three-phase current. Nonlinear AC circuits. Four-terminal networks.	**6**	V						V					
22	Physical principles of	Objective: To train students in the field of	**5**	V						V			V		

	electronics	electronic engineering, including the analysis of the operation of semiconductor elements and their characteristics in instrumentation. Contents: 1. Physical principles of electrical conductivity of semiconductors. 2. Electron-hole junction and its properties, including the current-voltage characteristic, breakdown, the effect of temperature and junction capacitance. 3. Characteristics and parameters of semiconductor diodes: rectifier, high-frequency, pulse, Schottky diodes, reference, tunnel and inverted, varicaps, photodiodes, light-emitting diodes, optoelectronic pairs.													
23	Modern electronic technologies in telecommunications	This course focuses on modern electronics technologies in telecommunications. Students will become familiar with analog and digital signal processing, semiconductor devices, microcircuits, and the principles of high-frequency devices. They will also learn how to design, analyze, and maintain electronic components in communication systems.	**5**	V						V			V		
24	TETRA Trunked Radio Communication	Objective: To gain a deep understanding of the principles of trunked radio communications in the TETRA standard, intended for use in emergency response and control services. Content: The course covers the basics of TETRA technology, including network architecture, protocols, security features, and how to integrate with other communication systems. Students will examine case studies of TETRA use in government and commercial structures.	**5**			V	V						V		
25	Digital Mobile Radio -	Objective: To study the technical and operational	**5**		V									V	V

	DMR	aspects of digital mobile radio communications (DMR). Students will gain knowledge of the operating principles, system architecture and application of DMR technology in various environments. Content: The course covers topics on the structure of DMR networks, spectral efficiency, access methods and the advantages of using DMR over analog systems. Students will also learn how to design and test DMR systems.														
26	Digital devices in telecommunications	Objective: study of principles of construction and design of functional units of digital technology with their practical implementation. Contents: consideration of the structure of organization and principles of operation of digital devices, microprocessor and microcontroller systems. Analysis of the purpose and structure of operational units, as well as functional units of digital devices and microprocessor technology.	**4**			V	V			V			V			
Cycle of major disciplines University component																
27	Digital Automatic Switching	Objective: To improve skills in the field of digital automatic switching. Contents: To study the principles of digital automatic switching, the role and requirements for switching devices, their characteristics and operating principles, as well as the construction of switching fields and blocks. Discussion of the digital switching system, including the numbering, synchronization and signaling system in networks.	**5**			V	V							V		
28	Components of fiber optic transmission systems	The main tasks of digital optical transmission systems and their place in the communication network. The structure of optical digital	**4**				V							V	V	

		telecommunication systems. The main optical linear devices, their design, operational characteristics, electrical parameters. Model of a fiber-optic transmission system; optical connectors, splices and passive optical devices; technological processes during operation, repair and construction of optical linear structures.													
29	Mobile communication systems	The course provides an overview and classification of modern mobile radio communication systems, features of the conditions of use and the main indicators of the quality of their operation. Composition and structural elements of the cellular communication system. Basic technologies, main functional blocks of a typical block diagram of a mobile communication system. Base station system. Antenna equipment of mobile communication systems. Features of radio wave propagation in mobile communication systems. Radio planning of cellular mobile radio communication systems.	**2**			V	V						V		
30	Design of radio engineering and telecommunication systems	Objective: study of the process of designing radar systems taking into account the optimization of the entire system according to the adopted efficiency criteria. Contents: presentation of the design procedure, the main stages and phases of the process, as well as the content and features of individual stages. Discussion of the need to make technical decisions, starting from the development of a mathematical model and ending with the detailing of the design, taking into account the optimization of the entire system according to the adopted efficiency criteria.	**5**		V							V	V		

31	Designing Communication Systems in MATLAB and Simulink	Objective: to teach students the basics of working in the virtual MatLab software environment to acquire skills in creating models, processing data and working with model components. Contents: familiarization with the set of programs, applications, libraries and components of MatLab; mastering the creation of models and data processing schemes; studying the properties of model components for effective use of the software environment.	**5**		V			V				V	V		
Cycle of basic disciplines Component of choice															
32	Theory of electrical communication	Objective: development of skills in signal generation and transformation in electrical circuits. Contents: The course examines methods of mathematical representation of messages, signals and interference; methods of signal generation and transformation in electrical circuits; issues of noise immunity and capacity analysis of telecommunication systems; methods of noise-resistant coding, optimal message reception, principles of multichannel transmission and distribution of information in communication networks, issues of telecommunication system optimization.	**4**							V			V		V
33	Signal Transmission Theory	Objective: development of skills in signal transmission and processing; patterns that determine the properties of signals and the transmission of their work. Contents: general information on the formation, transmission and reception of signals in transmission systems (signal classification, signal description,	**4**							V			V		V

		processing and transmission of analog and digital signals). Elements of transmission systems and types of signals; communication channels and their characteristics; purpose and main types of modulations and demodulations; methods and devices for noise-resistant coding.													
34	Networks and information transmission systems	Objective: study of principles of construction of switching systems of various types and distribution of information on networks. Contents: principles of analog and digital switching, principles of switching during integration of different types of information, principles of numbering, planning, design and features of operation of digital switching systems. Calculations of load on nodes of switching systems, analysis of reliability of switching systems.	**4**							V			V		V
35	Structured cabling system	Objective: communication line construction patterns; designs; electrical, optical and physical-mechanical characteristics of communication lines, their design, construction and technical operation. Contents: mutual influences in communication lines and protection measures; influence of external electromagnetic fields on communication circuits and protection measures; corrosion of cable sheaths. Structured cabling systems (SCS), types of cables and auxiliary devices for SCS.	**5**			V				V				V	
36	Guided Telecommunications Environments	Objective: laws of construction of communication lines; designs; electrical, optical and physical-mechanical characteristics of communication lines, their design, construction and technical	**5**									V		V	V

		operation. Contents: mutual influences and protection measures in communication lines; influence of external electromagnetic fields on communication circuits and protection measures; corrosion of cable sheaths. Structural cable systems (SCS), types of cables and auxiliary devices.													
37	Linear cable communication structures	Objective: study of the laws of construction of communication lines, their designs and characteristics, including electrical, optical and physical-mechanical aspects, as well as design, construction and operation. Contents: analysis of mutual influence and protection measures in communication lines; assessment of the influence of external electromagnetic fields on communication circuits and protection methods; study of the problem of corrosion of cable sheaths. Also considered are structural cable systems (SCS), various types of cables and auxiliary devices.	**5**									V		V	V
38	Fundamentals of Sustainable Development and ESG Projects in Kazakhstan	Objective: to provide students with theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Content: introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation at enterprises and organizations.	**5**								V	V			

39	Network technologies	The fundamental issues of network theory are considered, in particular, the OSI reference model, network devices, the TCP/IP protocol stack, the IP internetworking protocol; addressing and routing in networks. Various technologies of local and global networks, voice and video transmission in IP networks are studied; network construction based on the NGN concept; multimedia session management; quality of service in packet-switched networks.	**5**			V	V							V	
40	Legal regulation of intellectual property	Objective: to develop a comprehensive understanding of the system of legal regulation of intellectual property, including the basic principles, mechanisms for protecting intellectual property rights and the specifics of their implementation. Content: the course covers the basics of IP legislation, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, and also examine legal disputes and methods for resolving them.	**5**								V	V			
41	Telecommunication equipment of computer network	The course is devoted to studying the types of telecommunications equipment used in computer networks, their operating principles and configuration methods. Students will study routers, switches, servers, modems, network adapters and data transmission technologies. In addition, they will become familiar with network security and troubleshooting methods.	**5**			V	V						V		V
42	Radio communication transceivers	Objective: study of the basic principles of construction of radio transmitting and receiving devices, as well as formation and processing of	**5**			V	V		V						

		radio signals. Contents: consideration of the general structure of the transmitting path of a radio transmitting device, the main characteristics of microwave semiconductor devices used in such devices. Analysis of the principles of construction of radio receiving devices, including processing of radio signals and the main quality indicators. Discussion of input circuits, filters, resonant amplifiers, frequency converters, signal detectors, adjustments and noise immunity. Consideration of the features of radio receiving devices in various radio systems.													
43	VHF antenna feeder devices	Objective: to master the principles of designing and operating VHF antenna-feeder devices. Contents: The course covers the theoretical foundations of antennas and feeders, methods of their calculation and adjustment. Students will study various types of antennas	**5**				V						V		V
44	Modeling of communication systems	Objective: use of modeling in designing and researching telecommunication systems and networks. Contents: stages of mathematical modeling. Fundamentals of system queuing theory (SQS). Calculation of main characteristics for different types of SQS. OSI reference model, TCP/IP protocol stack, IP internetwork protocol; addressing and routing in IP networks; technologies of local and global networks, voice and video broadcasting in IP networks; quality of service in networks.	**5**		V		V							V	
45	Fundamentals of Artificial Intelligence	Objective: to introduce students to the basic concepts, methods and technologies in the field of artificial intelligence: machine learning, computer	**5**		V							V			

		vision, natural language processing, etc. Contents: general definition of artificial intelligence, intelligent agents, information retrieval and state space exploration, logical agents, architecture of artificial intelligence systems, expert systems, observational learning, statistical learning methods, probabilistic processing of linguistic information, semantic models, natural language processing systems.													
46	Modern radio broadcasting technologies	Objective: development of methods for applying digital intelligent control to improve the operation of radio waves, radio receivers and transmitters in radio broadcasting. Contents: study of terrestrial and satellite radio waves, as well as methods of transmitting radio waves via satellites in near-earth orbit. Analysis of technologies for transmitting messages of digital radio stations, including radio stations of amplitude and frequency modulation. Definition of physical processes occurring in radio frequency units of radio broadcasting devices, and consideration of circuit methods for calculating analog and digital electronic devices.	**6**		V								V	V	
47	Radio engineering means of transmission, reception and processing of signals	Objective: study of technical characteristics and structural diagrams of radio devices, including radio transmitting and receiving devices for various purposes. Contents: analysis of the design of the main units of radio transmitters, including exciters, matching circuits and output stages on transistors. Consideration of the choice of means for ensuring sensitivity, selectivity, control and tuning of radio receivers. Study of the features of	**6**		V	V			V						

		design diagrams and main units of radio receivers, including household receivers and stereo signal receivers. Discussion of the operating principle and structural diagrams of television receivers, as well as the element base of modern radio receivers.													
48	Digital communication technology	Objective: construction of digital communication systems. Contents: methods of digital signal transmission, current state of digital communication technology, algorithms for construction of digital communication systems, patterns determining the properties of data transmission devices and tasks of their operation; synchronization in digital communication systems, methods and devices of noise-immune coding, data compression in digital communication systems.	**6**				V							V	
49	Discrete Message Transfer	Objective: development of skills in broadband reception of discrete signals and recovery of discrete signals. Contents: reception of broadband discrete signals, regeneration of discrete signals; quantity and speed of information transfer via a discrete channel, bandwidth of a discrete channel; comparative assessment of continuous and discrete signals, modulation and manipulation, structural diagrams of transceivers.	**6**							V			V		V
50	Digital switching systems	Objective: construction of switching fields; switching units; digital switching system; network numbering, synchronization and signaling system. Contents: principles of automatic switching; purpose of switching devices, their characteristics and requirements for them; operating principle,	**6**			V	V							V	

		design and electrical parameters of switching devices.													
51	Information security and data protection in telecommunications	The course is devoted to studying information security issues, data protection technologies and methods of countering cyber attacks in telecommunications. Students will study encryption algorithms, authentication systems, network traffic monitoring and threat detection systems. In addition, they will master strategies for strengthening the protection of telecommunications infrastructure.	**5**	V	V	V									
52	Inclusive technologies and universal design in engineering systems	This course explores the principles of inclusive technology and universal design in engineering systems. Students will learn how to create accessible environments, adaptive technologies, and ergonomic solutions that provide equal opportunities for all users, including people with disabilities. The course covers the integration of assistive technologies, smart systems, and sustainable design approaches to improve accessibility in a variety of engineering applications.	**5**	V		V				V					V
Cycle of major disciplines Component of choice															
53	Modern wireless technologies and standards	The course covers the architecture of wireless communication systems, their operating principles, and modern wireless technologies. Students will study IoT, Wi-Fi, 5G, 6G, Bluetooth, NFC, LoRaWAN, Zigbee. In addition, methods of radio channel modulation, spectrum management, interference reduction, and wireless network security are considered.	**5**		V	V	V							V	

54	Artificial Intelligence in Telecommunications	This course focuses on the application of artificial intelligence (AI) and machine learning techniques in telecommunications systems. Students will learn the role of AI in data analysis, network optimization, automatic fault detection, traffic forecasting, and improving communication quality. They will also master adaptive algorithms and neural networks used in telecommunications.	**5**	V	V							V			
55	Optical communication technologies	Basic information about fiber-optic transmission system. Fiber-optic networks and DWDM technology. Principles of construction of passive optical networks PON. Application of fiber-optic communication lines in local telemetry networks, ultra-long-distance communication. FTTx broadband access technologies. Equipment of linear-cable structures of access networks. Measuring techniques for operational measurements of fiber-optic communication lines.	**6**			V								V	V
56	Transport communication networks	Principles of construction of modern transport digital communication networks; methods of description of transport digital communication networks, main directions and prospects of development of modern transport networks, main parameters and requirements for modern transport communication networks, methods of management of transport communication networks. Equipment of optical transmission systems and transport networks with wave multiplexing WDM, organization of transportation of packet traffic in SDH, NG-SDH, PON transmission systems.	**6**			V								V	V

57	Multichannel telecommunication transmission systems	Objective: study of the basics of constructing multi-channel transmission systems and skills in designing a conventional fragment of a communication network, including local, intra-zone and trunk sections using electric cables. Contents: presentation of the basics of determining the length of a regeneration section, drawing up a trunk line diagram, assessing the noise of terminal equipment and other design issues. Discussion of skills in designing intercity sections of a route and connecting lines at city telephone exchanges in the context of multi-channel transmission systems.	**6**		V	V							V		
58	Multiservice NGN networks	Evolution of telecommunication technologies: Traditional networks. Multiservice networks. NGN networks, features of NGN networks. Construction in accordance with the NGN concept of an unlimited set of infocommunication services: VoIP voice services; video calls; video conferences; Internet; corporate networks, VPN; IPTV, VoD television services; organization of data transmission for housing and communal services, for organizing control of public order, traffic.	**5**			V		V						V	V
59	Subscriber access networks	Objective: to prepare students to master the basic principles of construction and operation of multiservice subscriber access networks, as well as their protocols, transmission methods and technologies used in the networks. Contents: study of the principles of construction and operation of wired and wireless multiservice subscriber access networks, analysis of protocols and data transmission methods used in such networks.	**5**		V	V	V								

		Consideration of all technologies used in multiservice subscriber access networks, with the aim of preparing students to solve problems of telecommunication networks and their qualified operation.													
60	Digital TV and Radio Broadcasting Systems	Principles of formation and transmission of audio broadcast signal. Methods of coding sources of broadcast signals of television and radio broadcasting. Standards of analog television. Parameters of color image. Color signals and color difference signals. Standards of color television: NTSC, PAL, SECAM. Quality of color TV image. Methods of ADC of audio broadcast signals. Methods and tasks of compression of digital audio and television signals. Systems and standards of digital radio broadcasting. Models of radio channels in broadcasting systems.	**5**			V	V		V						V
61	Terrestrial and space communication and television and radio broadcasting systems	Study of general principles of organization and operation of television and radio broadcasting systems based on space and ground systems; principles of construction, effective methods of selecting the main parameters and design methods; methods of organization, management, ensuring operation in various frequency bands. Knowledge of methods of monitoring the main electrical parameters of signals and channels, methods of operating television and radio broadcasting systems. Study of the principles of operation of various digital television and radio broadcasting systems.	**5**				V		V					V	

62	Electronic sensors and transducers	Objective: to familiarize students with electronic sensors and converters used in electric power systems at all stages - from production to consumption of electric power. Contents: study of the purpose, main characteristics and areas of application of electronic sensors and converters in electric power systems. Consideration of the principles of their operation, design features and methods of use at various stages of production, transmission, distribution and consumption of electric power.	**4**			V	V						V	
63	Measuring and control devices in communication systems	The course is aimed at studying the principles of operation of measuring and control devices used in telecommunication systems. Students will study radio frequency spectrum analyzers, fiber optic testing devices, devices for measuring antenna parameters and network monitoring systems. In addition, they will master the methods of testing and diagnostics of communication systems.	**4**			V						V	V	
64	Electromagnetic compatibility of radio electronic equipment	Ensuring electromagnetic compatibility in the design of radio electronic equipment. Filtering of intra-system interference. Sources and levels of interfering radiation in radio transmitting devices. Mutual interference when amplifying the power of several signals in a common frequency band. Electromagnetic environment in the radio reception zone. The role of antenna devices in forming the electromagnetic environment and ensuring EMC. Organizational measures to ensure EMC. Radiocommunication Regulations. ITU Recommendations.	**5**				V					V		

65	Noise immunity and security of infocommunication systems	Noise immunity and safety of infocommunication systems. Methods of signal transmission via communication channels. Distortions in communication channels. Selective interference in wire communication channels. Pulse interference. Causes of pulse interference. Effect of interference on the fidelity of discrete information transmission. Effect of short-term interruptions on the fidelity of discrete information transmission. Effect of fluctuation and pulse interference on the throughput of feedback systems.	**5**		V	V									V
66	Using IoT to Monitor Electromagnetic Pollution	The course is aimed at studying the methods of using IoT technologies to monitor electromagnetic pollution. Students will learn the principles of sensor networks, methods for measuring the level of electromagnetic radiation and data analysis systems. In addition, they will master the design and implementation of environmental monitoring systems based on IoT.	**5**		V	V				V	V				
67	Intelligent Grids	The course examines the problems that cause network problems and ways to solve them, rationale for installing Smart Grid components, ways to update existing network infrastructure, management features and methods for implementing sensor technologies in smart grids, advantages and benefits of implementing smart grids - distributed generation, power electronics, virtual power plants, data concentrators via satellite navigation network, fiber optics, radio communications and the widespread introduction of digital devices. New methods of control theory.	**5**			V							V	V	

68	M2M and Internet of Things Networks	Study of the principles of building Internet of Things and M2M networks, including the specifics of using the radio frequency spectrum, building access networks using 3GPP Partnership Project technologies (GSM, GPRS, UMTS, LTE, 5G), satellite technologies and LPWAN technologies (LoRa, SigFox, NB-IoT, EC-GSM, XNB, Bluetooth, ZigBee), its architecture and domains, interfaces, security, types of services and traffic management features.	**5**		V	V							V	V
69	Wireless Sensor Network and IoT	Objective: To teach students the principles and technologies of wireless sensor networks, including node types, protocols and data security, to support their participation in research and innovation in this field. Content: To study the basic principles and technologies of wireless sensor networks, analyze data security issues and methods for solving them. To support and stimulate research and innovation to develop new technologies and improve existing systems in the field of wireless sensor networks.	**5**		V	V		V					V	
70	Design of modern telecommunication systems and networks	The course covers the fundamentals of designing, configuring and optimizing telecommunications systems and networks. Students will study data transfer protocols, infrastructure solutions, methods for increasing network capacity and technologies for ensuring their reliability. In addition, they will master tools for modeling networks and analyzing their performance.	**6**		V	V							V	

71	Scientific research of telecommunication technologies	Objective: Research of telecommunication technologies with the aim of expanding knowledge, developing new methods of data transmission and optimizing existing systems in this area. Contents: 1. Development of new technologies in telecommunications. 2. Optimization of existing communication systems. 3. Understanding the fundamental principles of functioning of telecommunication systems. 4. Research and development of new areas of application of telecommunication technologies.	**6**	V						V			V		V

NON-PROFIT JOINT STOCK COMPANY
"KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 06.03.2025 Minutes № 10

WORKING CURRICULUM

Academic year — **2025-2026 (Autumn, Spring)**

Group of educational programs — **B059 - "Information and communication technologies"**

Educational program — **6B06201 - "Telecommunication"**

The awarded academic degree — **Bachelor of information and communications technologies**

Form and duration of study — **full time - 4 years**

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters								Prerequisites
									1 course		2 course		3 course		4 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	7 sem	8 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																	
M-1. Module of language training																	
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E	5								
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E	5								
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E		5							
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E		5							

M-2. Module of physical training																
KFK101	Physical culture I		GED, RC	2	60	0/0/30	30	E	2							
KFK102	Physical culture II		GED, RC	2	60	0/0/30	30	E		2						
KFK103	Physical culture III		GED, RC	2	60	0/0/30	30	E			2					
KFK104	Physical culture IV		GED, RC	2	60	0/0/30	30	E				2				
M-3. Module of information technology																
CSE677	Information and communication technology		GED, RC	5	150	30/15/0	105	E				5				
M-4. Module of socio-cultural development																
HUM137	History of Kazakhstan		GED, RC	5	150	15/0/30	105	GE	5							
HUM132	Philosophy		GED, RC	5	150	15/0/30	105	E			5					
HUM120	Module of socio-political knowledge (sociology, political science)		GED, RC	3	90	15/0/15	60	E			3					
HUM134	Module of socio-political knowledge (cultural studies, psychology)		GED, RC	5	150	30/0/15	105	E				5				
M-5. Module of anti-corruption culture, ecology and life safety base																
CHE656	Ecology and life safety	1	GED, CCH	5	150	30/0/15	105	E			5					
ELC577	Fundamentals of scientific research methods	1	GED, CCH	5	150	30/0/15	105	E			5					
MNG489	Fundamentals of economics and entrepreneurship	1	GED, CCH	5	150	30/0/15	105	E			5					

HUM136	Fundamentals of anti-corruption culture and law	1	GED, CCH	5	150	30/0/15	105	E			5						
MNG564	Basics of Financial Literacy	1	GED, CCH	5	150	30/0/15	105	E			5						
CYCLE OF BASIC DISCIPLINES (BD)																	
M-6. Module of physical and mathematical training																	
MAT101	Mathematics I		BD, UC	5	150	15/0/30	105	E	5								
PHY111	Physics I		BD, UC	5	150	15/15/15	105	E	5								
MAT102	Mathematics II		BD, UC	5	150	15/0/30	105	E		5							MAT101
PHY112	Physics II		BD, UC	5	150	15/15/15	105	E		5							PHY111
MAT103	Mathematics III		BD, UC	5	150	15/0/30	105	E			5						MAT102
M-7. Module of basic training																	
GEN429	Engineering and computer graphics		BD, UC	5	150	15/0/30	105	E	5								
M-8. Module of basic technologies in telecommunications																	
ELC648	Fundamentals of radio engineering and telecommunications (Introduction to the specialty)		BD, UC	4	120	15/15/15	75	C		4							
AAP173	Practical training		BD, UC	2				R		2							
ELC469	Electrical Circuit Theory		BD, UC	6	180	30/15/15	120	E			6						
ELC649	Theory of electrical communication	1	BD, CCH	4	120	15/15/15	75	C			4						
ELC651	Theory of signal transmission	1	BD, CCH	4	120	15/15/15	75	C			4						

ELC652	Networks and information transmission systems	1	BD, CCH	4	120	15/15/15	75	C			4						
ELC680	The physical foundations of electronics		BD, UC	5	150	30/15/0	105	E				5					
ELC803	Modern electronics technologies in telecommunications		BD, UC	5	150	15/15/15	105	E					5				
ELC657	Structured cabling system	1	BD, CCH	5	150	30/0/15	105	E					5				
ELC658	Guiding telecommunication environments	1	BD, CCH	5	150	30/0/15	105	E					5				
ELC659	Linear cable communication facilities	1	BD, CCH	5	150	30/0/15	105	E					5				
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan	1	BD, CCH	5	150	30/0/15	105	E					5				
MNG562	Legal regulation of intellectual property	1	BD, CCH	5	150	30/0/15	105	E						5			
ELC530	Network technologies	1	BD, CCH	5	150	15/15/15	105	E						5			
ELC804	Telecommunication equipment of a computer network	1	BD, CCH	5	150	30/0/15	105	E						5			
ELC665	Radio communication receiving and transmitting devices	2	BD, CCH	5	150	30/0/15	105	E						5			
ELC666	Antenna-feeder devices of the VHF band	2	BD, CCH	5	150	30/0/15	105	E						5			
M-9. Module of innovative technologies in telecommunications																	
ELC650	Modeling of communication systems	1	BD, CCH	5	150	30/0/15	105	E				5					
CSE831	Fundamentals of Artificial Intelligence	1	BD, CCH	5	150	15/0/30	105	E				5					

ELC661	TETRA trunking radio communication		BD, UC	5	150	30/0/15	105	E						5			
ELC670	Modern radio broadcasting technologies	1	BD, CCH	6	180	30/0/30	120	E							6		
ELC671	Radio engineering means of transmitting, receiving and processing signals	1	BD, CCH	6	180	30/0/30	120	E							6		
M-10. Module of digital technologies in telecommunications																	
ELC653	Digital communication technology	1	BD, CCH	6	180	15/15/30	120	C				6					
ELC654	Transmission of discrete messages	1	BD, CCH	6	180	15/15/30	120	C				6					
ELC655	Digital switching systems	1	BD, CCH	6	180	15/15/30	120	C				6					
ELC656	Digital Mobile Radio Communication - DMR		BD, UC	5	150	30/15/0	105	E					5				
ELC809	Information security and data protection in telecommunications	1	BD, CCH	5	150	30/15/0	105	E					5				
ELC802	Inclusive technologies and universal design in engineering systems	1	BD, CCH	5	150	30/0/15	105	E					5				
ELC663	Digital devices in telecommunications		BD, UC	4	120	15/15/15	75	C						4			
CYCLE OF PROFILE DISCIPLINES (PD)																	
M-11. Module of professional activity																	
AAP102	Production practice I		PD, UC	2				R				2					
ELC660	Digital automatic switching		PD, UC	5	150	30/0/15	105	E					5				
ELC805	Modern wireless technologies and standards	1	PD, CCH	5	150	30/0/15	105	E					5				

ELC806	Artificial intelligence in telecommunications	1	PD, CCH	5	150	30/15/0	105	E					5				
ELC473	Components of Fiber Optic Transmission Systems		PD, UC	4	120	15/15/15	75	E						4			
ELC472	Mobile communication systems		PD, UC	4	120	30/0/15	75	E						4			
AAP183	Production practice II		PD, UC	3				R						3			
ELC667	Design of radio engineering and telecommunication systems		PD, UC	5	150	30/0/15	105	C							5		
ELC476	Optical communication technologies	1	PD, CCH	6	180	15/15/30	120	E							6		
ELC477	Transport communication networks	1	PD, CCH	6	180	15/15/30	120	E							6		
ELC668	Multichannel telecommunication transmission systems	1	PD, CCH	6	180	15/15/30	120	E							6		
ELC434	Multiservice networks NGN	2	PD, CCH	5	150	30/0/15	105	E							5		
ELC669	Subscriber access networks	2	PD, CCH	5	150	30/0/15	105	E							5		
ELC549	Digital systems of TV and radiobroadcasting	3	PD, CCH	5	150	30/0/15	105	E							5		
ELC513	Ground-based and space-based systems of communications, of TV and radiobroadcasting	3	PD, CCH	5	150	30/0/15	105	E							5		
ELC677	Electronic sensors and transducers	4	PD, CCH	4	120	30/0/15	75	E							4		
ELC807	Measuring and control devices in communication systems	4	PD, CCH	4	120	15/15/15	75	E							4		
ELC679	Design of communication systems in MATLAB and Simulink		PD, UC	5	150	30/15/0	105	E								5	

ELC552	Electromagnetic compatibility of radio electronic means	1	PD, CCH	5	150	30/0/15	105	E								5	
ELC138	Interference immunity and safety of infocommunication systems	1	PD, CCH	5	150	30/0/15	105	E								5	
ELC810	Using IoT for electromagnetic pollution monitoring	1	PD, CCH	5	150	30/15/0	105	E								5	
ELC507	Intellectual networks	2	PD, CCH	5	150	30/0/15	105	E								5	
ELC432	M2M and Internet of Things networks	2	PD, CCH	5	150	30/0/15	105	E								5	
ELC676	Wireless Sensor Network and IoT	2	PD, CCH	5	150	30/0/15	105	E								5	
M-12. Module "R&D"																	
ELC675	Scientific research of telecommunication technologies	1	PD, CCH	6	180	30/0/30	120	E								6	
ELC808	Design of modern telecommunication systems and networks	1	PD, CCH	6	180	30/15/15	120	E								6	
M-13. Module of final attestation																	
ECA103	Final examination		FA	8												8	
Additional type of training (ATT)																	
AAP500	Military training																
Total based on UNIVERSITY:									32	28	30	30	30	30	31	29	
									60		**60**		**60**		**60**		

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	University component (UC)	Component of choice (CCH)	Total
GED	Cycle of general education disciplines	51	0	5	56

BD	Cycle of basic disciplines	0	66	41	107
PD	Cycle of profile disciplines	0	28	41	69
Total for theoretical training:		**51**	**94**	**87**	**232**
FA	Final attestation				8
TOTAL:					**240**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024

Decision of the Academic Council of the Institute. Minutes № 4 dated 22.11.2024